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Fire resistance test report

Test standard: Sections 2 and 10 of AS 1530.4:2014

Test sponsor: H.B. Fuller Australia

Job number: FRT220129

Test date: 21 October 2022 Revision: R1.0

Warringtonfire: accredited for compliance with ISO/IEC 17025 – Testing

ilac-MRA NATA Accreditation No. 3277

Quality management

Revision	Date	Information about the report			
R1.0	29 November 2022	Description	Initial issue		
			Prepared by	Reviewed by	Authorised by
		Name	Rami Al Tam	Mandeep Kamal	Mandeep Kamal
		Signature			

Executive summary

This report documents the findings of the fire resistance test of control joints in accordance with sections 2 and 10 of AS 1530.4:2014. The testing was done on 21 October 2022.

Warringtonfire performed the test at the request of H.B. Fuller Australia.

Table 1 provides details of the test assembly, and Table 2 provides a summary of the test specimen. A summary of the results is provided in Table 3.

Table 1 Test assembly

Item	Detail	
Separating element	Wall system	
Nominal separating element size	Width	1200 mm
	Height	1200 mm
	Thickness	96 mm / 90 mm
Number of control joints	Two	
Restraint conditions	Restrained on all edges	

Table 2 Test specimen

Control joint	Service	Aperture size	Local fire-stopping protection	Sealant depth	Sealant width
A	Vertical control joint	1200 mm high × 20 mm wide	• HB Fuller Firesound™	13 mm	20 mm
B	Vertical control joint	1200 mm high × 20 mm wide	• HB Fuller Firesound™	20 mm	20 mm

Table 3 Test results

Control joint	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	Not applicable	**-/120/60**
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 63 minutes	
B	Structural adequacy	Not applicable	**-/120/60**
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 81 minutes	

Contents

1. Introduction

This report documents the findings of the fire resistance test of control joints in accordance with sections 2 and 10 of AS 1530.4:2014. The testing was done on 21 October 2022.

Warringtonfire performed the test at the request of the test sponsor listed in Table 4.

Table 4 Test sponsor details

Test sponsor	Address
H.B. Fuller Australia	16-22 Redgum Drive Dandenong South VIC 3175 Australia

2. Test specimen

2.1 Schedule of components

Table 5 describes the test specimen and lists the schedule of components. These were provided by the test sponsor and surveyed by Warringtonfire.

All measurements were done by Warringtonfire – unless indicated otherwise.

Detailed drawings of the test specimen are provided in Appendix A.

Table 5 Schedule of components

Item	Description	
Separating element (SE)		
1.	Item name	Wall frame studs
	Product name	Rondo 64 mm steel stud
	Manufacturer	Rondo Building Services Pty Ltd
	Size	64 mm × 36 mm × 0.50BMT
	Material	Galvanised steel
2.	Item name	Wall frame tracks
	Product name	Rondo 64 mm steel track
	Manufacturer	Rondo Building Services Pty Ltd
	Size	64 mm × 28 mm × 0.50BMT
	Material	Galvanised steel
3.	Item name	Plaster stopping angles
	Product name	Rondo 13 mm plaster stopping angles
	Manufacturer	Rondo Building Services Pty Ltd
	Size	13 mm × 28 mm × 0.40BMT
	Material	Galvanised steel
4.	Item name	Plaster stopping angles
	Product name	Rondo 16 mm plaster stopping angles
	Manufacturer	Rondo Building Services Pty Ltd
	Size	16 mm × 28 mm × 0.40BMT
	Material	Galvanised steel
5.	Item name	Fire rated plasterboard
	Product name	16 mm Knauf Firestop® plasterboard

Item	Description	
	Manufacturer	Knauf
	Density	812 kg/m^3
	size	3000 mm wide × 1200 mm high × 16 mm thick (cut to size)
6.	Item name	Fire rated plasterboard
	Product name	13 mm Knauf Firestop® plasterboard
	Manufacturer	Knauf
	Density	840 kg/m^3
	size	3000 mm wide × 1200 mm high × 13 mm thick (cut to size)
Fixings		
7.	Item name	Masonry anchors
	Product name	Ø6 × 45 mm masonry anchors – HUS3-M
	Manufacturer / supplier	Hilti
	Material	Galvanised carbon steel
8.	Item name	Plasterboard screws
	Product name	6g × 25 mm, bugle head, needle point screws
	Manufacturer / supplier	Zenith
	Material	Hardened carbon steel
Sealant		
9.	Item name	Fire rated sealant
	Product name	H.B. Fuller Firesound™ sealant
	Manufacturer / supplier	H.B. Fuller Australia
	Density	1613 kg/m^3
	Batch number	0001609174
Backing rod		
10.	Item name	Backing rod
	Product name	Open cell backing rod
	Supplier	H.B. Fuller Australia
	Material	Polyurethane foam
	Density	25.3 kg/m^3
Insulation		
11.	Item name	Cavity insulation batts
	Product name	R1.2 Ecowool acoustic wall batts
	Manufacturer	Ecowool Insulation
	Size	1200 mm long × 600 mm wide × 50 mm thick (cut to suit)
	Density	11 kg/m^3
	Product code	606005
SE	Overall size	1200 mm wide × 1200 mm high × 96 mm / 90 mm thick

Item	Description	
	Restraint conditions	Restrained on all edges
	Installation	The wall framing comprised of steel framing with studs (item 1) located along the vertical edges and spaced internally to suit the control joints. The head and sill incorporated wall tracks (item 2). The perimeter framing was masonry anchored (item 7) to the test frame blockwork at nominal 300 mm centres. Insulation batts (item 11) were installed in the wall framing cavities between the studs. The western side separating element consisted of a 210 mm wide × 1200 mm high steel frame and a 346 mm wide × 1200 mm high steel frame. They were both clad with one layer of 16 mm thick fire rated plasterboard (item 5) on either side of the steel frame. The eastern side separating element consisted of a 210 mm wide × 1200 mm high steel frame and a 346 mm wide × 1200 mm high steel frame. They were clad with one layer of 13 mm thick fire rated plasterboard (item 6) on either side of the steel frame. Plasterboard sheets in both sections of separating element finished at a nominal 16 mm distance from the top edge and 10 mm from the bottom and both vertical edges. The gaps between the plasterboard and the surround blockwork were sealed with fire rated sealant (item 9) The fire rated plasterboard sheets were secured to the steel frame with plasterboard screws (item 8) at 300 mm centres. Both sections of separating element were separated by three layers of 16 mm thick fire rated plasterboard. See Figure 1 to Figure 6 in Appendix A for more details.
Control joint A		
A	Aperture size	1200 mm high × 20 mm wide
	Control joint size	1200 mm high × 20 mm wide × 13 mm deep
	Local fire-stopping protection	
	Protection	Two plaster stopping angles (item 3) were installed and stapled to the 13 mm plasterboard on both vertical edges of the control joint aperture on both exposed and unexposed sides. An open cell backing rod (item 10) was inserted into the aperture to a depth of 13 mm from both the exposed and unexposed faces of the separating element. Fire rated sealant (item 9) was then applied onto the open cell backing rod and finished flush with the exposed and unexposed faces of the separating element. See Figure 5 to Figure 7 in Appendix A for more details.
Control joint B		
B	Aperture size	1200 mm high × 20 mm wide
	Control joint size	1200 mm high × 20 mm wide × 20 mm deep
	Local fire-stopping protection	
	Protection	Two plaster stopping angles (item 4) were installed and stapled to the 16 mm plasterboard on both vertical edges of the control joint aperture on both exposed and unexposed sides. An open cell backing rod (item 10) was inserted into the aperture to a depth of 20 mm from both the exposed and unexposed faces of the separating element. Fire rated sealant (item 9) was then applied onto the open cell backing rod and finished flush with the exposed and unexposed faces of the separating element. See Figure 5 to Figure 7 in Appendix A for more details.

2.2 Installation details

Table 6 lists the installation details for the test specimen.

Table 6 Installation details

Item	Detail
Start date for construction of separating element	24 August 2022
Start date for installation of fire-stopping protection for the control joints	21 September 2022
Completion date for constructing and installing the test specimen	21 September 2022
Separating element constructed by	Representatives of Warringtonfire
Fire-stopping protection for control joints installed by	Representatives of the test sponsor
Symmetry	Symmetrical

3. Test procedure

Table 7 details the test procedure for this fire resistance test.

Table 7 Test procedure

Item	Detail	
Statement of compliance	The test was performed in accordance with the requirements of sections 2 and 10 of AS 1530.4:2014 appropriate for control joints.	
Variations	None	
Pre-test conditioning	The construction and installation of the test specimen was completed on 21 September 2022. The test specimen was subjected to normal laboratory temperatures and conditions between the completion of its construction and the start of the test.	
Sampling / specimen selection	The laboratory was not involved in sampling or selecting the test specimen for the fire resistance test. The results obtained during the test only apply to the test samples as received and tested by Warringtonfire.	
Ambient laboratory temperature	Start of the test Minimum temperature Maximum temperature	20 °C 20 °C 25 °C
Test duration	121 minutes	
Instrumentation and equipment	The instrumentation was provided in accordance with AS 1530.4:2014 as follows: • The furnace temperature was measured by four mineral insulated metal sheathed (MIMS) Type K thermocouples – with wire diameters not greater than 1 mm, an overall diameter of 3 mm, and the measuring junction insulated from the sheath. The thermocouples protruded a minimum of 25 mm from steel supporting tubes. • The unexposed side specimen temperatures were measured by Type K thermocouples with wire diameters less than 0.5 mm soldered to 12 mm diameter × 0.2 mm thick copper discs covered by 30 mm × 30 mm × 2.0 mm thick inorganic insulating pads. • The thermocouple positions are shown in Table 10 and in Figure 10 in Appendix D.	

Item	Detail
	• A roving thermocouple was available to measure temperatures at positions that appeared hotter than the positions monitored by the fixed thermocouples. • Cotton pads were available during the test to assess the performance of the specimen under the criteria of integrity. • The furnace pressure was measured at approximately mid-height of the vertical control joints.

4. Test measurements and results

Table 8 summarises the results the specimen achieved against the performance criteria listed in sections 2 and 10 of AS 1530.4:2014.

Appendix E includes details of the measurements taken during the test.

Table 9 in Appendix B includes observations of any significant behaviour of the specimen and details of the occurrence of the various performance criteria specified in AS 1530.4:2014.

Photographs of the specimen are included in Appendix F.

Table 8 Test results

Control joint	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	Not applicable	**-/120/60**
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 63 minutes	
B	Structural adequacy	Not applicable	**-/120/60**
	Integrity	No failure at 121 minutes	
	Insulation	Failure at 81 minutes	

5. Application of test results

5.1 Test limitations

The results of these fire tests 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 fire conditions.

These results only relate to the behaviour of the specimen of the element of 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, and they do not necessarily reflect the actual behaviour in fires.

5.2 Variations from the tested specimen

This report details methods of construction, the test conditions and the results obtained when the specific element of construction described here was tested following the procedure outlined in AS 1530.4:2014. Any significant variation with respect to size, construction details, loads, stresses, edge or end conditions, other than that allowed under the field of direct application in the relevant test method, is not covered 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 C – should be referred to the test sponsor. They should then obtain appropriate documentary evidence of compliance from Warringtonfire or another accredited testing authority.

5.3 Uncertainty of measurements

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 for the result.

Appendix A Drawings of test assembly

The leaders in the drawings represent the items listed in section 2.1. All measurements – unless indicated – are in millimetres.

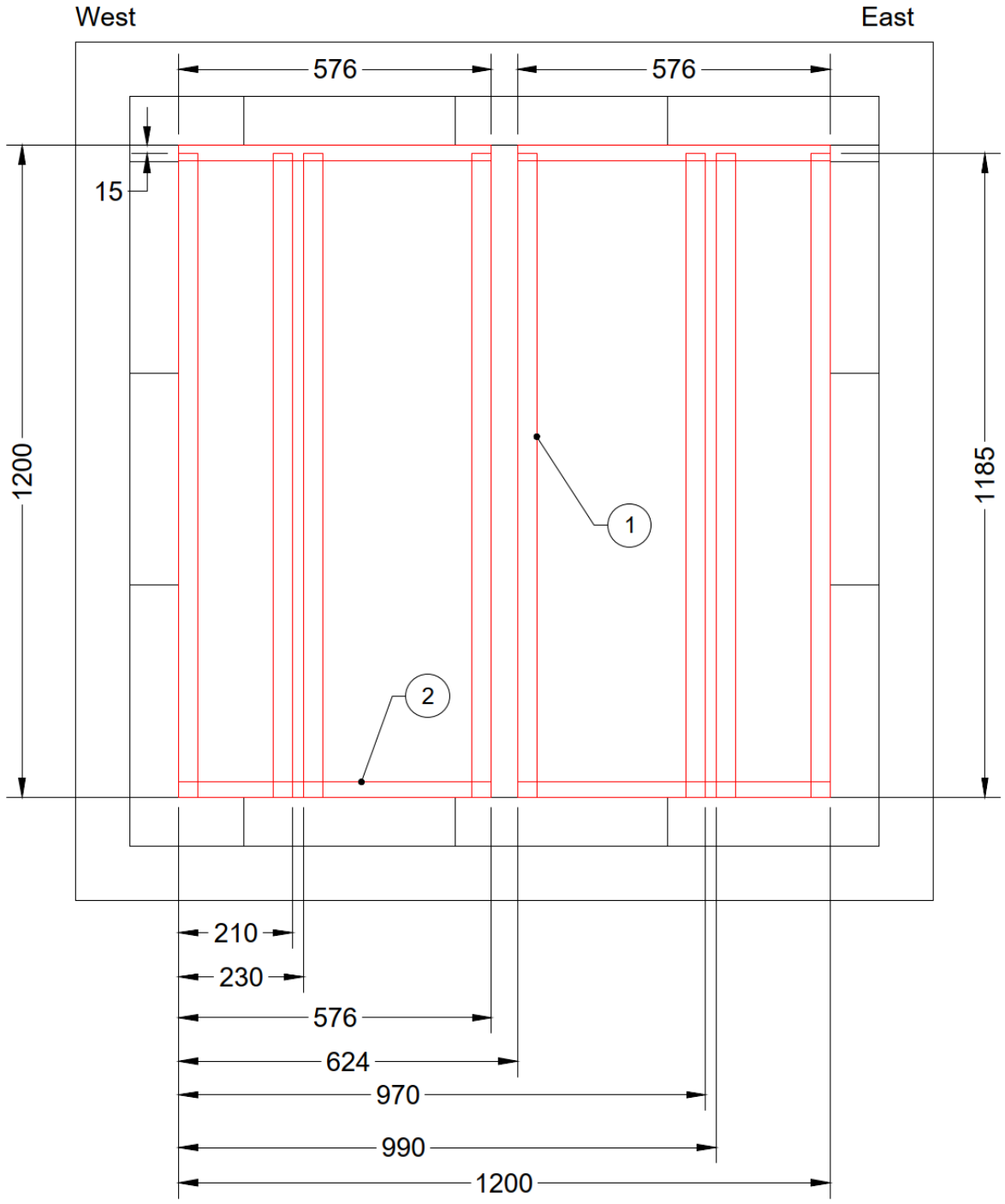


Figure 1 Elevation view of steel framing (unexposed side)

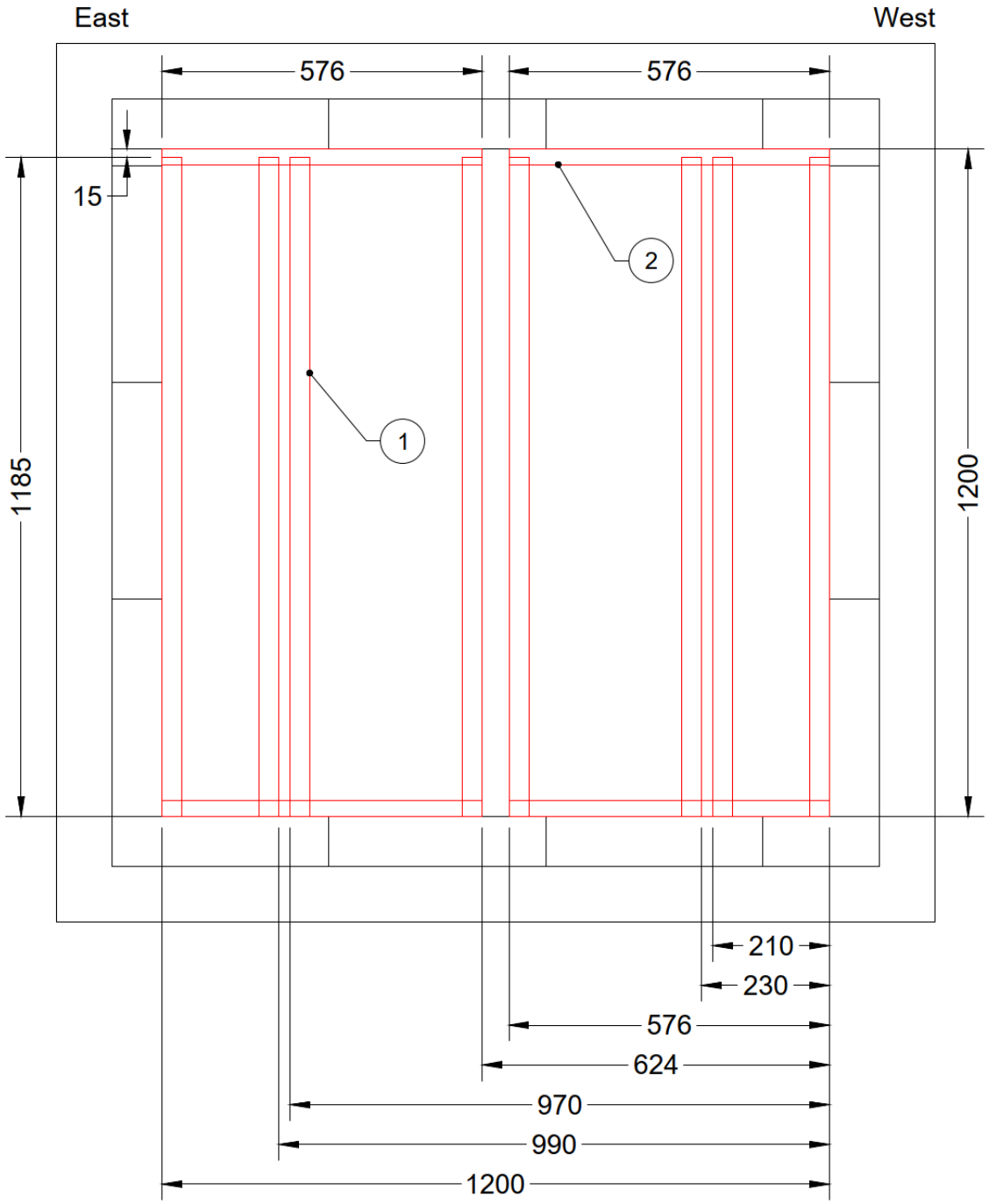


Figure 2 Elevation view of steel framing (exposed side)

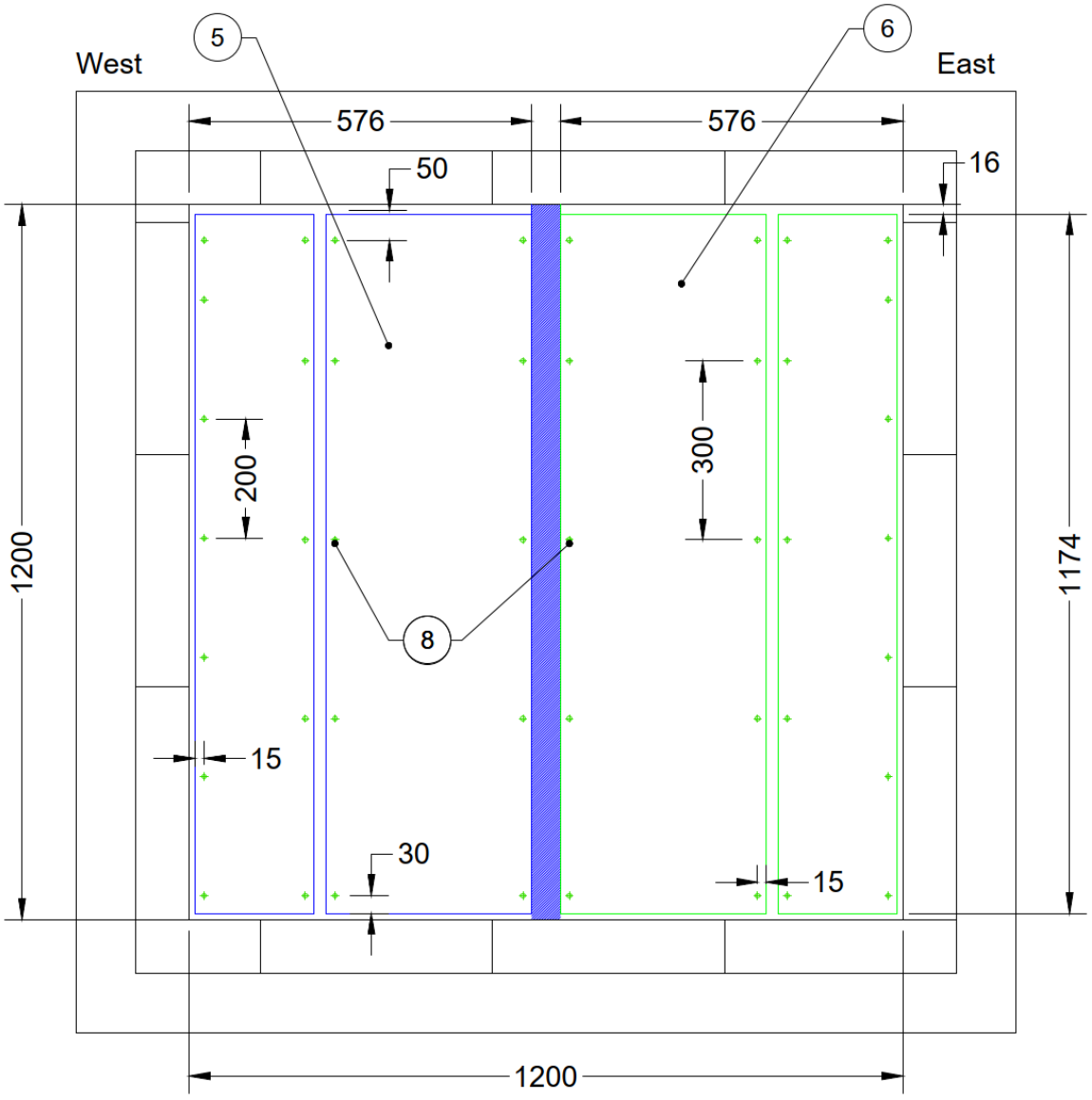


Figure 3 Elevation view of cladding (unexposed side)

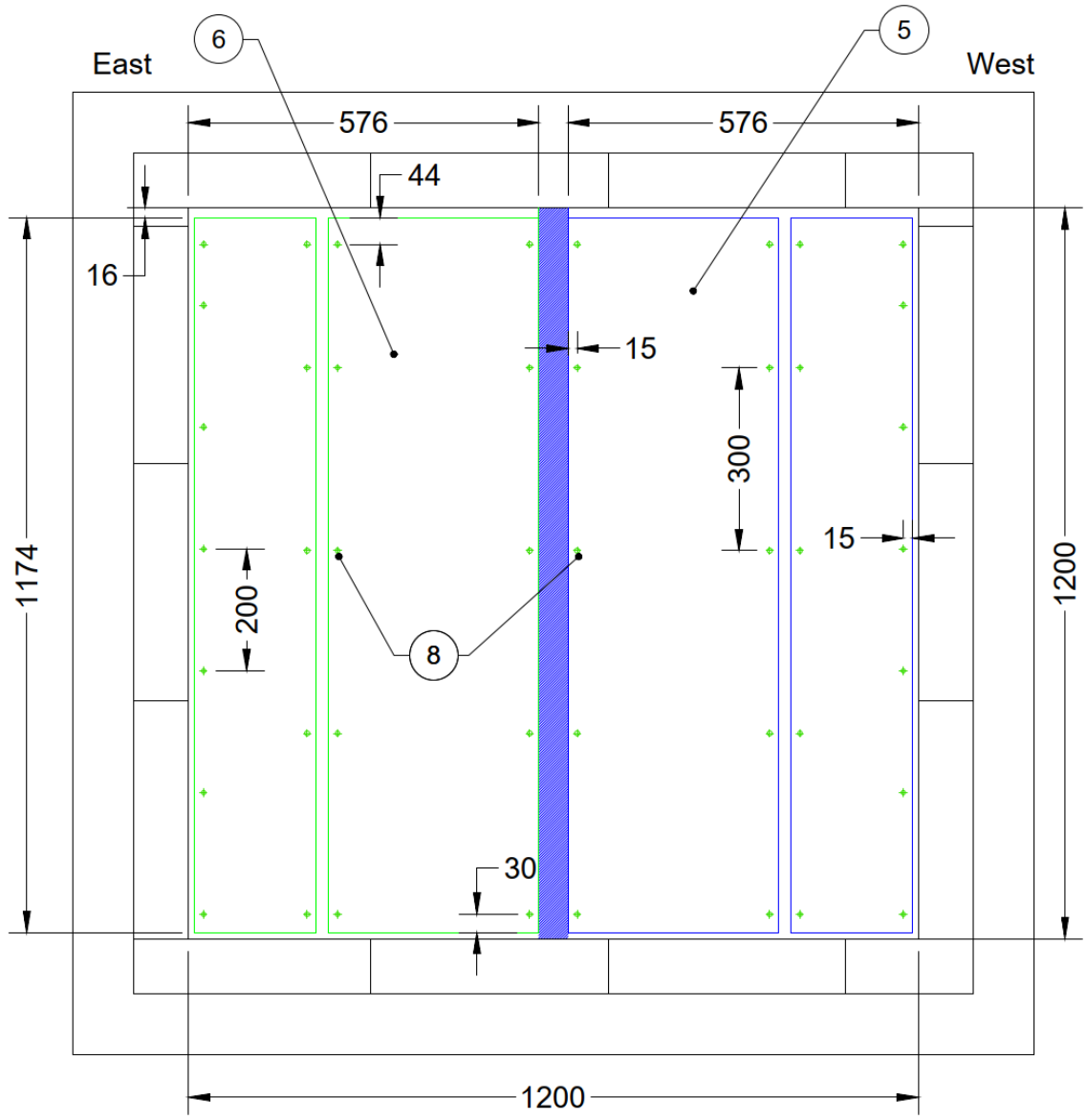


Figure 4 Elevation view of cladding (exposed side)

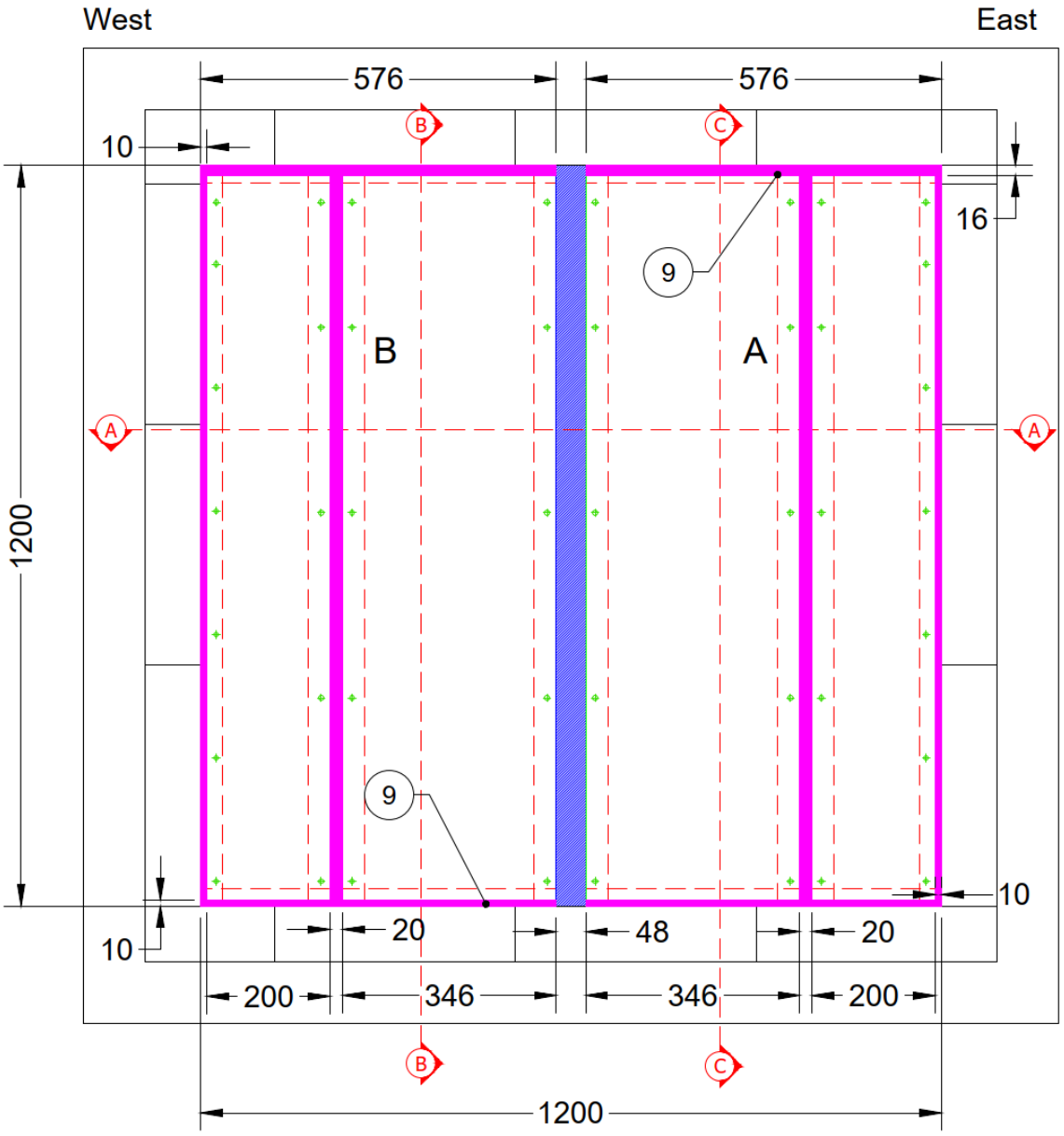


Figure 5 Elevation view of the specimen (unexposed side)

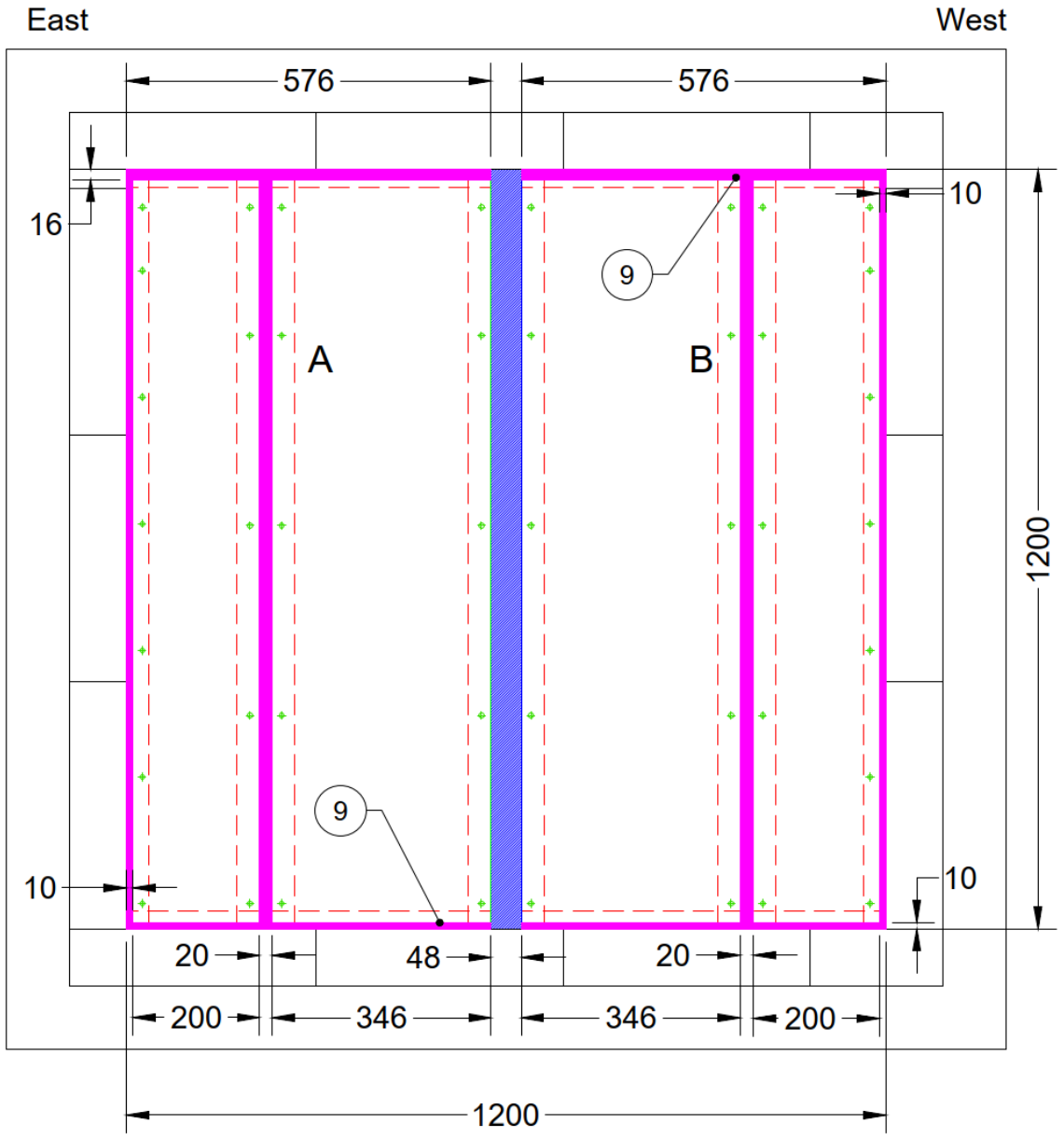


Figure 6 Elevation view of the specimen (exposed side)

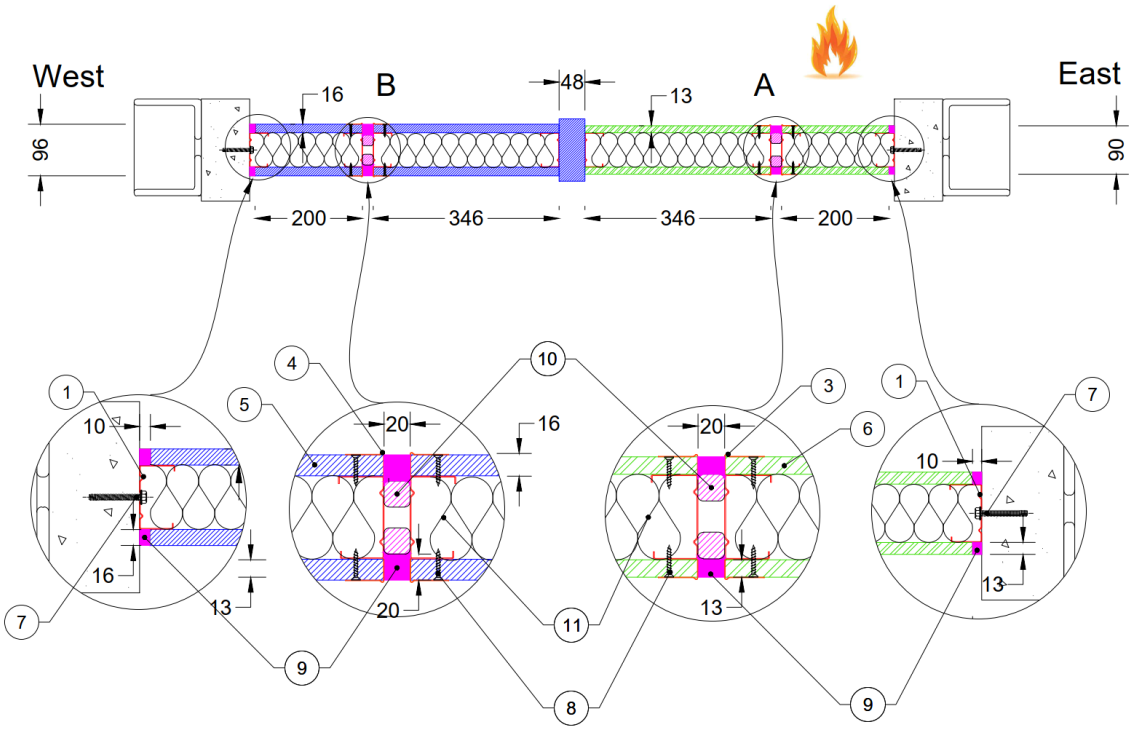


Figure 7 Cross section A-A

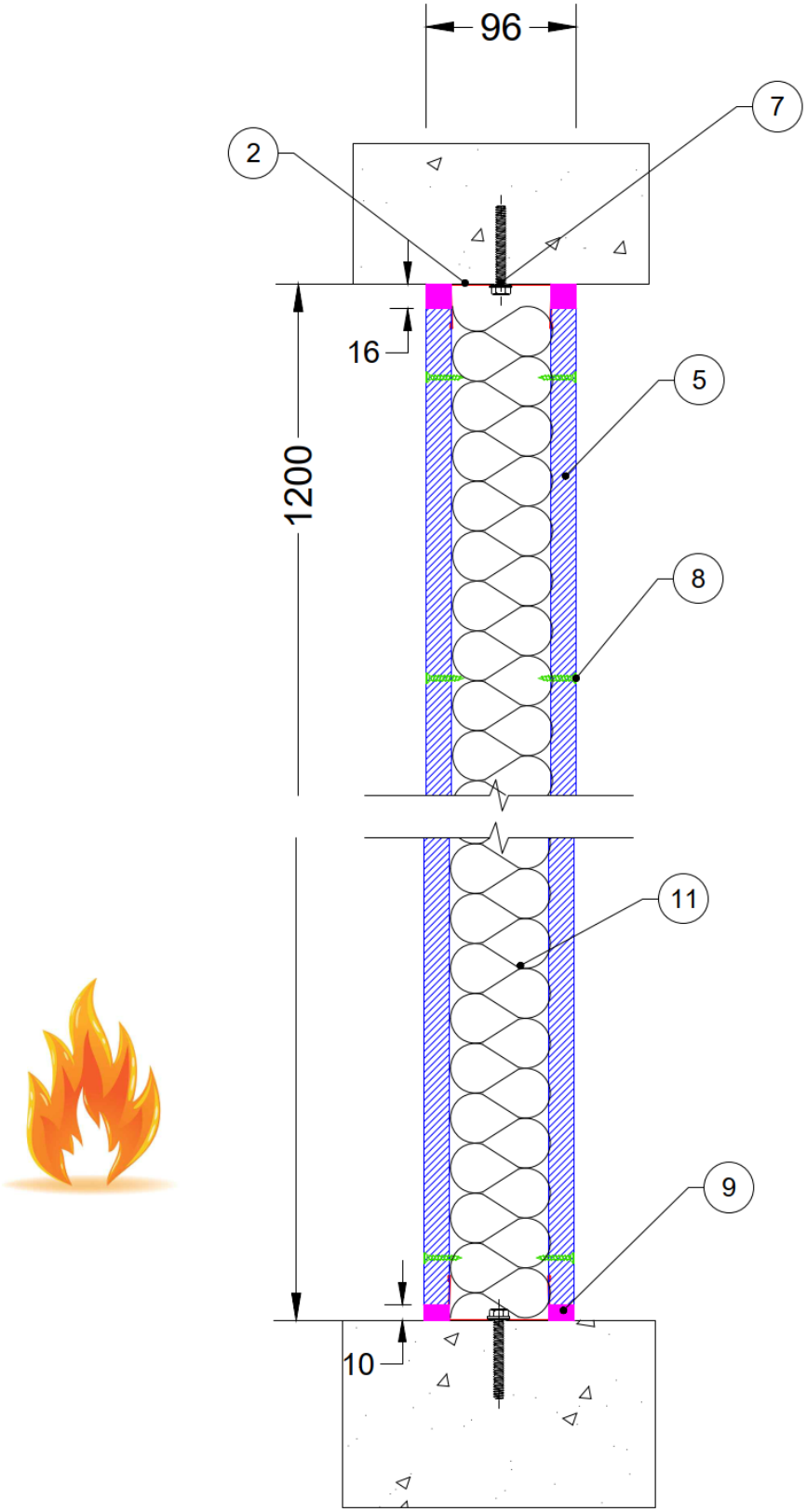


Figure 8 Cross section B-B

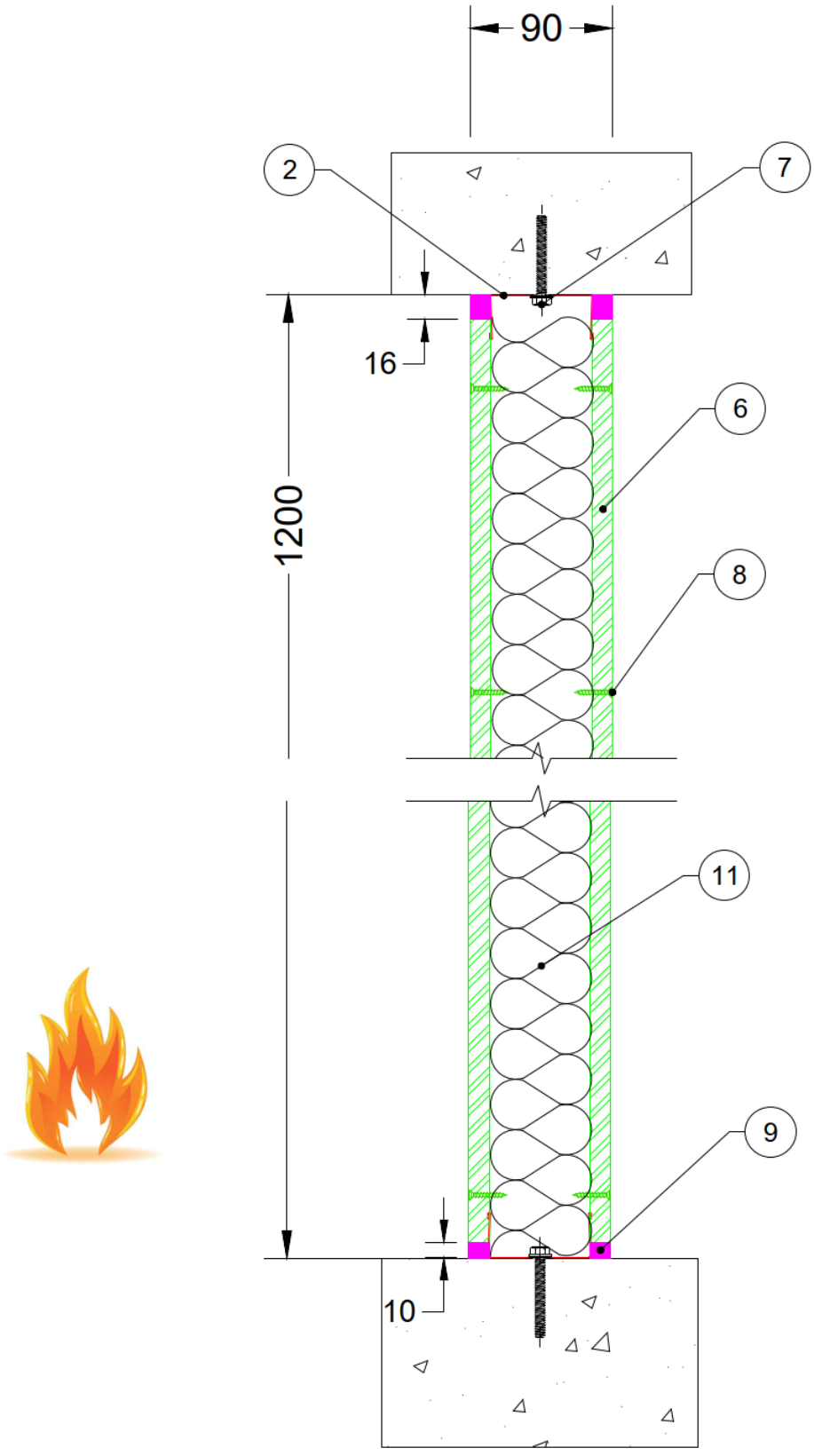


Figure 9 Cross section C-C

Appendix B Test observations

Table 9 shows the observations of any significant behaviour of the specimen during the test.

Table 9 Test observations

Time		Observation
Min	Sec	
Control joint A		
00	00	The fire resistance test started. The initial temperature of the test specimen was approximately 21 °C.
4	00	Smoke emitting from the top of the separating element.
7	35	Smoke emitting from the control joint.
15	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
21	30	Smoke emitting from the top and bottom of the interface between the separating element and concrete lintels.
30	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
38	30	Discolouration started on the plasterboard around the control joint.
40	00	Sealant on the control joint started to expand.
45	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
60	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
63	**35**	**TC001, on control joint, 250 mm up from the centre, recorded a temperature of 201 °C.** **Failure of insulation in accordance with clause 2.13.3(b) of AS 1530.4:2014, where the maximum temperature of thermocouple TC001 exceeded the initial temperature by more than 180 K.**
90	00	The test specimen continued to maintain integrity in accordance with AS 1530.4:2014.
120	00	The test specimen continued to maintain integrity in accordance with AS 1530.4:2014.
121	00	Test stopped.
Control joint B		
00	00	The fire resistance test started. The initial temperature of the test specimen was approximately 21 °C.
4	00	Smoke emitting from the top of the separating element.
7	35	Smoke emitting from the control joint.
15	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
30	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
34	00	Smoke emitting from the control joint had increased.
38	30	Discolouration started on the plasterboard around the control joint.
45	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.
52	00	Sealant on the control joint started to expand.
60	00	The test specimen continued to maintain integrity and insulation in accordance with AS 1530.4:2014.

Time		Observation
Min	Sec	
81	**10**	**TC013, on the plasterboard, 25 mm from the control joint, 125 mm up from the centre, recorded a temperature of 201 °C.** **Failure of insulation in accordance with clause 2.13.3(b) of AS 1530.4:2014, where the maximum temperature of thermocouple TC013 exceeded the initial temperature by more than 180 K.**
90	00	The test specimen continued to maintain integrity in accordance with AS 1530.4:2014.
120	00	The test specimen continued to maintain integrity in accordance with AS 1530.4:2014.
121	00	Test stopped.

Appendix C Direct field of application

The text, figures and tables in this appendix have been taken from section 10 of AS 1530.4:2014.

C.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 one or more of the changes set out in clauses 10.12.2 to 10.12.6 of AS 1530.4:2014 have been made.

C.2 Separating elements

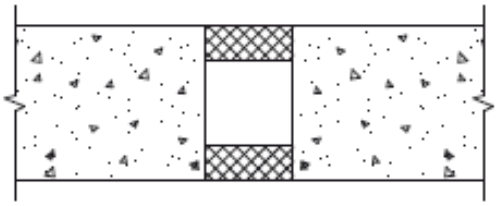
Results obtained for sealing systems in various types of masonry and concrete construction may be applied as follows:

- For elements manufactured from similar types of concrete or masonry, the results of the prototype test may be applied to materials of density within ±15% of the tested specimen. For greater variations, the opinion of a registered testing authority shall be obtained.
- 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.
- 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.
- 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.
- 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.

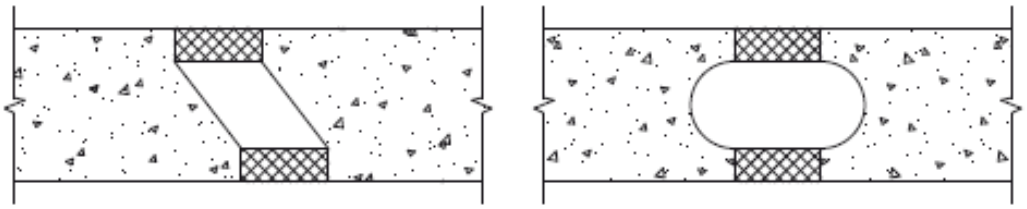
C.3 Control joints

The following variations are permitted:

- Results obtained from single test on a butt joints may be applied to contoured joints, provided the joints have —
  - equal width and equal or greater depth of sealant; and
  - equal or greater thickness of fire-separating element.
  - Note: Examples of butt and contoured control joints are shown in figure 10.12.6 of AS 1530.4:2014.
- Facings may be applied to the surface of the fire-stopping system.



(a) Butt joint



(b) Contoured joints

LEGEND:

= Fire-separating element

= Fire-stopping material

FIGURE 10.12.6 CONTOURED CONTROL JOINTS

Appendix D Instrumentation locations

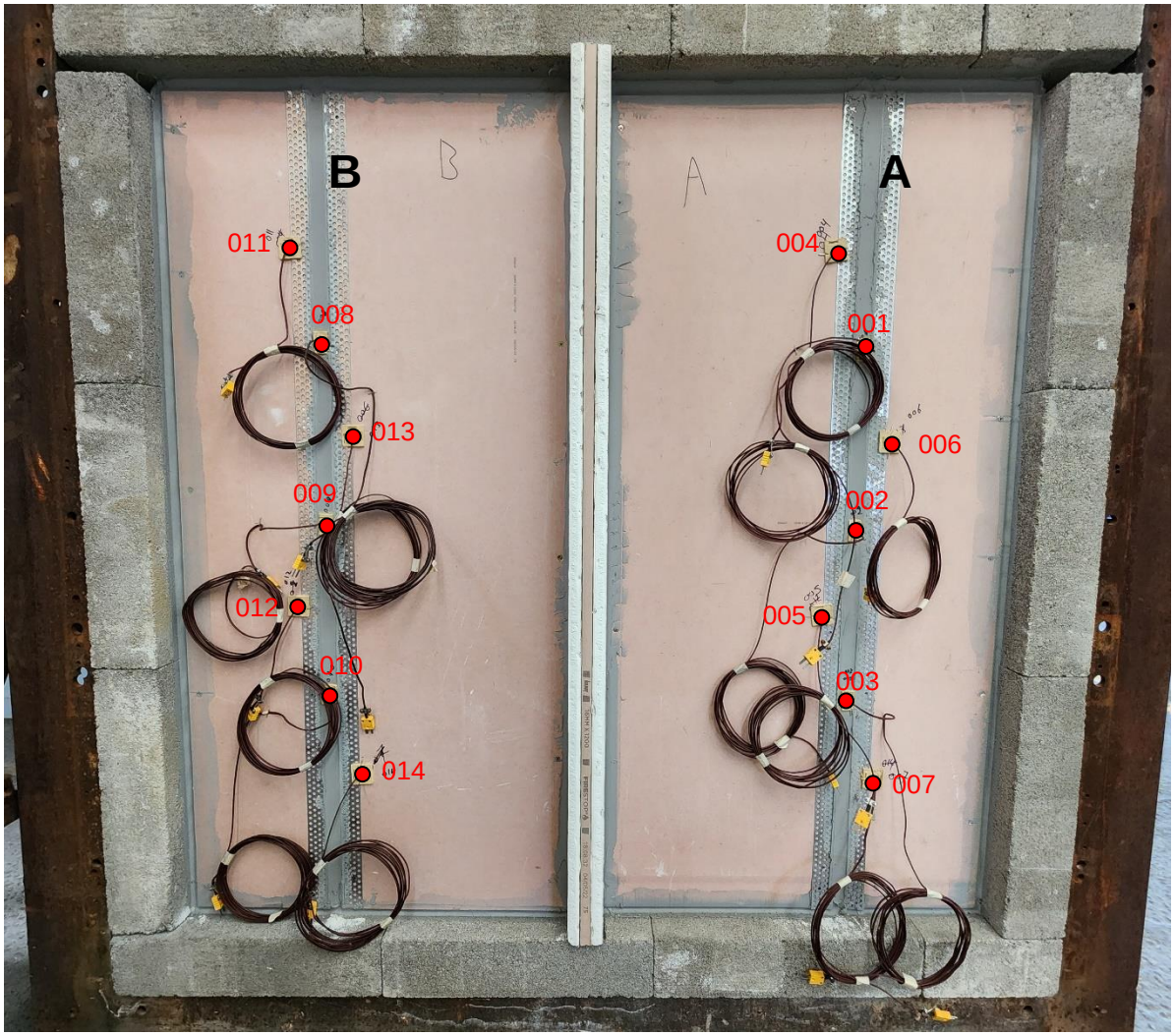


Figure 10 Instrumentation locations

Table 10 Thermocouple locations

Control joint	T/C #	Description
A	001	On the control joint, 250 mm up from the centre.
	002	On the control joint, at the centre.
	003	On the control joint, 250 mm down from the centre.
	004	25 mm from the control joint, 375 mm up from the centre.
	005	25 mm from the control joint, 125 mm down from the centre.
	006	25 mm from the control joint, 125 mm up from the centre.
	007	25 mm from the control joint, 375 mm down from the centre.
B	008	On the control joint, 250 mm up from the centre.
	009	On the control joint, at the centre.
	010	On the control joint, 250 mm down from the centre.
	011	25 mm from the control joint, 375 mm up from the centre.
	012	25 mm from the control joint, 125 mm down from the centre.
	013	25 mm from the control joint, 125 mm up from the centre.
	014	25 mm from the control joint, 375 mm down from the centre.

Appendix E Test data

E.1 Furnace temperature and severity

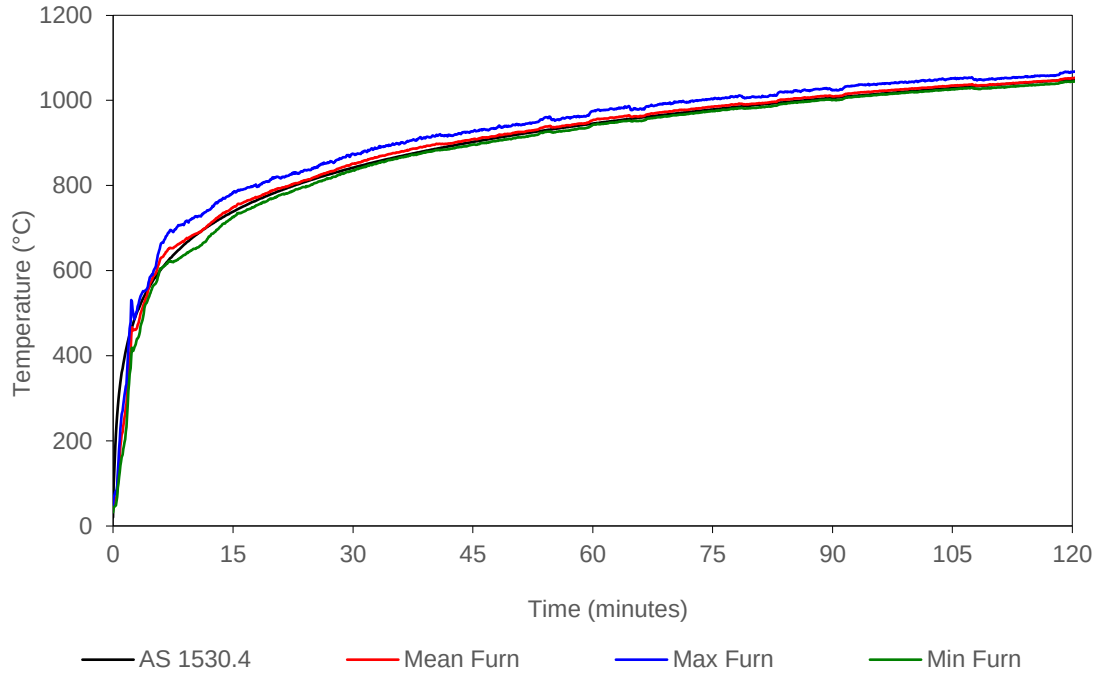


Figure 11 Furnace thermocouple temperature vs time

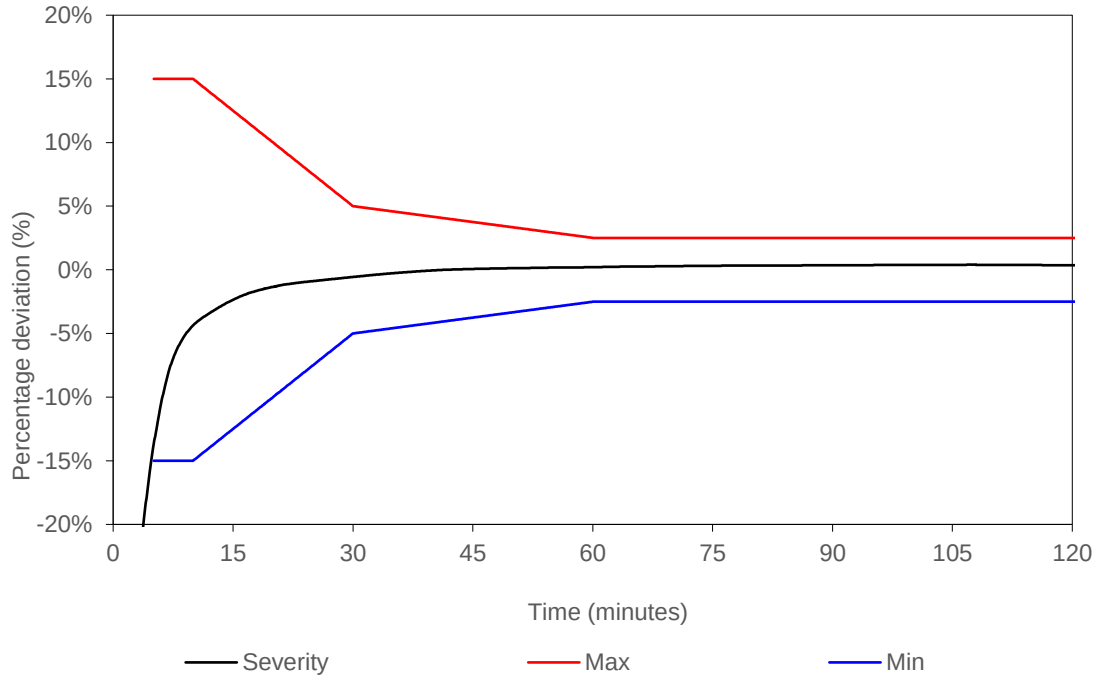


Figure 12 Percentage deviation of exposure severity vs time

E.2 Furnace pressure

The furnace pressure was measured at mid-height of control joints.

Table 11 Furnace pressure

Time (minutes)	Average pressure (Pa)	Time (minutes)	Average pressure (Pa)	Time (minutes)	Average pressure (Pa)
5-10	15	45-50	16	85-90	17
10-15	16	50-55	17	90-95	15
15-20	16	55-60	16	95-100	16
20-25	17	60-65	17	100-105	16
25-30	17	65-70	17	105-110	17
30-35	18	70-75	17	110-115	17
35-40	17	75-80	17	115-120	16
40-45	16	80-85	16		

E.3 Specimen temperatures

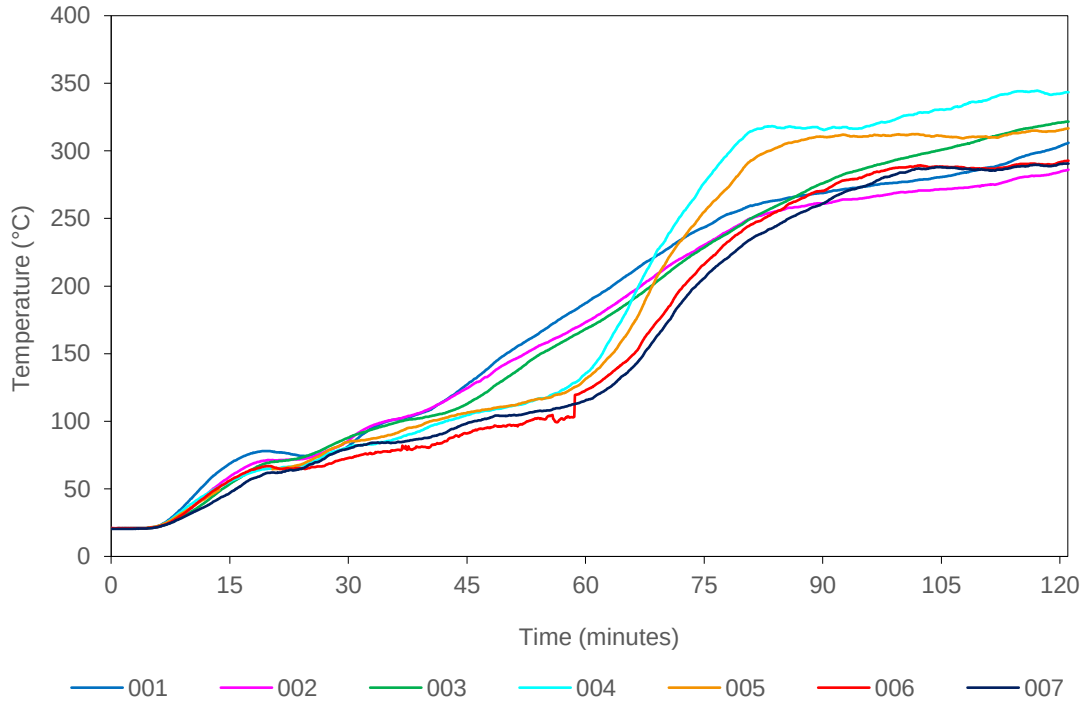


Figure 13 Control joint A – temperature vs time

Note: TC005 malfunctioned between 13 minutes and 20 minutes.

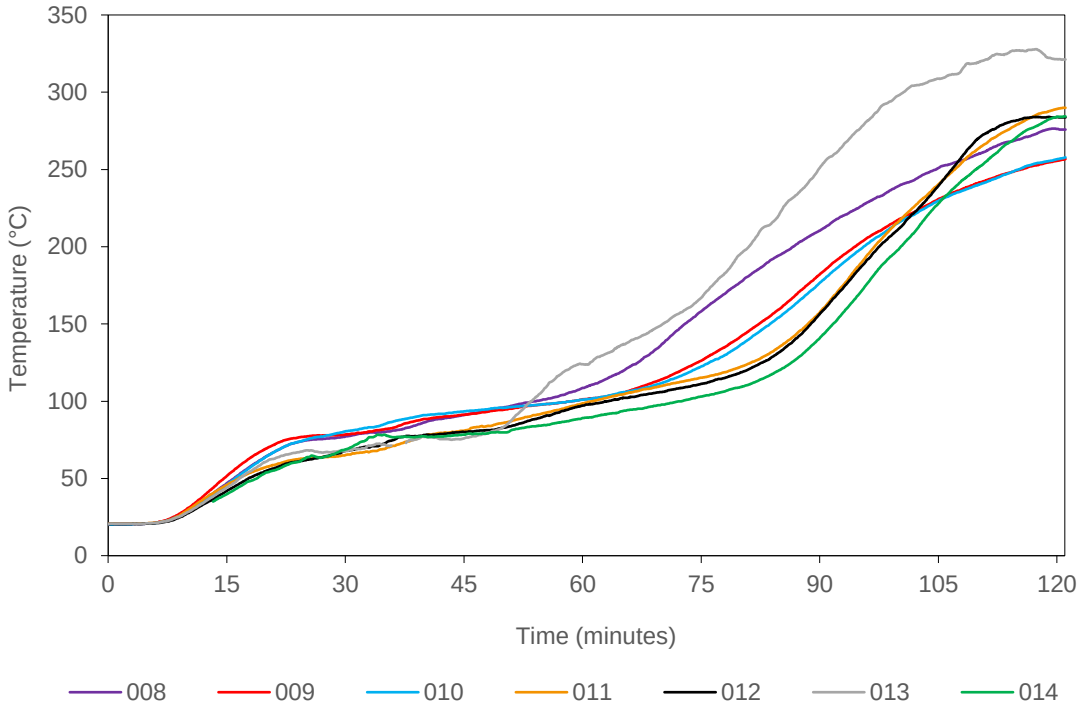


Figure 14 Control joint B – temperature vs time

Note: TC014 was faulty for the initial 13 minutes.

Table 12 Test specimen temperatures

Control joint	T/C #	Description[1]	Temp (°C) at t (minutes)					Limit[2] (minutes)
			t=0	t=30	t=60	t=90	t=120	
A	001	On the control joint, 250 mm up from the centre.	21	82	188	269	303	63
	002	On the control joint, at the centre.	21	87	174	261	284	67
	003	On the control joint, 250 mm down from the centre.	21	88	169	276	321	68
	004	25 mm from the control joint, 375 mm up from the centre.	21	81	136	316	342	66
	005	25 mm from the control joint, 125 mm down from the centre.	21	85	132	310	315	68
	006	25 mm from the control joint, 125 mm up from the centre.	21	73	123	271	291	72
	007	25 mm from the control joint, 375 mm down from the centre.	20	80	116	261	290	74
B	008	On the control joint, 250 mm up from the centre.	21	77	109	210	277	86
	009	On the control joint, at the centre.	20	79	101	182	255	94
	010	On the control joint, 250 mm down from the centre.	20	81	101	176	256	95

Control joint	T/C #	Description[1]	Temp (°C) at t (minutes)					Limit[2] (minutes)
			t=0	t=30	t=60	t=90	t=120	
	011	25 mm from the control joint, 375 mm up from the centre.	21	65	99	157	289	97
	012	25 mm from the control joint, 125 mm down from the centre.	21	68	97	156	284	97
	013	25 mm from the control joint, 125 mm up from the centre.	21	68	124	251	322	81
	014	25 mm from the control joint, 375 mm down from the centre.	#	69	89	140	284	100

Note:

1 Refer to Table 10 for the locations of thermocouples as only a generic description is included in the table.

2 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 180 K above the initial temperature.

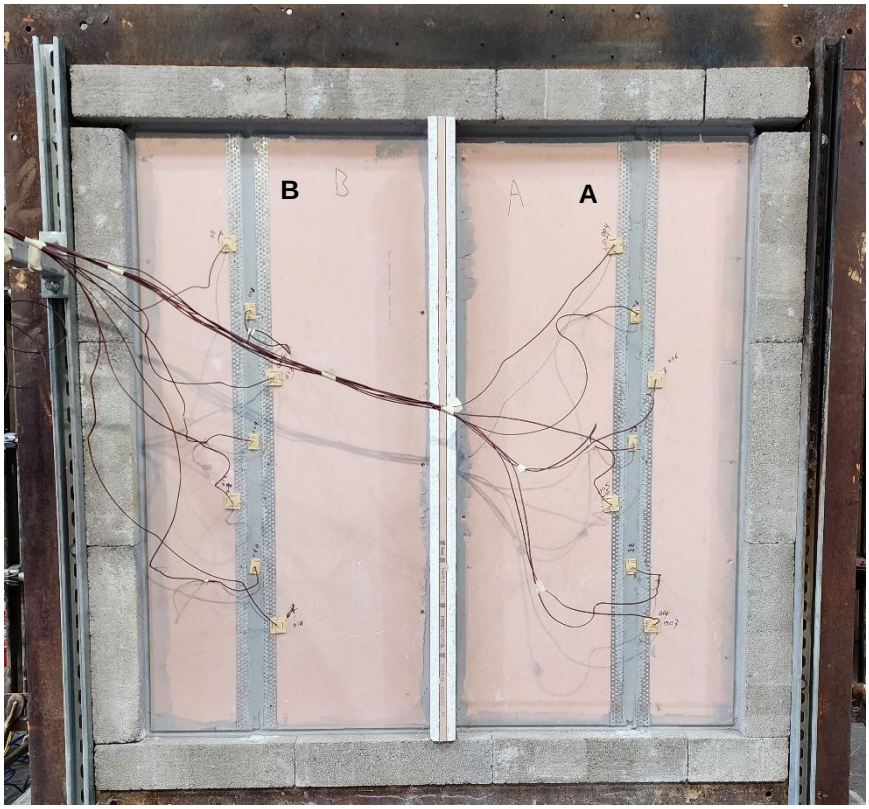
3 No insulation failure before thermocouple malfunction.

Thermocouple malfunction

'–' 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 F Photographs

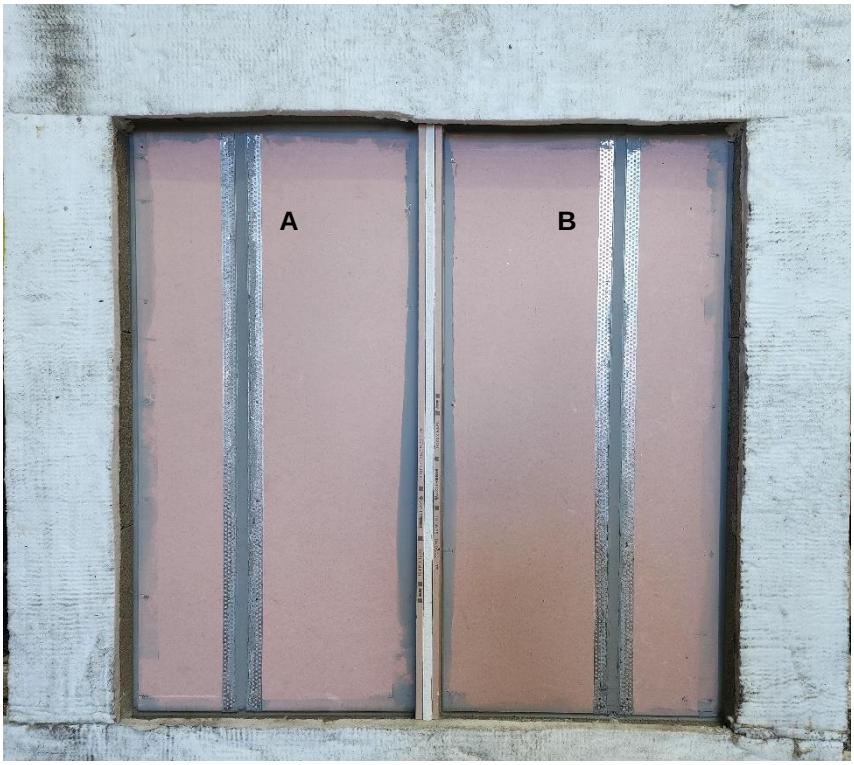
West



East

Figure 15 Unexposed face of the specimen before the start of the test

East



West

Figure 16 Exposed face of the specimen before the start of the test

Figure 17 Unexposed face of the specimen at the end of the test

Figure 18 Exposed face of the specimen at the end of the test

warringtonfire
Proud to be part of element

Global locations

Warringtonfire Australia Pty Ltd
ABN 81 050 241 524

Perth

Suite 4.01, 256 Adelaide Terrace
Perth WA 6000
Australia
T: +61 8 9382 3844

Canberra

Unit 10, 71 Leichhardt Street
Kingston ACT 2604
Australia
T: +61 2 6260 8488

Melbourne

WeWork Level 4, 152 Elizabeth Street
Melbourne VIC 3000
Australia
T: +61 3 9767 1000

Sydney

Suite 802, Level 8, 383 Kent Street
Sydney NSW 2000
Australia
T: +61 2 9211 4333

Brisbane

Suite B Level 6, 133 Mary Street
Brisbane QLD 4000
Australia
T: +61 7 3238 1700

Melbourne – NATA accredited laboratory

409-411 Hammond Road
Dandenong South VIC 3175
Australia
T: +61 3 9767 1000