



TEST REPORT

Fire resistance test in accordance with AS1530.4-2014 of various control joint in a 116mm thick non-loadbearing fire rated plasterboard wall protected by HB Fuller Fulacaulk FR sealant.

EWFA Report No:

56967400.1

Report Sponsor:

H B Fuller Aust CO P/L
16-22 Redgum Dr.
Dandenong South, VIC 3175

Test Date:

5 October 2018

DOCUMENT REVISION STATUS

Date Issued	Issue No	Description
4/12/2018	56967400.1	Initial Issue

CONTACT INFORMATION

Exova Warringtonfire Aus Pty Ltd - ABN 81 050 241 524

NATA Registered Laboratory

Unit 2, 409-411 Hammond Road
Dandenong Victoria 3175
Australia

T: +61 (0)3 9767 1000

New South Wales

Suite 802, Level 8
383 Kent Street
Sydney NSW 2000
Australia

T: +61 (0)2 9211 4333

Perth

Unit 22, 22 Railway Road
Subiaco WA 6008
Australia

T: +61 (0)8 9382 3844

Queensland

T6, L12
133 Mary Street
Brisbane QLD 4000
Australia

T: +61 (0)7 3238 1700
F: +61 (0)7 3211 4833

Canberra

2/11 Murray Cres
Griffith ACT 2603
Australia

T: +61 (0)2 6260 8488

SIGNATORIES

Prepared by



Patrick Chan

Reviewed by



Mandeep Kamal

GENERAL CONDITIONS OF USE

This report may only be reproduced in full without modifications by the report sponsor only. Copies, extracts or abridgments of this report in any form shall not be made distributed or published by other organisations or individuals without the permission in writing from a Director of Exova Warringtonfire Aus Pty Ltd.

CONTENTS

1	Construction Details	4
	Test Assembly	4
	Test Specimens	4
	Assembly and Installation Methods	4
	Orientation	4
2	Schedule of Components	5
3	Test Procedure	7
	Statement of compliance	7
	Variations to test method	7
	Pre-test conditioning	7
	Sampling / Specimen Selection	7
	Ambient Temperature	7
	Test Duration	7
	Instrumentation and Equipment	7
4	Test Measurements	8
	Furnace Temperature and Pressure Measurements	8
	Specimen Temperatures	8
	Observations	8
5	Test Results	8
6	Application of Test Results	9
	Test Limitations	9
	Variations from the Tested Specimens	9
	Uncertainty of measurement	9
APPENDIX 1	DRAWINGS OF TEST ASSEMBLY	10
APPENDIX 2	TEST OBSERVATIONS	13
APPENDIX 3	DIRECT FIELD OF APPLICATION	16
	A 3.1 General	16
	A 3.2 Separating elements	16
	A 3.3 Control joints	16
APPENDIX 4	INSTRUMENTATION POSITIONS	17
APPENDIX 5	TEST DATA	20
	A 5.1 Furnace Temperature	20
	A 5.2 Furnace Pressure	20
	A 5.3 Specimen Temperatures	21
APPENDIX 6	PHOTOGRAPHS	25

1 CONSTRUCTION DETAILS

TEST ASSEMBLY

The test assembly comprised a nominal 1200mm wide × 1161mm high × 116mm thick separating element incorporating fire resistant plasterboard and steel framing.

Head lintel incorporated 3 layers of 190mm wide × 1200 long, 13mm Knauf FireShield plasterboard fixed to the head blockwork.

The system comprised of two 64mm wide × 0.55mm BMT steel frames with 22mm clearance between them. The frames were clad with two layers of 13mm Knauf FireShield plasterboard on both the exposed and unexposed sides.

Plasterboard at sill was stopped 10mm from the blockwork, 10mm at the east edge and 20mm at the top edge.

TEST SPECIMENS

The test specimen comprised of 4-off control joint and protected by HB Fuller Fulacaulk FR sealant .

The test specimen is summarised in the table below.

The full description of the specimen is provided in Figures A1.1 to A1.6 and the 'Schedule of Components' in Section 2.

Control joint					
Specimen	Control joint orientation / size	Fire protection	Sealant depth	Backing material	Location
A	Vertical 1161mm long × 22mm wide	HB Fuller Fulacaulk FR sealant	25mm depth	Open cell PE backing rod	At the mid-width of the separating element between two steel studs.
B	Horizontal 1200mm long × 20mm high		26mm depth	Deflection head track	Top edge of the separating element between plasterboard infill and separating element's plasterboards.
C	Vertical 1161mm long × 10mm wide		26mm depth	Steel stud	Between steel stud and concrete blockwork on the east edge.
D	Horizontal 1200 mm long × 10mm high		26mm depth	Steel track	Bottom edge of the separating element between plasterboard and concrete blockwork.

ASSEMBLY AND INSTALLATION METHODS

The wall system and control joint sealants were installed into the test frame by representatives of HB Fuller Aust CO P/L at Exova Melbourne on the 6 September 2018.

The test sponsor supplied the fire protection sealant.

ORIENTATION

The test assembly was symmetrical.

2 SCHEDULE OF COMPONENTS

Item	Description	
1	Separating Element	
	Product	13mm fire rated plasterboard (Knauf FireShield plasterboard), 64mm steel deflection track, 64mm steel studs and 64mm steel bottom track
	Size	116m thick in total
	Installation	<p>The wall system comprised of 64mm thick steel stud system with 4-off steel studs, deflection head track and bottom track.</p> <p>The steel frame was secured to the concrete brickwork and lintel with 6.5mm masonry anchors.</p> <p>The masonry anchors were installed at middle of the tracks and 30mm in from either end of the tracks.</p> <p>The wall system was clad with two layers of 13mm fire rated plasterboard on the exposed and the unexposed side using 6g self-drilling, bugle head, 45mm plasterboard screws. The fixings were nominal at 600mm centres on the inner layer and 300mm centre on the outer layer.</p> <p>There was a 22mm gap at the centre of the wall system between 2 centre studs.</p> <p>There was a 20mm gap between the top edge of the plasterboard and the head lintel.</p> <p>There was a 10mm gap on the east vertical edge between the plasterboard and the concrete blockwork.</p> <p>There was a 10mm gap between the bottom edge of the plasterboard and the concrete sill.</p>
Service Protection		
2	Product name	HB Fuller Fulacaulk FR sealant
	Density	Wet: 1560kg/m ³ (provided) Dry: 1972kg/m ³ (measured)
	Installation	The sealant was installed at all control joints as detailed in various service descriptions below. See Appendix 1 for more details.
SERVICE A		
3	Control Joint	
	Dimensions	Vertical control joint was nominally 1161mm long × 22mm wide, 116mm deep
	Location	At the centre of the wall system, sandwiched by two steel studs.
	Penetration Protection	
	Product name	HB Fuller Fulacaulk FR sealant
	Installation	The sealant was applied to the control joint on both exposed and unexposed side. The sealant was finished flush on the surface, 25mm deep on each side and backed by the open cell backing rod. See Figure A1.6. in Appendix 1 for more details.
SERVICE B		
4	Control Joint	
	Dimensions	Horizontal control joint was nominally 1200mm long × 20mm high, 26mm deep.

Item	Description	
	Location	On the top edge of the wall system between the plasterboard edge and head lintel.
	Penetration Protection	
	Product Name	HB Fuller Fulacaulk FR sealant
	Installation	The sealant was applied to the control joint on both exposed and unexposed side. The sealant was 26mm deep on each side and backed by the deflection head track. See Figure A1.3 in Appendix 1 for more details.
SERVICE C		
5	Control Joint	
	Dimensions	Vertical control joint was nominally 1161mm long × 10mm wide, 26mm depth.
	Location	On the east edge of the wall, between the plasterboards and concrete blockwork.
	Penetration Protection	
	Product Name	HB Fuller Fulacaulk FR sealant
	Installation	The sealant was applied to the control joint on both exposed and unexposed side. The sealant was 26mm depth on each side and backed by the steel stud. See Figure A1.4 in Appendix 1 for more details.
SERVICE D		
6	Control Joint	
	Dimensions	Horizontal control joint was nominally 1200mm long × 10mm high, 26mm deep.
	Location	On the bottom edge of the wall system between the plasterboard and concrete blockworks.
	Penetration Protection	
	Product Name	HB Fuller Fulacaulk FR sealant
	Installation	The sealant was applied to the control joint on both exposed and unexposed side. The sealant was 26mm depth on each side and backed by the steel track. See Figure A1.5 in Appendix 1 for more details.

3 TEST PROCEDURE

STATEMENT OF COMPLIANCE

The test was performed in accordance with the requirements of AS1530.4-2014 Sections 2 & 10 subject to the variations below.

VARIATIONS TO TEST METHOD

None

PRE-TEST CONDITIONING

The construction of the specimen was finished on the 6 September 2018 and was tested on 5 October 2018. During this period the test specimen was subject to normal laboratory temperatures and relative humidity conditions.

SAMPLING / SPECIMEN SELECTION

The laboratory was not involved in the sampling or selection of the test specimen for the fire resistance test.

AMBIENT TEMPERATURE

The ambient temperature of the laboratory at the start of the test was 20°C and did not vary significantly during the test.

TEST DURATION

The test duration was 177 minutes.

INSTRUMENTATION AND EQUIPMENT

The instrumentation was provided in accordance with AS1530.4-2014 and as detailed below:

The furnace temperature was measured by 4-off mineral insulated metal sheathed Type K thermocouples with wire diameters not greater than 1mm and overall diameter of 3mm with the measuring junction insulated from the sheath. The thermocouples protruded a minimum of 25mm from steel supporting tubes.

The non-fire side specimen temperatures were measured by Type K thermocouples with wire diameters less than 0.5mm soldered to 12mm diameter x 0.2mm thick copper discs covered by 30mm x 30mm x 2.0 mm inorganic insulating pads. The thermocouple positions are described in Table A4.1, and are shown on Figure A4.1 in Appendix 4.

A roving thermocouple was available to measure temperatures at positions that appeared hotter than the positions monitored by the fixed thermocouples.

The furnace pressure was measured at the mid-height of the control joint A.

Cotton pad was available during the test to assess the performance under the criteria for integrity.

4 TEST MEASUREMENTS

FURNACE TEMPERATURE AND PRESSURE MEASUREMENTS

Furnace temperature and pressure data are provided in Figure A5.1 and Table A5.1 in Appendix 5.

SPECIMEN TEMPERATURES

Specimen temperature data is provided in Figure A5.2 to Figure A5.6 and Table A5.2 in Appendix 5.

OBSERVATIONS

A table that includes observations of the significant behaviour of the specimen and details of the occurrence of the various performance criteria specified in AS1530.4-2014 is provided in Appendix 2. Photographs of the specimen are included in Appendix 6.

5 TEST RESULTS

The specimens listed below achieved the following performance when tested in accordance with AS1530.4-2014, Section 2 & 10 subject to the variations listed in Section 3.

Service	Criteria	Result
A	Structural Adequacy	Not applicable
	Integrity	Failure at 176 minutes
	Insulation	Failure at 161 minutes
	FRL	-/120/120
B	Structural Adequacy	Not applicable
	Integrity	No failure at 177 minutes
	Insulation	Failure at 160 minutes
	FRL	-/120/120
C	Structural Adequacy	Not applicable
	Integrity	No failure at 177 minutes
	Insulation	Failure at 166 minutes
	FRL	-/120/120
D	Structural Adequacy	Not applicable
	Integrity	No failure at 177 minutes
	Insulation	No failure at 177 minutes
	FRL	-/120/120

6 APPLICATION OF TEST RESULTS

TEST LIMITATIONS

The results of this fire test 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. The results only relate to the behaviour of the specimen of the element of the construction under the particular conditions of the test; they are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they necessarily reflect the actual behaviour in fires.

VARIATIONS FROM THE TESTED SPECIMENS

This report details the methods of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the general procedure outlined in AS1530.4. Any significant variation 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 addressed by this report. It is recommended that any proposed variation to the tested configuration other than as permitted under the field of direct application specified in Appendix 3 should be referred to the test sponsor in the first instance to obtain appropriate documentary evidence of compliance from Exova Warringtonfire Aus Pty Ltd or another Registered Testing Authority.

UNCERTAINTY OF MEASUREMENT

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.

APPENDIX 1 DRAWINGS OF TEST ASSEMBLY

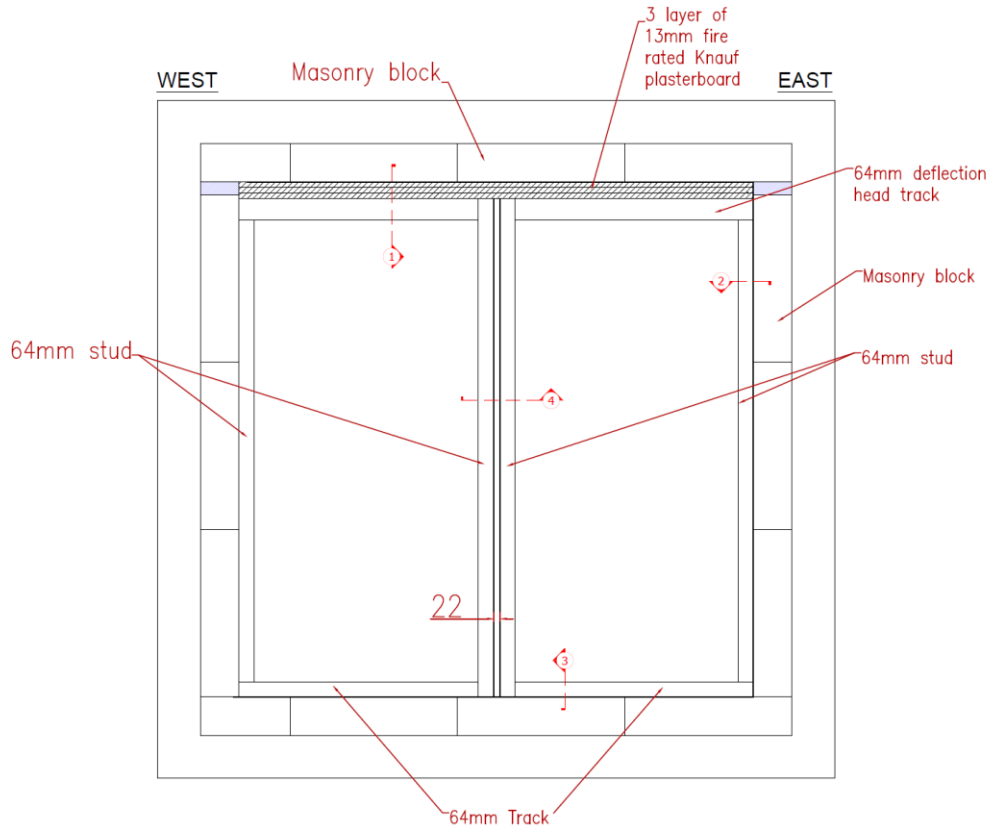


Figure A1.1: Frame structure, Unexposed side

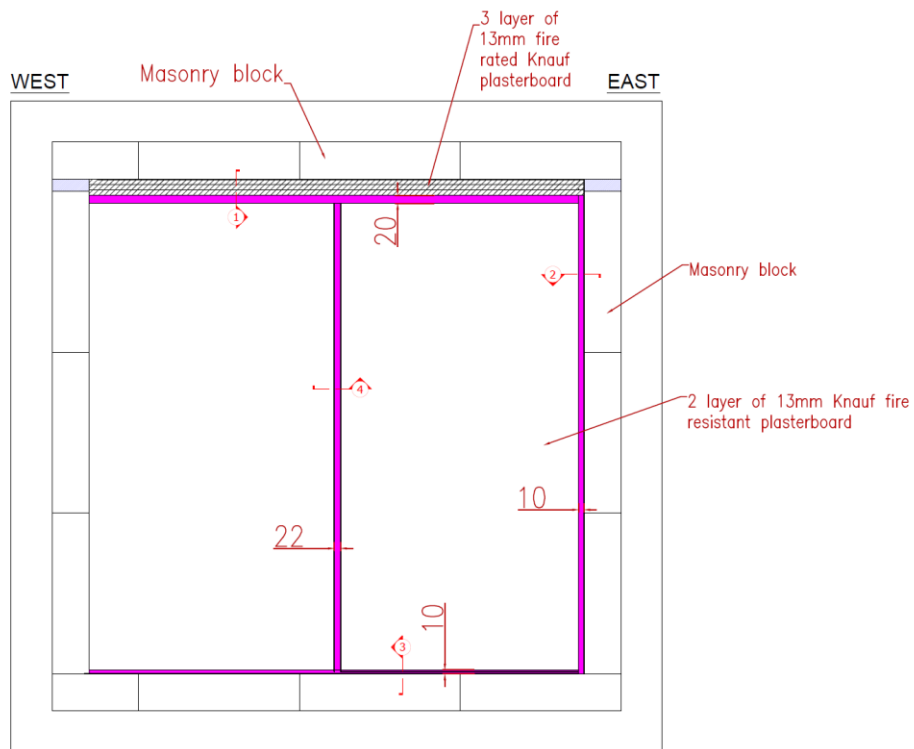


Figure A1.2: Size of the control joint, unexposed side.

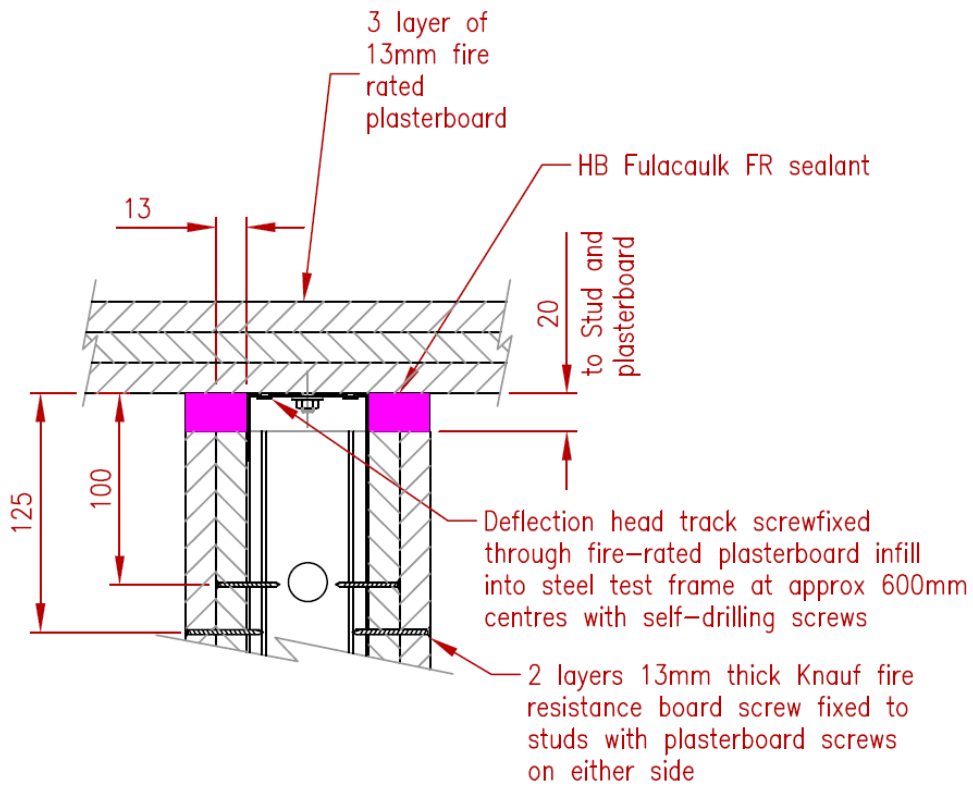


Figure A1.3: Cross-Section 1-1, (specimen B)

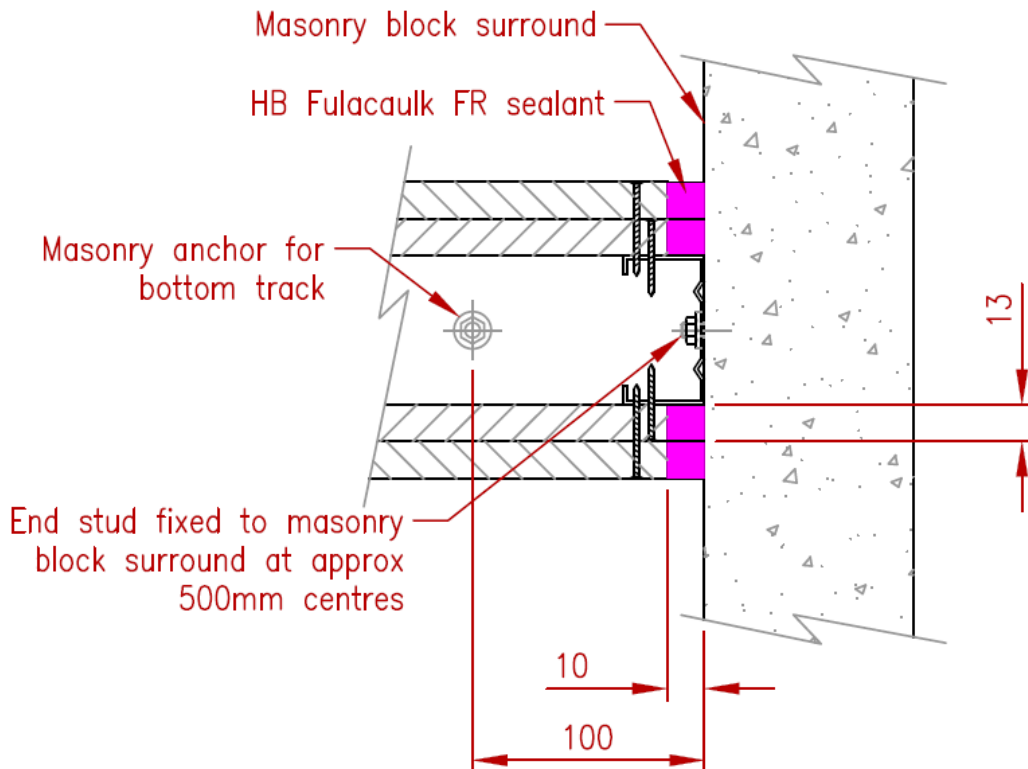


Figure A1.4: Cross-Section 2-2 (Specimen C)

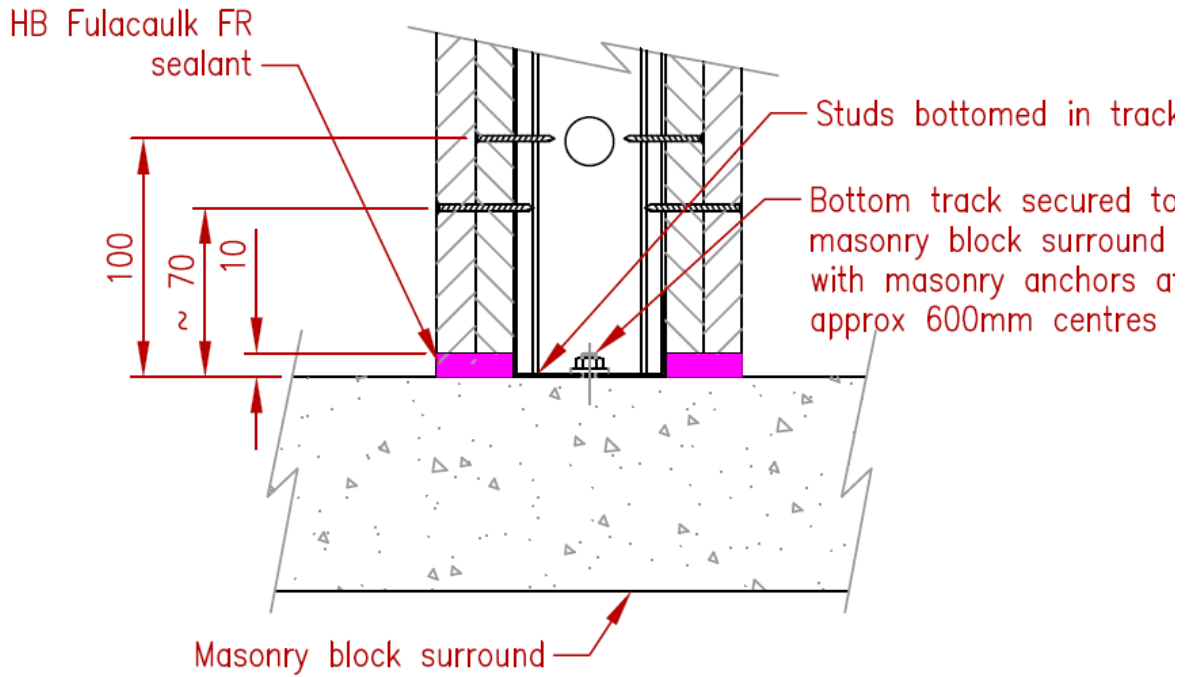


Figure A1.5: Cross-Section 3-3 (Specimen D)

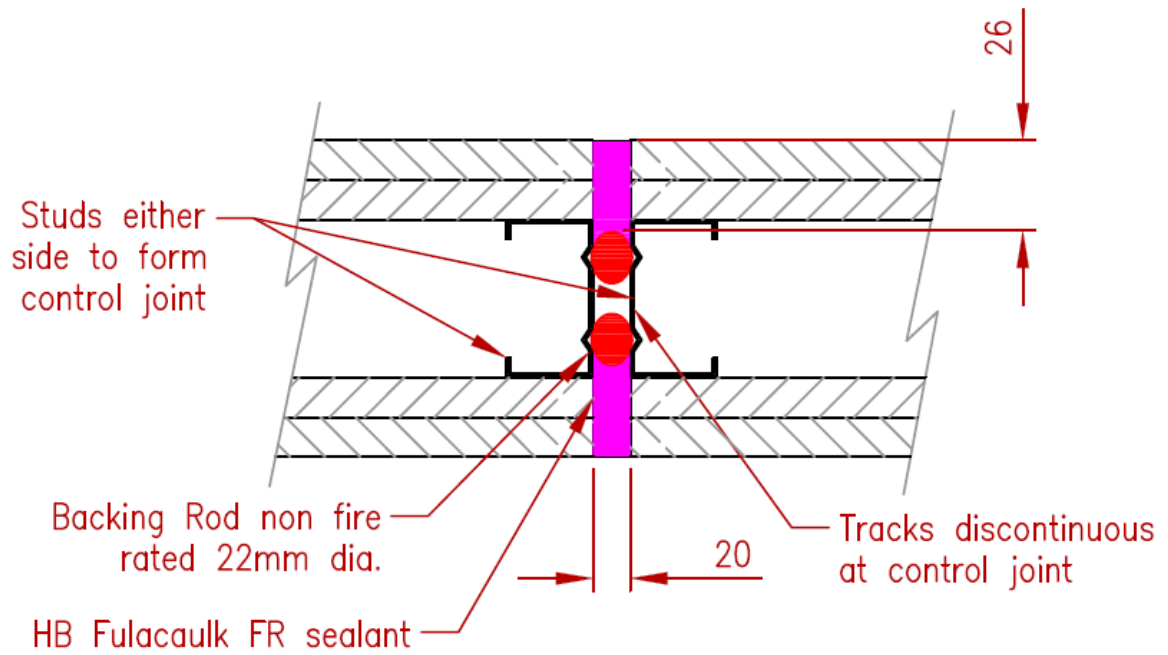


Figure A1.6: Cross-Section 4-4 (Specimen A)

APPENDIX 2 TEST OBSERVATIONS

The following include observations of the significant behaviour of the specimen.

Time		Observations
min	sec	
Service A		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 21°C.
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
79	20	Slightly discolouration appeared on the top and bottom section of the control joint
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
101	14	Small bulging appeared on the sealant at the mid-height of the control joint
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
123	22	Discolouration appeared on the plasterboard at the mid-section of the control joint
125	21	Deformation appeared on the sealant across the whole control joint
161	20	TC 011 on the plasterboard, 25mm away from the sealant recorded a temperature of 201°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 011 exceeded the initial temperature by more than 180°C.
163	30	Discolouration appeared on the plasterboard.
165	58	Discolouration of the plasterboard had advanced
169	20	Charring and glowing appeared on the paper skin of the plasterboard
176	40	Flaming for greater than 10 seconds had become evident at the centre of the control joint. Integrity failure in accordance with AS 1530.4-2014 Clause 2.13.2.4 due to flaming for more than 10 seconds on the unexposed side.
Service B		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 20°C.
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
92	35	Small bulging appeared on the sealant at the west side corner
111	56	Small bulging appeared on the sealant at the centre of the control joint
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014

Time		Observations
min	sec	
126	bb	Deformation appeared on the sealant across the whole control joint
160	15	TC 021 on the sealant, recorded a temperature of 201°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 021 exceeded the initial temperature by more than 180°C.
163	30	Discolouration appeared on the plasterboard.
165	58	Discolouration of the plasterboard had advanced
169	20	Charring and glowing appeared on the paper skin of the plasterboard
177	00	Test stopped at the request of the sponsor.
Service C		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 20°C.
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
137	40	Small bulging appeared on the sealant at the bottom section
163	30	Discolouration appeared on the plasterboard.
165	58	Discolouration of the plasterboard had advanced
166	55	TC 031 on the plasterboard, 25mm away from the sealant recorded a temperature of 201°C. Failure of insulation in accordance with AS 1530.4-2014 clause 2.13.3(b), where the maximum temperature of Thermocouple TC 031 exceeded the initial temperature by more than 180°C.
169	20	Charring and glowing appeared on the paper skin of the plasterboard
177	00	Test stopped at the request of the sponsor.
Service D		
00	00	Fire resistance test commenced and the average initial temperature of the specimen was approximately 20°C.
30	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
60	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
90	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
120	00	The specimen had continued to maintain integrity and insulation in accordance with AS 1530.4-2014
163	30	Discolouration appeared on the plasterboard.

Time		Observations
min	sec	
165	58	Discolouration of the plasterboard had advanced
169	20	Charring and glowing appeared on the paper skin of the plasterboard
177	00	Test stopped at the request of the sponsor.

APPENDIX 3 DIRECT FIELD OF APPLICATION

A 3.1 GENERAL

AS1530.4-2014 indicates that the results of the fire test contained in the test report are directly applicable without reference to the testing authority to similar constructions where one or more of the changes have been made:

A 3.2 SEPARATING ELEMENTS

Results obtained for sealing systems in various types of masonry and concrete construction may be applied as follows:

- a) For elements manufactured from similar types of concrete or masonry, the results of the prototype test may be applied to materials of density within $\pm 15\%$ of the tested specimen. For greater variations, the opinion of a registered testing authority shall be obtained.
- b) Test results obtained in conjunction with hollow concrete blocks may be used in a solid concrete element of the same overall thickness. The reverse does not apply.
- c) Results obtained from framed wall systems 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. The reverse does not apply.
- d) Results obtained from framed wall systems may be applied to similar walls having studs of the same material with sizes greater than the tested prototype.
- e) Results obtained from a prototype test may be applied to framed wall systems of similar construction but having thicker facings of the same material applied to the studs.

A 3.3 CONTROL JOINTS

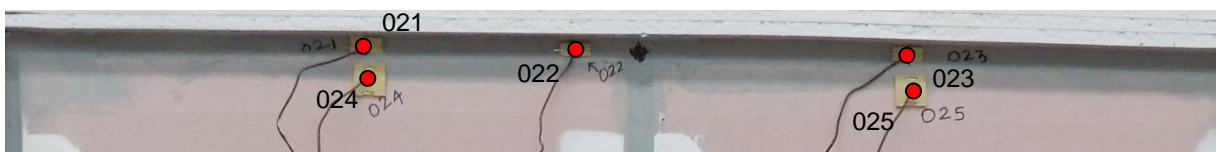
The following variations are permitted:

- a) Results obtained with butt-joints may be applied to contoured joints provided that, if only one specimen has been tested, the results may be applied to joints of the same configuration having—
 - i. equal width and equal or greater depth of sealant; and
 - ii. equal or greater thickness of fire-separating element.
- b) Facings may be applied to the surface of the fire-stopping system.

APPENDIX 4 INSTRUMENTATION POSITIONS



Service A



Service B



Service C



Service D

Figure A4.1: Unexposed surface thermocouple locations

Table A4.1: Thermocouple Locations

Service	T/C No.	Description
A	011	On the plasterboard, 25mm away from the sealant, at 205mm away from the top edge
	012	On the plasterboard, 25mm away from the sealant, at 705mm away from the top edge
	013	On the plasterboard, 25mm away from the sealant, at 205mm away from the bottom edge
	014	On the plasterboard, 25mm away from the sealant, at 705mm away from the top edge
	015	On the sealant, 330mm away from the top edge
	016	On the sealant, at the mid-height of the control joint
	017	On the sealant, 830mm away from the top edge
B	021	On the sealant, 350mm away from the west edge
	022	On the sealant, 50mm away from the mid width.
	023	On the sealant, 850mm away from the west edge
	024	On the plasterboard, 25mm away from the sealant, 350mm away from the west edge.
	025	On the plasterboard, 25mm away from the sealant, 850mm away from the west edge.
C	031	On the plasterboard, 25mm away from the sealant, 315mm away from the top edge
	032	On the plasterboard, 25mm away from the sealant, 815mm away from the top edge
D	041	On the plasterboard, 25mm away from the sealant, 350mm away from the west edge.
	042	On the plasterboard, 25mm away from the sealant, 850mm away from the west edge.

APPENDIX 5 TEST DATA

A 5.1 FURNACE TEMPERATURE

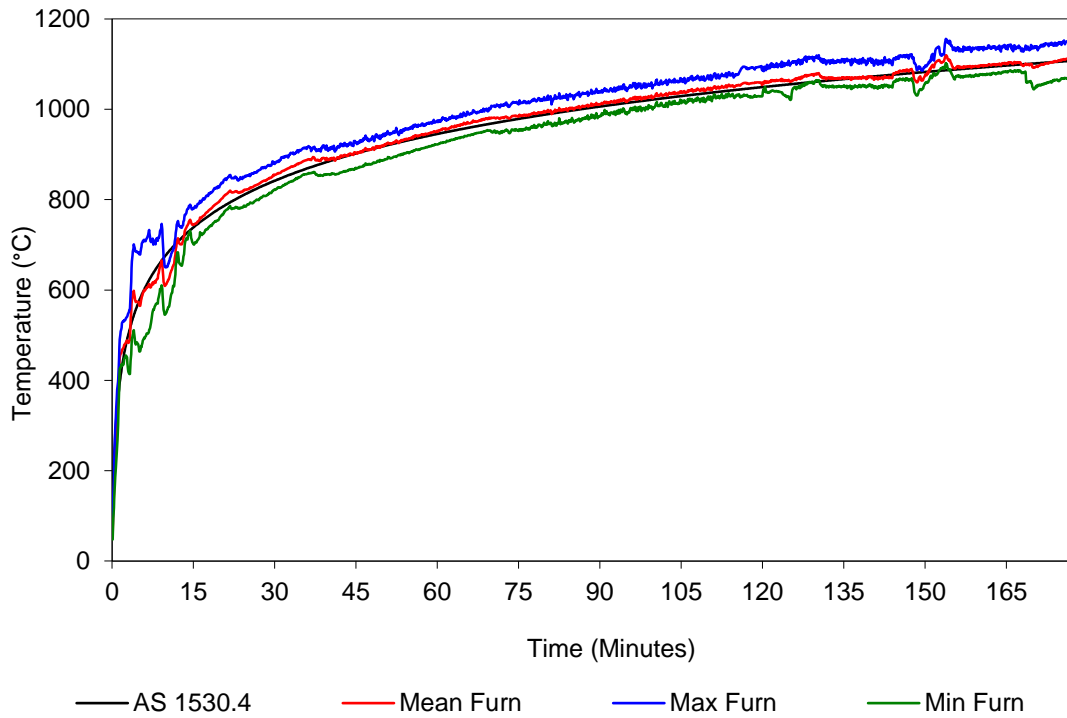


Figure A5.1: Furnace Temperatures vs. Time

A 5.2 FURNACE PRESSURE

The furnace pressure was measured at the mid-height of the control joint A.

Table A5.1: Pressure

Time (Minutes)	Pressure (Pa) Avg.	Time (Minutes)	Pressure (Pa) Avg.	Time (Minutes)	Pressure (Pa) Avg.
5-10	16	65-70	16	125-130	16
10-15	16	70-75	15	130-135	15
15-20	15	75-80	15	135-140	15
20-25	15	80-85	15	140-145	14
25-30	15	85-90	15	145-150	15
30-35	14	90-95	15	150-155	18
35-40	14	95-100	15	155-160	15
40-45	14	100-105	15	160-165	15
45-50	15	105-110	16	165-170	15
50-55	15	110-115	16	170-175	14
55-60	15	115-120	16		
60-65	16	120-125	15		

A 5.3 SPECIMEN TEMPERATURES

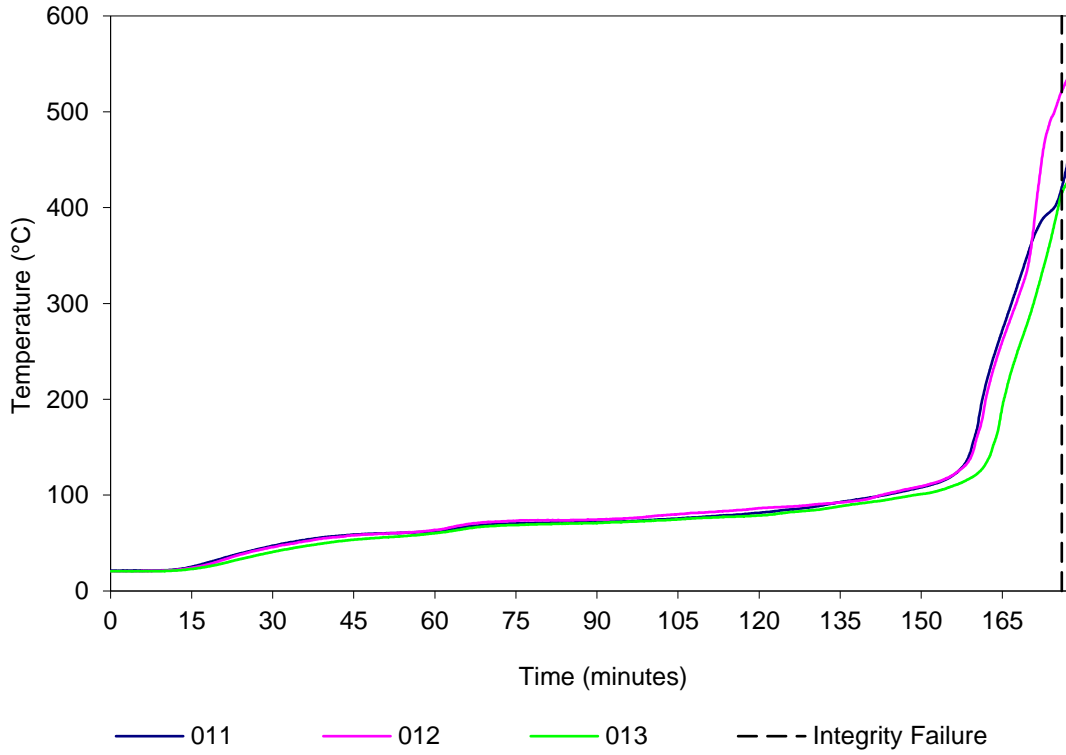


Figure A5.2: Specimen A. Temperatures vs. time

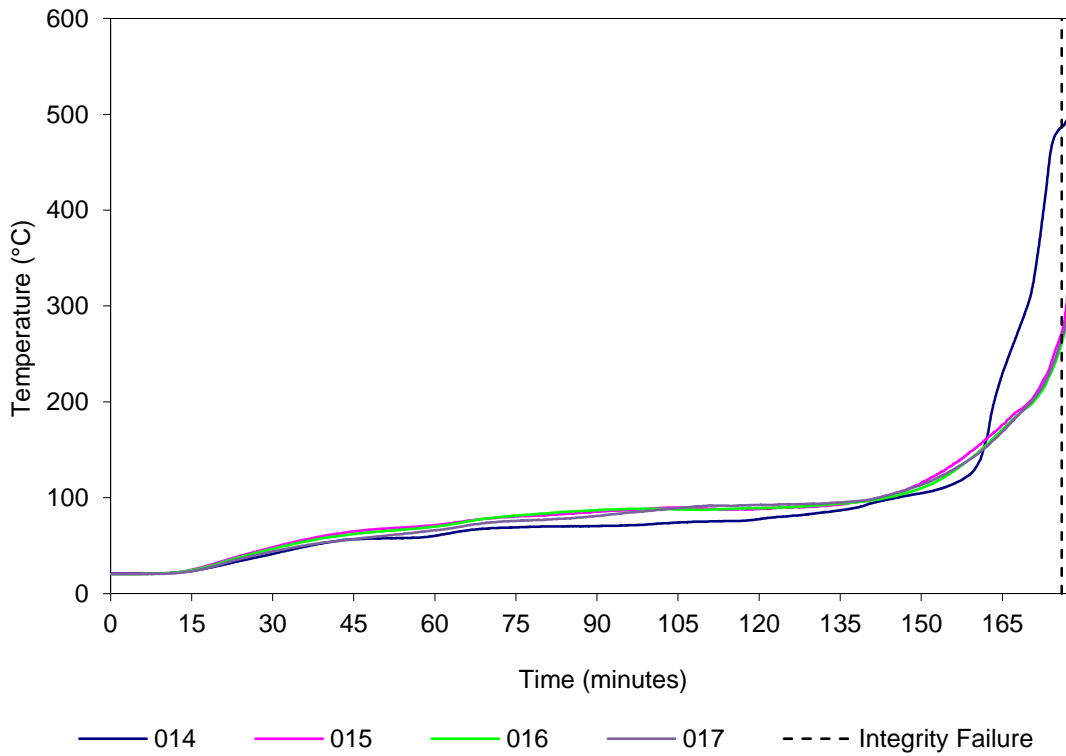


Figure A5.3: Specimen A. Temperatures vs. time

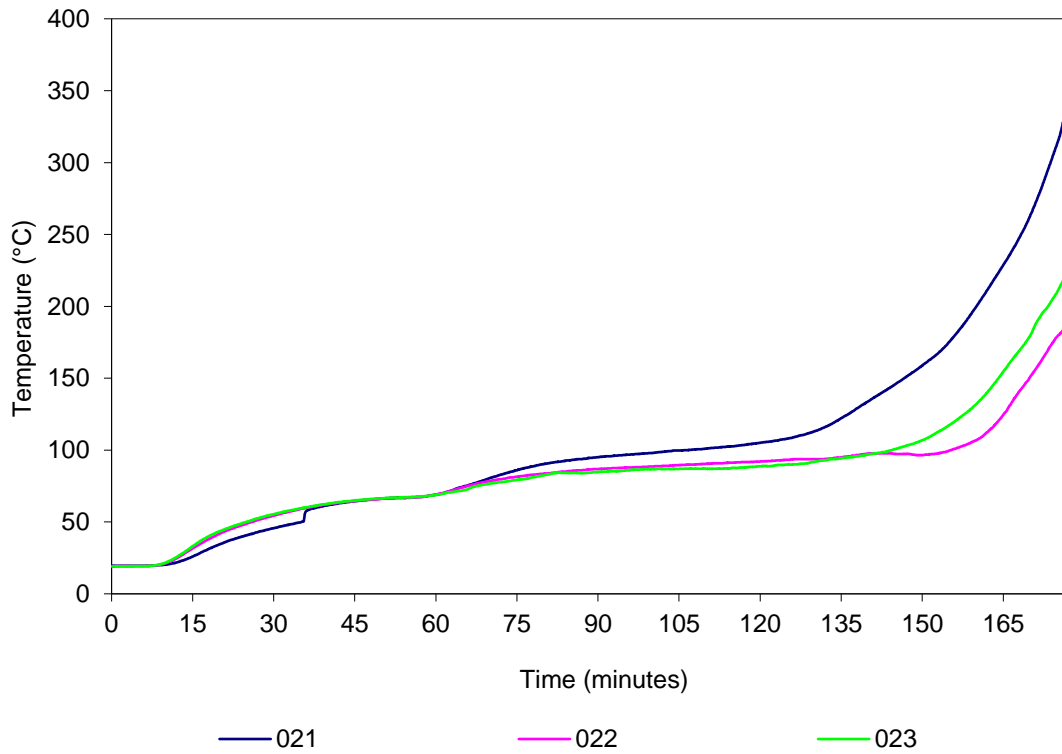


Figure A5.4: Specimen B. Temperatures vs. Time

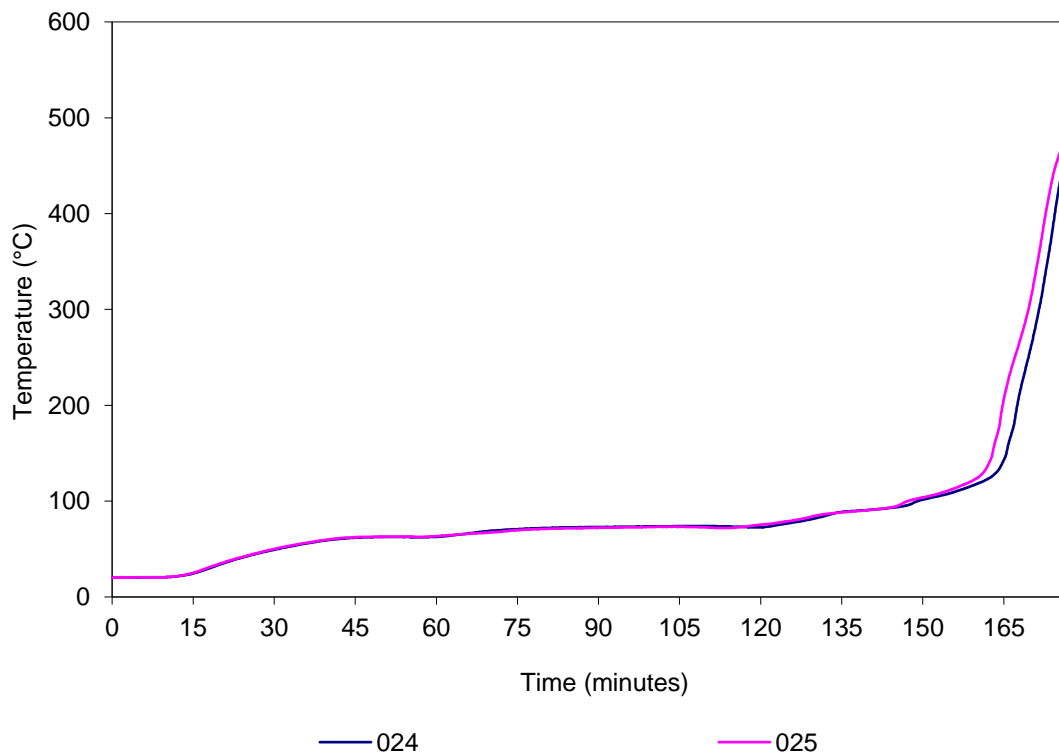


Figure A5.5: Specimen B. Temperatures vs. time

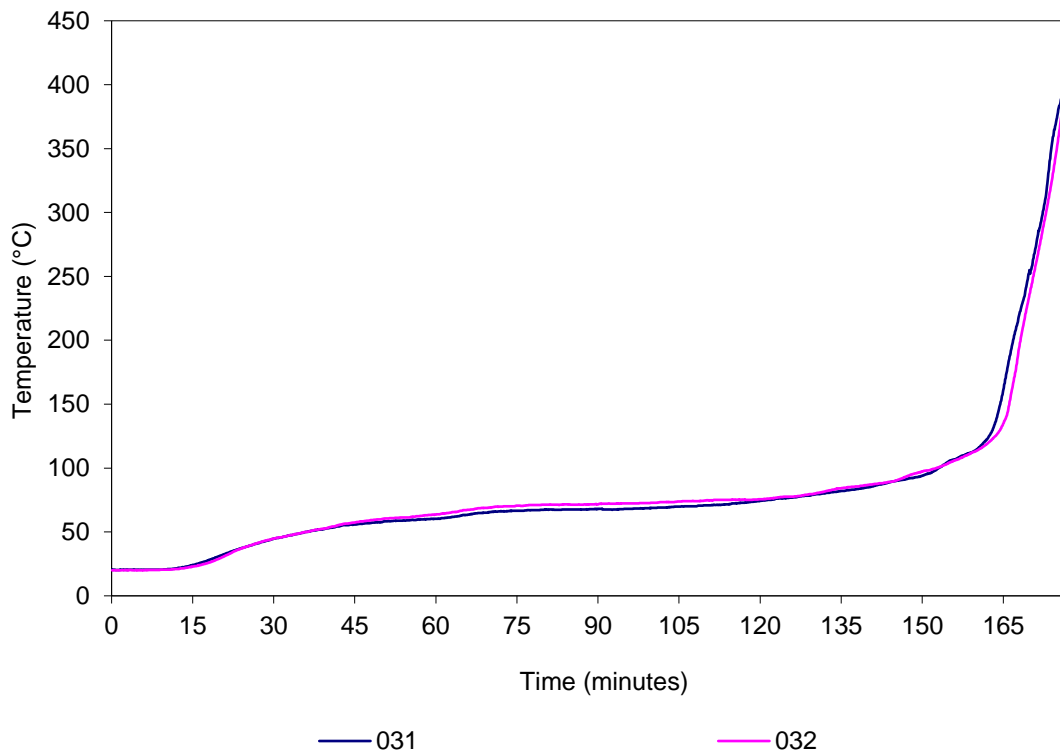


Figure A5.6: Specimen C. Temperatures vs. time

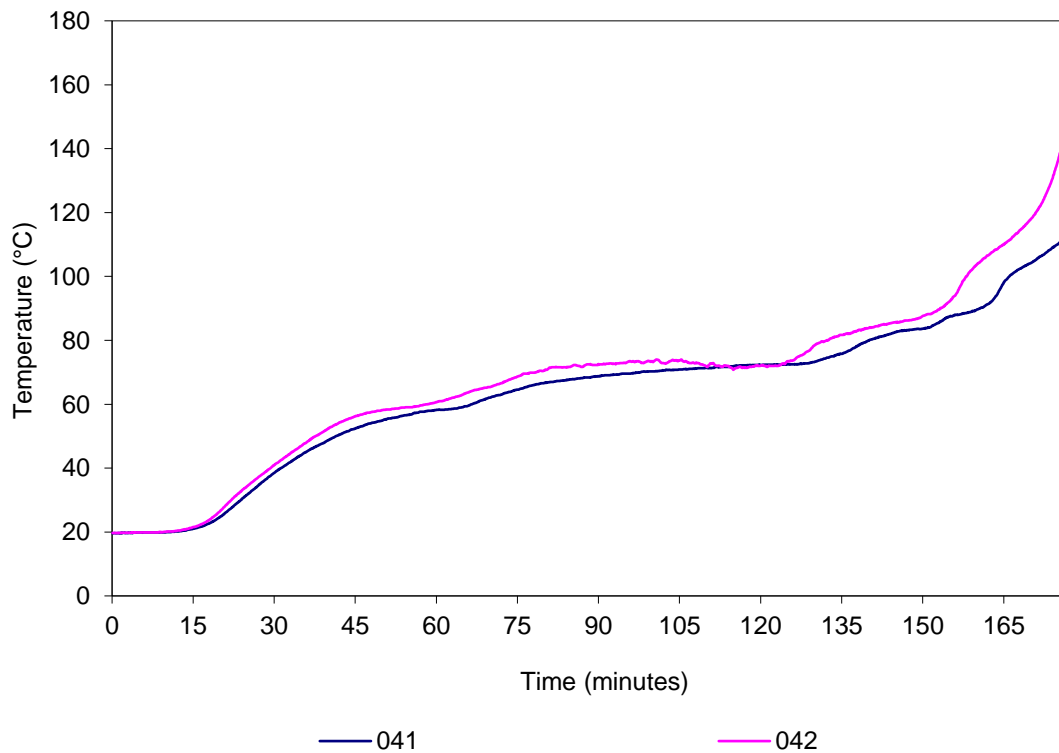


Figure A5.7: Specimen D. Temperatures vs. time

Table A5.2: Test Specimen Temperatures

Service	T/C No.	Description ²	Temp (°C) at t (minutes)						Limit ¹ (Mins)
			t=0	t=30	t=60	T=90	t=120	t=177	
A	011	On the plastic board	21	48	63	72	82	*	161
	012	On the plastic board	21	46	64	75	86	*	162
	013	On the plastic board	21	41	60	71	79	*	165
	014	On the plastic board	21	42	60	71	77	*	163
	015	On the sealant	21	49	72	85	88	*	170
	016	On the sealant	20	47	70	87	89	*	170
	017	On the sealant	20	44	66	81	92	*	170
B	021	On the sealant	20	46	69	95	105	344	160
	022	On the sealant	19	55	69	87	92	193	-
	023	On the sealant	19	56	69	85	89	225	173
	024	On the plasterboard	20	50	63	73	73	459	167
	025	On the plasterboard	20	51	64	72	75	487	164
C	031	On the sealant	21	45	60	68	74	408	166
	032	On the sealant	20	45	64	72	76	413	168
D	041	On the plasterboard	20	39	58	69	72	113	-
	042	On the plasterboard	20	42	61	73	72	152	-

- Notes**
- ¹ Limit time is the time to the nearest whole minute, rounded down to the nearest minute, at which the temperature recorded by the thermocouple does not rise by more than 180K above the initial temperature.
 - ² Refer to Appendix 4 for locations of thermocouples as only a generic description is included in the table.
 - ³ No insulation failure prior to thermocouple failure.
 - # Thermocouple failure
 - * Service failure
 - ¹ Under limit column indicates the temperature limit was not exceeded during the test period or up until the time of integrity failure if a failure occurred.

APPENDIX 6 PHOTOGRAPHS



Figure A6.1: Unexposed face of specimen before commencement of the fire-resistance test



Figure A6.2: Exposed face of specimen before commencement of the fire-resistance test

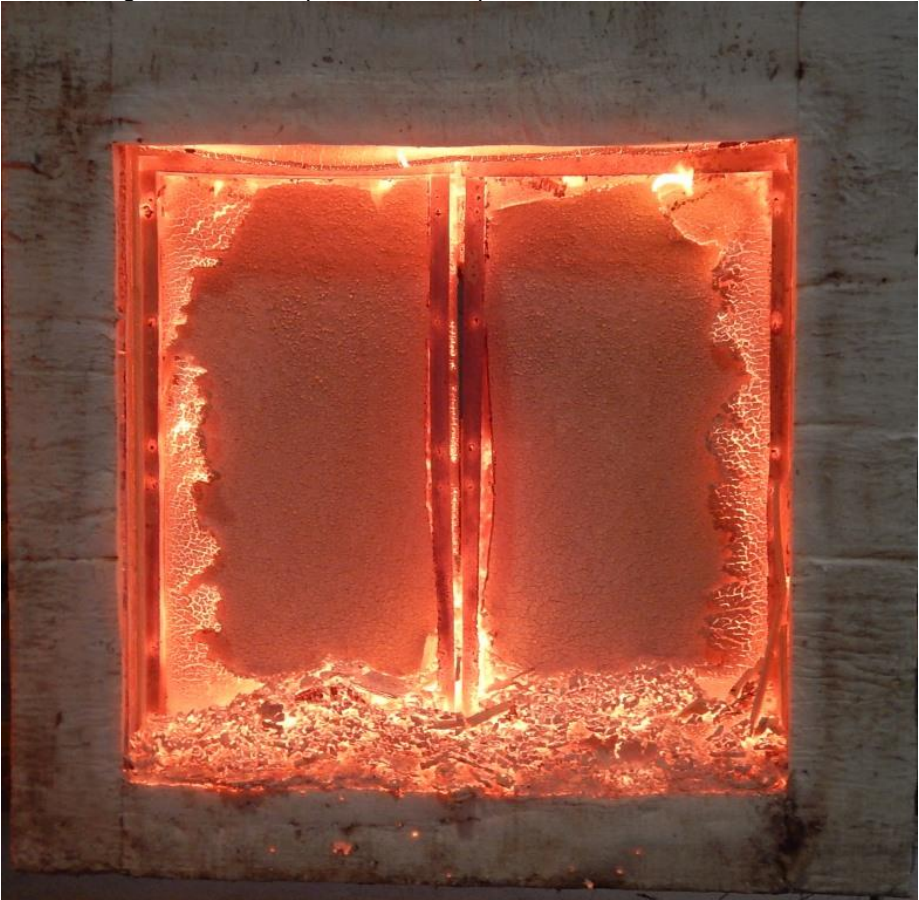
West



East

Figure A6.3: Unexposed face of specimen at the end of the test.

East



West

Figure A6.4: Exposed face of specimen at the end of the test.