

Test report # PF23060

Test Number 23060

Client: Firestop Centre Ltd

Fire resistance test for the C-purlin and I-beam penetrations through a vertical separating element

Test method: AS 1530.4:2014

Report Date 14/08/2023


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1.1 Document revision schedule

Revision #	Date	Description
1	07/08/23	Initial Issue for Client review
2	14/08/23	Issued with Client comments

1.2 Signatories

Report	Name	Signature	Date
Prepared by:	Alexey Kokorin		14/08/23
Authorized by:	Andrew Bain (Authorized signatory)		14/08/23



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

2. Contact details

2.1 IANZ registered Testing Authority

Fire TS Lab - Passive Fire Inspection and Test Services Ltd

Accreditation Number - 1335

1/113 Pavilion Drive, Mangere, Auckland, 2022

New Zealand

Contact e-mail: tests@firelab.co.nz

2.2 Client/Applicant

Firestop Centre Ltd

Unit J/657 Great South Road, Penrose, Auckland, 1061

New Zealand

Contact e-mail: greg@firestopcentre.co.nz

2.3 Manufacturer

Same as Client/Applicant

3. Test Results

Specimen #	Service	Actual Integrity (min)	Actual insulation (min)	FRL
A	200/12 C-purlin	125 NF	125 NF	-/120/120
B	250UC89.5 I-Beam	125 NF	125 NF	-/120/120
C	400/20 C-purlin	125 NF	68	-/120/60
D	250UC89.5 I-Beam	125 NF	95	-/120/90

NF – No failure during the test

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The test results relate to the specimens of the product in the form in which they were tested. Differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product, which is supplied or used, is fully represented by the specimens, which were tested.

The specimens were supplied by the sponsor and the Laboratory was not involved in any of selection or sampling procedures.

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.

4. Test Overview

Test Specification Fire Resistance:

Failure shall be deemed to have occurred when one of the following occurs:

- a) the temperature at any location on the unexposed face of the test specimen exceeds the initial temperature by more than 180 °C
- b) Integrity failure shall be deemed to have occurred upon ignition of the cotton pad when glowing or flaming occurs or for a period of 30 seconds.
- c) Flaming to the unexposed face for 10 seconds or longer shall be deemed to be an Integrity failure.

Testing scope:

AS 1530-2014 Part 4 Section 10 Service penetrations and control joints

AS 4072.1-2005 Part 1 Appendix A - Typical examples of fire-stopping systems for movement joints.

Documentation:

Testing products were verified and tested based on Client description, refer to Specimens description below. No additional documentation was provided.

Testing date:

25/07/2023

Installation completion date:

12/07/2023

Specimens conditioning and delivery to Laboratory:

Separating element was built by Laboratory in line with Client instructions. Installation of fire stopping system was performed by Laboratory in line with Client instructions. The Laboratory was not involved in sampling of the materials. Laboratory verified materials during construction of the specimen.

Termination of The Test:

The test was discontinued at 125 minutes.

Use of Reports:

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This report details the methods of construction, test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in AS 1530.4. Any significant variation with respect to size, constructional 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.

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. Equipment

Furnace:

1200X1200 Indicative Furnace designed to operate to AS1530.4:2014

Temperature:

Furnace Temperature measurements were controlled with four 3mm Type K MIMS thermocouples set within 50-100 mm from the face of the specimens in line with AS1530.4-2014. All thermocouples are calibrated by ISO/IEC 17025 accredited laboratory - a signatory to the International Laboratory Accreditation Corporation (ILAC) through their Mutual Recognition Agreement (MRA) to the accuracy required by AS 1530.4-2014.

Pressure measurement:

Kepware Siemens Data logging system including multi-channel recording data at 5 second intervals. Calibrated by ISO/IEC 17025 accredited laboratory - a signatory to the International Laboratory Accreditation Corporation (ILAC) through their Mutual Recognition Agreement (MRA) to the accuracy required by AS 1530.4-2014.

Ambient Temperature:

Ambient temperature was recorded 15 minutes before the test was commenced, at the start of the test and monitored during the test. All thermocouples are calibrated by ISO/IEC 17025 accredited laboratory - a signatory to the International Laboratory Accreditation Corporation (ILAC) through their Mutual Recognition Agreement (MRA) to the accuracy required by AS 1530.4-2014.

Specimen thermocouples:

Specimen thermocouples were installed to the unexposed face. Type K copper disk thermocouples fixed within the required locations referenced from AS1530.4-2014. Thermocouples are calibrated by ISO/IEC 17025 accredited laboratory - a signatory to the International Laboratory Accreditation Corporation (ILAC) through their Mutual Recognition Agreement (MRA) to the accuracy required by AS 1530.4-2014.

Dimensional measurements:

All linear measurements are made with equipment calibrated by ISO/IEC 17025 accredited laboratory - a signatory to the International Laboratory Accreditation Corporation (ILAC) through their Mutual Recognition Agreement (MRA) to the accuracy required by AS 1530.4-2014.

6. Test Conditions

6.1 Furnace Temperature

The furnace was controlled to follow the temperature/time relationship specified in AS 1530.4-2014.

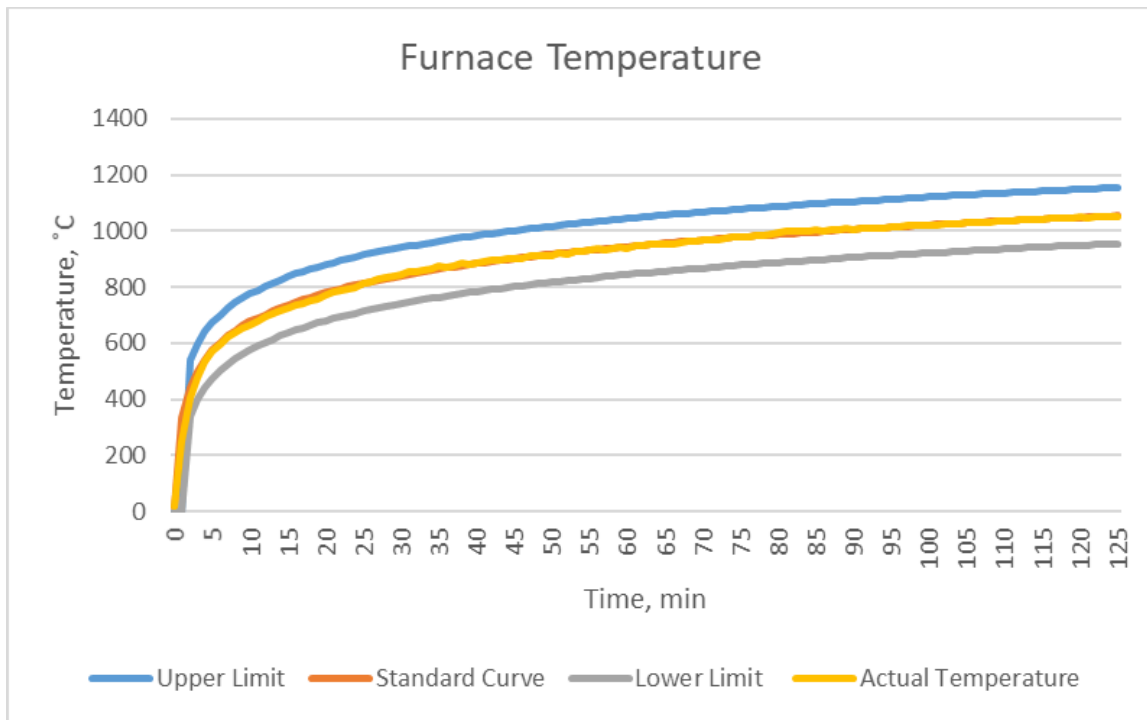


Figure 1 – Furnace Temperature during the test

6.2 Ambient Temperature

The ambient temperature of the test area 15 minutes before the test and at the commencement of the test was 16°C.

6.3 Pressure Readings

After the first 5 minutes of the test, the furnace pressure was maintained at 16 ± 3 Pa with respect to atmosphere. The probe was located 500mm above the furnace floor.

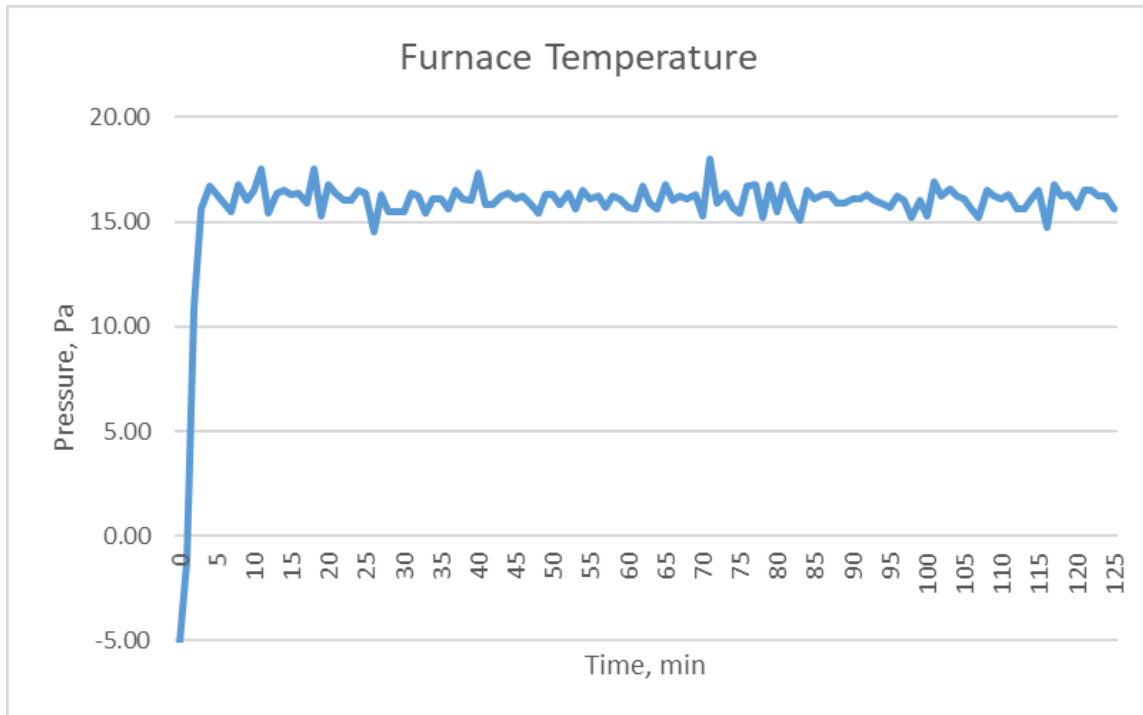


Figure 2– Furnace Pressure during the test

7. Schedule of Materials

Separating Element		
1.1	Item / Product Name	Steel Stud and Plasterboard Separating element
	Measurements	Width / Height (W/H): 1200mm × 1200mm
		Thickness (T): 144mm
1.2	Item / Product Name	Rondo Steel Track
	Measurements	Width / Height (W/H): 92mm × 30mm
		Thickness (T): 0.50mm
Additional Info	Used to construct separating element	
1.2	Item / Product Name	Rondo Steel Stud
	Measurements	Width / Height (W/H): 92mm × 34mm
		Thickness (T): 0.50mm
Additional Info	Used to construct separating element	
1.4	Item / Product Name	Concrete Slab
	Measurements	Width / Height (W/H): 1150mm × 985mm
		Thickness (T): 100mm
Additional Info	Used to construct separating element	
1.5	Item / Product Name	GIB Fyrelite Plasterboard
	Measurements	Width / Height (W/H): 1200mm × 1100mm
		Thickness (T): 13mm
Additional Info	Used to construct separating element	

Services		
2.1	Item / Product Name	200/12 steel C-purlin
	Measurements	Width / Height (W/H): 70mm × 200mm (nominal)
	Additional Info	Specimen A
2.2	Item / Product Name	250UC89.5 I-Beam
	Measurements	Width / Height (W/H): 255mm × 260mm (nominal)
	Additional Info	Specimen B, D
2.3	Item / Product Name	400/20 steel C-purlin
	Measurements	Width / Height (W/H): 100mm × 397mm (nominal)
	Additional Info	Specimen C

Sealants		
3.1	Item / Product Name	Protecta FR Acrylic sealant
	Measurements	50mm around aperture
	Installation	Used to aid adhesion of FR board and sealing joints and gaps at edges of FR board

Fixings		
4.1	Item / Product Name	KG Koala Wafer Head Self tapping screws
	Measurements	16mm × 10g

	Installation	Used to fix steel stud frame
4.2	Item / Product Name	GIB Grabber Self Tapping Screw
	Measurements	32mm
	Installation	Used to fix plasterboard to steel frame
4.3	Item / Product Name	Screw
	Measurements	5mm x 100mm
	Installation	Used to fix FR board to separating element
4.4	Item / Product Name	Steel Penny Washer
	Measurements	Outer Diameter (OD): 30mm
	Installation	Used to fix FR board to separating element
4.5	Item / Product Name	Galvanised Steel Brace strap
	Measurements	25mm wide x 1.0mm BMT
	Installation	Used to fix wrap around I beam

Fire Batt		
5.1	Item / Product Name	Protecta FR Board
	Thickness	60mm (nominal)
	Installation	Specimen A, B, C, D – installed around service and filling the space in the interior of service

Fire Wrap		
8.1	Item / Product Name	FIRESTOP Thermal Wrap
	Measurements	Width / Height (W/H): 600mm x 7600mm
		Thickness (T): 25mm
		Density (ρ): 96kg/m ³
Installation	Specimen B – wrapped around service, extending 370mm from separating element	

8. Testing Specimens Details

8.1 Thermocouple Positions Table

SPECIMEN	TC#	THERMOCOUPLE LOCATION DESCRIPTION
A	1	Separating element, 25mm below concrete slab, 25mm left from left side of FR board
A	2	Separating element, mid-height of FR board, 25mm left from left side of FR board
A	3	Separating element, mid-height of FR board, 25mm right from right side of FR board
A	4	Concrete slab, 25mm from FR board, 25mm left from left side of purlin
A	5	Concrete slab, 25mm from FR board, 25mm right from right side of purlin
A	6	FR board, mid-height of FR board, mid-width of the left side of FR board
A	7	FR board, mid-height of FR board, mid-width of the right side of FR board
A	8	FR board, 25mm below concrete slab, 25mm left of left side of purlin
A	9	FR board, mid-height of purlin, 25mm right of left side of FR board
A	10	FR board, mid-height of purlin, 25mm left of left side of purlin
A	11	FR board, 25mm below purlin, mid-height of purlin
A	12	FR board, mid-height of purlin, 25mm left of right side of FR board
A	13	FR board, 25mm below concrete slab, 25mm right of right side of purlin
A	14	Left side of purlin, 15mm below concrete slab, 25mm from FR board
A	15	Mid-height of the left side of purlin, 25mm from FR board
A	16	Mid-width bottom side of purlin, 25mm from FR board
A	17	Right side of purlin, 25mm below concrete slab, 25mm from FR board
A	18	Mid-width of the bottom side of purlin, 400mm from separating element
C	19	Separating element, 25mm above FR board, mid-width of FR board
C	20	Separating element, 140mm above bottom of FR board, 25mm left from left side of FR board
C	21	Separating element, mid-height of purlin, 25mm right from right side of FR board
C	22	FR board, 25mm above purlin, 20mm left of mid-width of FR board
C	23	FR board, mid-height of purlin, 25mm right of right side of FR board
C	24	FR board, mid-height of purlin, 25mm left of left side of FR board
C	25	FR board, 160mm above bottom of FR board, 25mm right of left side of FR board
B	201	Separating element, 25mm below concrete slab, 25mm left from left side of FR board
B	202	Separating element, mid-height of fire wrap, 25mm left from left side of FR board
B	203	Separating element, mid-height of fire wrap, 25mm right from right side of FR board
B	204	Concrete slab, 25mm left from left side of FR board, 25mm from plasterboard
B	205	Concrete slab, 25mm right from right side of FR board, 25mm from plasterboard
B	206	FR board, mid-height and mid-width of the left side of FR board
B	207	Mid-width of the right side of FR board, mid-height of fire wrap
B	208	FR board, 25mm below fire wrap, 25mm left of the sealant on the left side of fire wrap

B	209	FR board, mid-height of FR board, 25mm right from left side of FR board
B	210	FR board, 90mm below concrete slab, 25mm right the sealant on the right side of fire wrap
B	211	Fire wrap, 25mm from FR board, 15mm left from the cable tie on the left side
B	212	Fire Wrap, 25mm below the cable tie on the left side, 25mm from FR board
B	213	Left side of fire wrap, mid-height of fire wrap, 25mm from FR board
B	214	Right side of fire wrap, mid-height of fire wrap, 25mm from FR board
B	215	Left side of fire wrap, mid-height of fire wrap, 25mm from fire wrap
B	216	Mid-width of the bottom side of fire wrap, 25mm from the end of fire wrap
B	217	Right side of fire wrap, mid-height of fire wrap, 25mm from fire wrap
B	218	Mid-width of the bottom side of the beam, 25mm from the end of the beam
D	220	Separating element, 25mm above FR board, mid-width of FR board
D	221	Separating element, mid-height of purlin, 25mm left from left side of FR board
D	222	FR board, mid-width of the top of FR board, 25mm from separating element
D	223	FR board, mid-width and mid-height of the left side of FR board
D	224	FR board, 25mm above the beam, mid-width of beam
D	225	FR board, 25mm above the beam, 15mm from left edge of beam
D	226	FR board, mid-height of FR board, 25mm right of left side of FR board
D	227	FR board, mid-height of the beam, 25mm left of left side of beam
D	228	Top of beam, 25mm from FR board, 20mm from left edge of beam
D	229	Top of beam, 25mm from FR board, mid-width of beam
D	230	Left side of beam, mid-height of beam, 25mm from FR board
D	231	Top of beam, mid-width of beam, 410mm from FR board
C	241	FR board, mid-width and mid-height of the top of FR board
C	242	Right side of purlin, 25mm below top of purlin, 25mm from FR board
C	243	Mid-width of the top of purlin, 25mm from FR board
C	244	Mid-height of left side of purlin, 25mm from FR board
C	245	Mid-width of the top of purlin, 408mm from FR board
C	246	Mid-width of the right side purlin, mid-height of purlin

8.2 Observations during the test

TIME Mins	TEST FACE	SPECIMEN	OBSERVATIONS/REMARKS
1	E	B	Flame on top left of fire wrap
3	U	A	smoke from top of purlin
4	U	C	Smoke from sealant at top corners of purlin
6	U	D	Smoke from the left half of the interior of beam
7	U	A	Increased amount of smoke from specimen
8	U	D	Smoke from sealant at the top of the beam
10	E	B	Fire wrap reacting to heat
10	U	A, C, D	Further smoking of top corners
11	U	C	Smoke from mid-height of the sealant on the right side of specimen
14	E	B	Expansion of sealant around the perimeter of wrap
15	U	D	Cracking of sealant on the top of the beam
18	E	ALL	Further smoking of top corners
26	U	C	Disengagement of sealant on the right side of FR board
29	U	D	Smoke from sealant on the bottom of the right side of beam
30	U	ALL	Further smoking of sealant on each side of specimens
33	U	D	Discolouration of sealant and condensed vapours at mid-width of the top of the beam, next to FR board
39	U	C	Discolouration of FR board on the right side of purlin
40	U	B, D	Further smoke from top and right side of specimens
43	U	C	Discolouration of top corners of purlin and on the FR board above right corner
47	U	D	Cracking of sealant on the right side of the bottom of the beam
48	U	D	Discolouration of sealant and FR board on the left side of the interior of beam
49	U	D	Liquid from the top of the beam running down the FR board, on the right side of the beam
68	U	C	FR board fitted to the interior of the purlin move into the separating element by an inch, discolouration around the perimeter of the FR board moved in
78	U	D	Visible red glow on the left side of the interior of the beam
80	E	SE	Cracking of plasterboard
85	U	C, D	Further separation of FR board from specimens
87	U	C	3 × Cotton pads applied to red glow – PASS
91	U	C	Visible gap between FR board and purlin, above top left corner, along top right corner and on the left of the mid-height of purlin
100	U	D	Discolouration of separating element on the right side of FR board
108	U	C	Cotton pad test applied to the gap at top right and mid-height of purlin – PASS
119	U	C	Cotton pad test applied to the gap at top right and mid-height of purlin – PASS

125		Test Discontinued
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NOTE: E – Exposed Face (inside furnace)
U - Unexposed Face (outside furnace)

9. Separating Element Construction

The separating element (92mm steel stud wall with two layers of 13mm fire rated plasterboard each side) was constructed by the laboratory following client-approved drawings. A 100mm concrete slab (1.4) was fixed to the top of the refractory frame, protruding evenly from exposed and unexposed faces of the frame. The steel stud frame comprised of a top and a bottom plate (1.2), and 7 studs (1.3). Steel stud was installed to each side of the frame and at mid-width of the frame. Two studs were fixed at 205mm and 390mm from left side of the frame (unexposed view), with steel tracks installed between the studs. The tracks were 225mm below top of refractory frame and 95mm and 570mm above the bottom of the frame. Additional steel track was installed to the left side of the stud 390mm from the frame and onto the track 225mm below the top of the frame. Two studs were fixed at 145mm and 485mm from right side of the frame (unexposed view), with steel tracks installed between the studs. The tracks were 225mm below top of refractory frame and 165mm and 505mm above the bottom of the frame. The steel frame components were all fixed using screw (4.1). Two layers of plasterboard (1.5) were fixed to each face of the separating element using screws (4.2). The first layers were fixed at each corner of plasterboard 50mm from the corner, along the perimeter and mid-width of steel frame at 300mm centres, and along the steel tracks between steel studs. The second layers were fixed at each corner of plasterboard 70mm from the corner, along the perimeter and mid-width of steel frame at 600mm centres, and along the steel tracks between steel studs. Penetration apertures were then cut from the separating element.

10. Test results

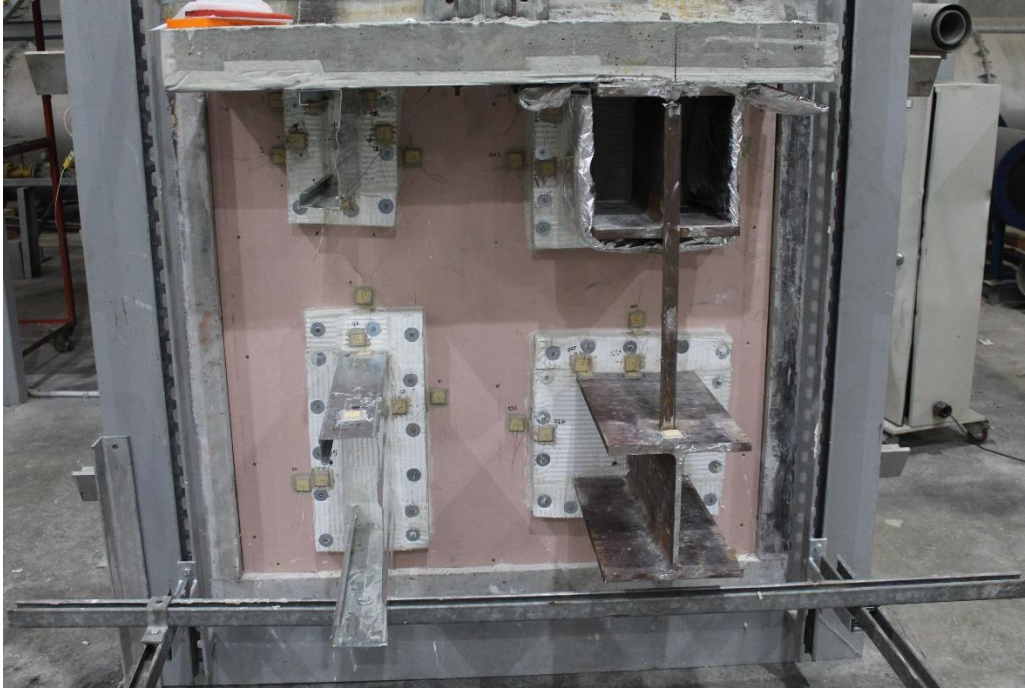


Figure 3 – Unexposed Face of the test

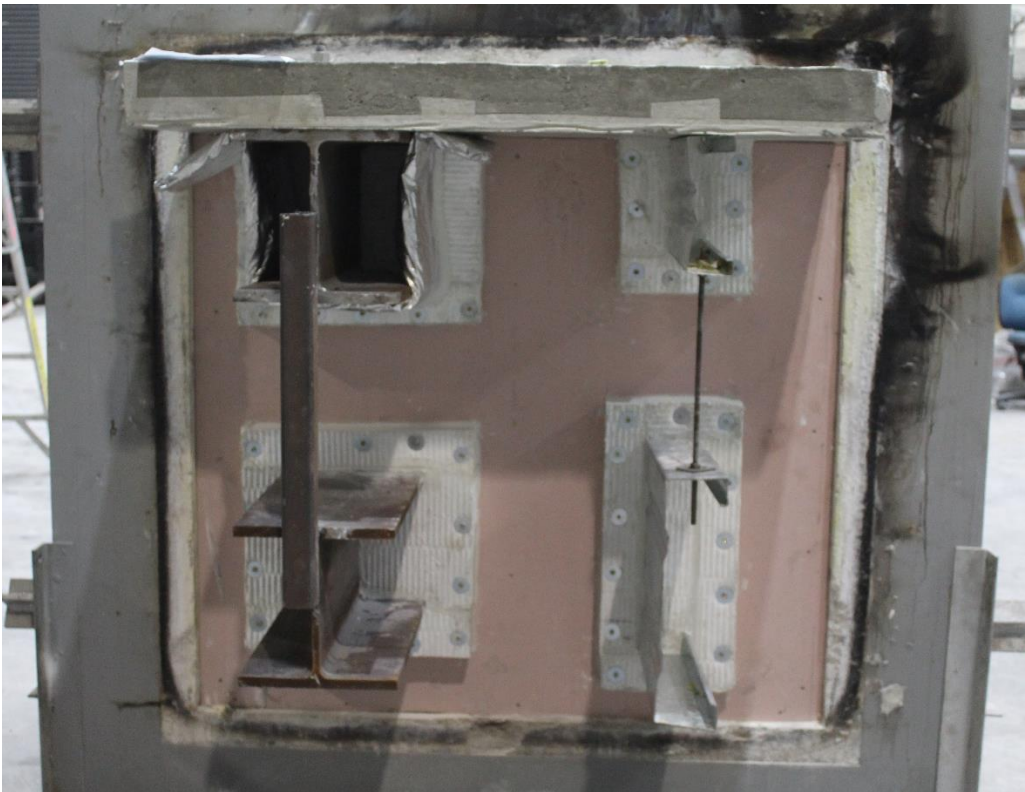


Figure 4 – Exposed Face of the test

10.1 Specimen A

Penetration System		
A	Service	200/12 steel C-purlin
	Service Details	C-purlin (2.1), Sealant (3.1), Fixings (4.1, 4.2), FR Board (5.1)
	Service Support	At 400mm on exposed face
	Width (W)	Min: 117mm, Max: 125mm
	Height (H)	Min: 225mm, Max: 227mm
	BMT	1.15mm
	Annular Spacing	Min: 13.5mm, Max: 32mm
	Local Fire-stopping Protection	
Fire Stop application	Symmetrical	
Protection Used	<p>Aperture was cut into the separating element. The purlin (2.1) was placed through the aperture with the top of purlin pressing against the concrete slab and the ends of purlin flush with the concrete slab. A thin coat of FR acrylic (3.1) was applied to the separating element around the aperture. A layer of FR board (5.1) was then pressed against the separating element and fixed with screw (4.1) and penny washer (4.2) at 25mm from board edges and 100mm centres. The FR Board overlapped the plasterboard aperture by a minimum of 50mm and formed a collar on three sides of the purlin with both vertical and horizontal joints.</p> <p>The interior of purlin was infilled with FR board flush with the FR board collar. FR Acrylic sealant was applied to the edges of FR boards and all joints and gaps between FR board and separating element or purlin.</p>	

Test results

Structural adequacy	Not Applicable
Integrity	No failure at 125 minutes
Insulation	No failure at 125 minutes

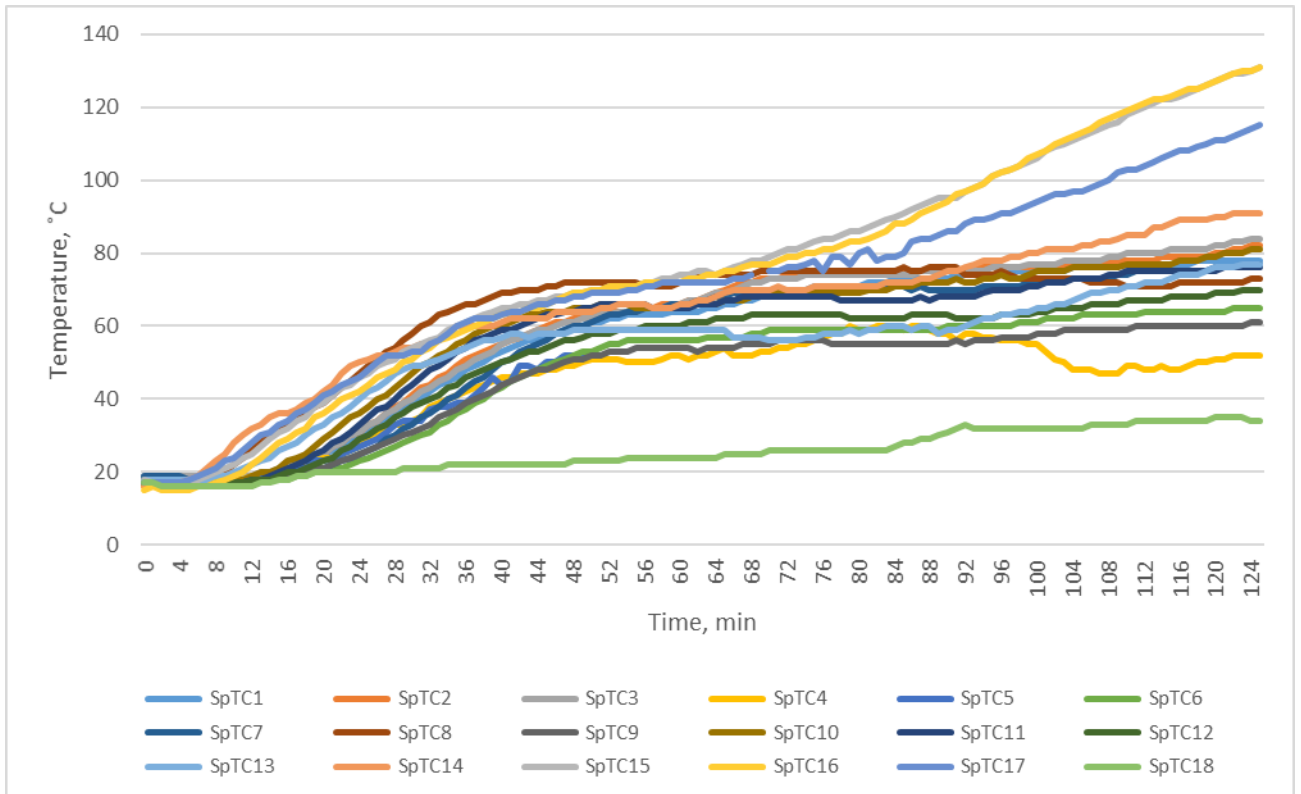


Figure 5 – Specimen A thermocouples readings

10.2 Specimen B

Penetration System		
B	Service	250UC89.5 I-Beam
	Service Details	I Beam (2.2), Sealant (3.1), Fixings (4.1, 4.2, 4.5), FR Board (5.1), Fire Wrap (8.1)
	Service Support	At the end of beam on exposed and unexposed face
	Width (W)	Min: 302mm, Max: 317mm
	Height (H)	Min: 280mm, Max: 290mm
	Annular Spacing	Min: 17mm, Max: 34mm
	Local Fire-stopping Protection	
Fire Stop application	Symmetrical	
Protection Used	Aperture was cut into the separating element. The beam (2.2) was placed through the aperture with the top of beam pressing against the concrete slab and the ends of beam flush with concrete slab. A thin coat of FR acrylic (3.1) was applied to the separating element around the aperture. A layer of FR board (5.1) was then pressed against the separating element and fixed with screw (4.1) and penny washer (4.2) at 25mm from board edges and 100mm centres. The FR Board was cut to fit the I-beam profile on each side and extended from the web face of the I-beam to 50mm (minimum) overlap of the plasterboard aperture. A section of FR Board was then attached below the I-beam to complete the collar. FR Acrylic sealant was applied to the edges of FR boards and all joints and gaps between FR board and separating element or beam. The beam was wrapped with fire blanket (8.1), extending 310mm from FR board. The blanket wrapped over three sides of the beam and fixed onto the concrete slab on each side of the beam with Steel Brace strap (4.5) at 100mm centres with 8Gx45mm masonry screws. Additional sealant was applied to the gap between FR Board and the perimeter of blanket.	

Test results

Structural adequacy	Not Applicable
Integrity	No failure at 125 minutes
Insulation	No failure at 125 minutes

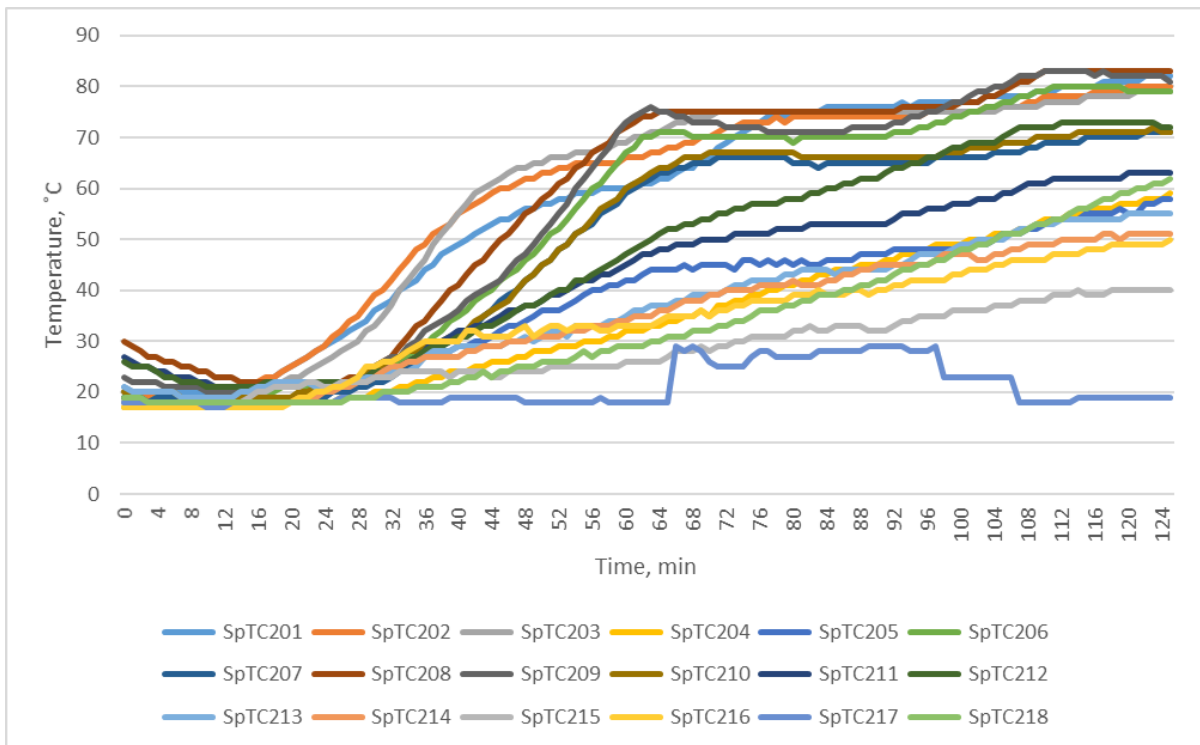


Figure 6 – Specimen B thermocouples readings

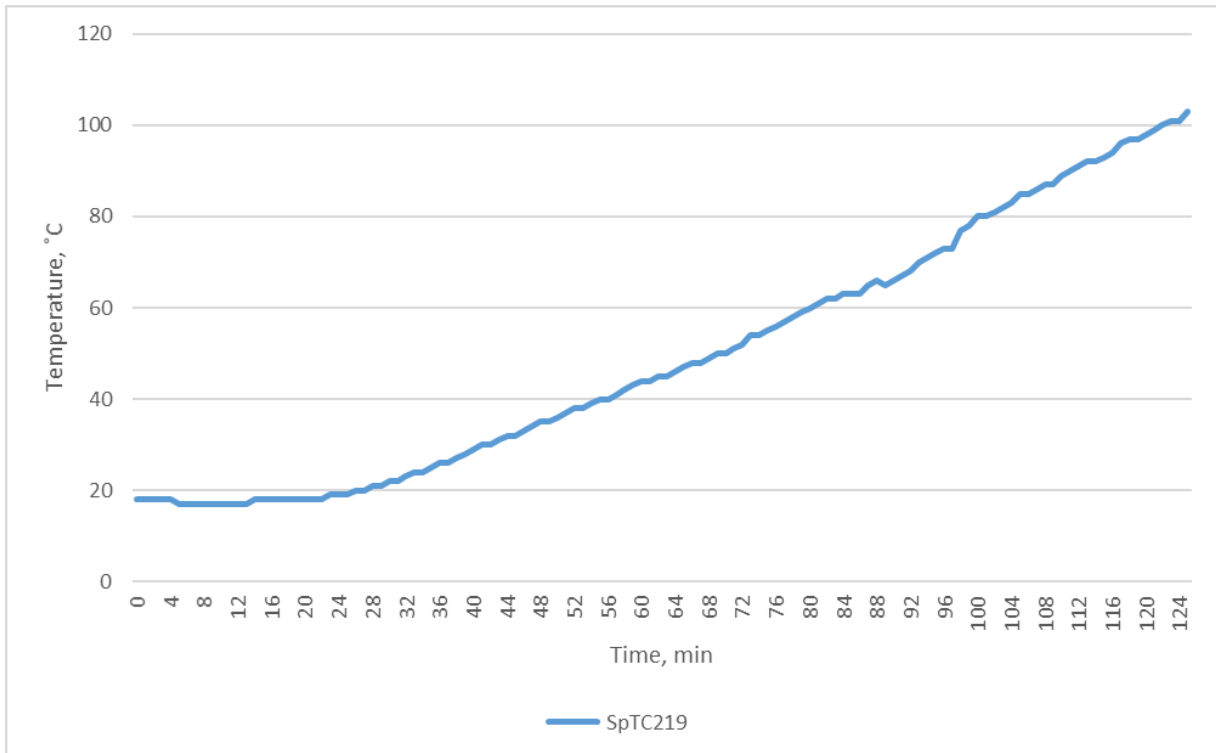


Figure 6.1 – Specimen B, SpTC219 was attached inside the wrapped section on the I beam surface 25mm from the FR Board (center of left bottom flange, from unexposed face view) – upon client request, for information purpose only.

10.3 Specimen C

Penetration System			
C	Service	400/20 steel C-purlin	
	Service Details	C-purlin (2.3), Sealant (3.1), Fixings (4.1, 4.2), FR Board (5.1)	
	Service Support	At 400mm on exposed face and unistrut structure at 470mm on unexposed face and	
	Width (W)	Min: 134mm, Max: 140mm	
	Height (H)	Min: 440mm, Max: 447mm	
	BMT	1.95mm	
	Annular Spacing	Min: 13.5mm, Max: 28.5mm	
	Local Fire-stopping Protection		
	Fire Stop application	Symmetrical	
	Protection Used	Aperture was cut into the separating element. The purlin (2.3) was placed through the aperture, extending 479mm from the exposed face, 575mm from the unexposed face. A thin coat of FR acrylic (3.1) was applied to the separating element around the aperture. A layer of FR board (5.1) was then pressed against the separating element and fixed with screw (4.1) and penny washer (4.2) at 25mm from board edges and 100mm centres. The FR Board overlapped the plasterboard aperture by a minimum of 50mm and formed a collar on all four sides of the purlin with both horizontal and vertical joints. The interior of purlin was infilled with FR board flush with the FR board collar. FR Acrylic sealant was applied to the edges of FR boards and all joints and gaps between FR board and separating element or purlin.	

Test results

Structural adequacy	Not Applicable
Integrity	No failure at 125 minutes
Insulation	68 minutes

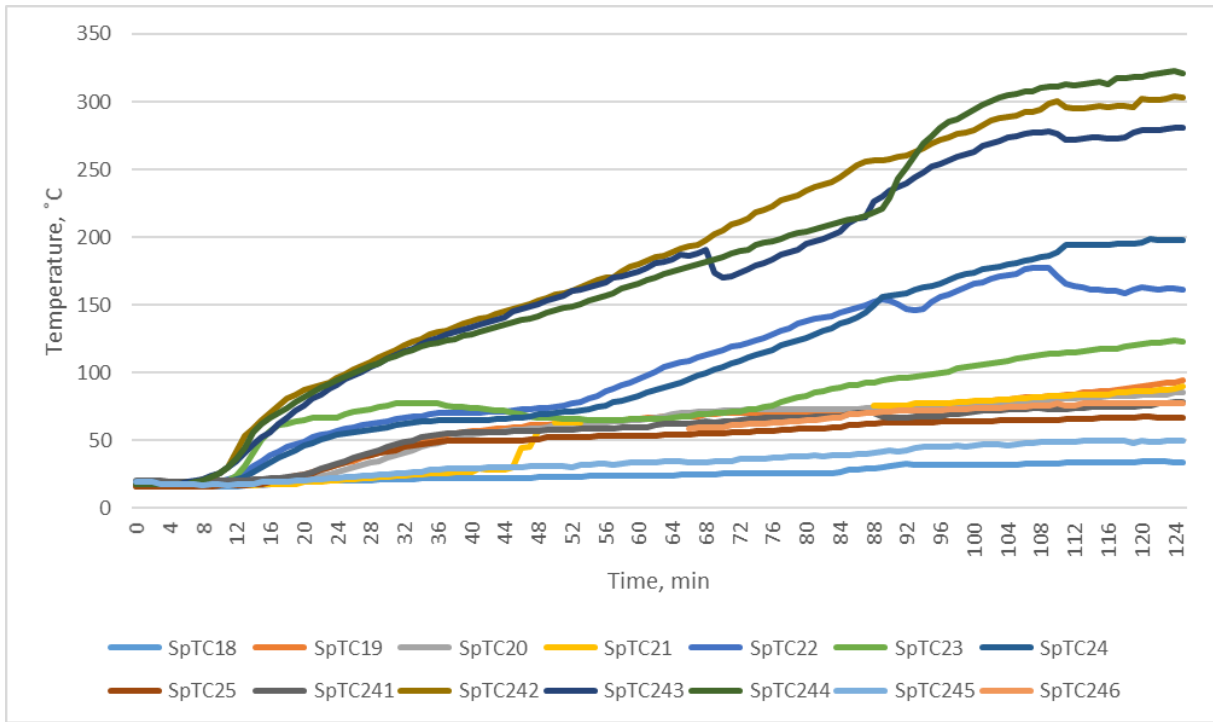


Figure 7 – Specimen C thermocouples readings

10.4 Specimen D

Penetration System		
D	Service	250UC89.5 I-Beam
	Service Details	I Beam (2.2), Sealant (3.1), Fixings (4.1, 4.2), FR Board (5.1)
	Service Support	At the end of beam on exposed face and at 470mm on unexposed face
	Width (W)	Min: 303mm, Max: 309mm
	Height (H)	Min: 305mm, Max: 309mm
	Annular Spacing	Min: 18mm, Max: 33.5mm
	Local Fire-stopping Protection	
Fire Stop application	Symmetrical	
Protection Used	Aperture was cut into the separating element. The beam (2.2) was placed through the aperture, extending 418mm from the exposed face, 524mm from the unexposed face. A thin coat of FR acrylic (3.1) was applied to the separating element around the aperture. A layer of FR board (5.1) was then pressed against the separating element and fixed with screw (4.1) and penny washer (4.2) at 25mm from board edges and 100mm centres. The FR Board was cut to fit the I-beam profile on each side and extended from the face of the I-beam to 50mm (minimum) overlap of the plasterboard aperture. A section of FR Board was then attached above and below the I-beam to complete the collar. FR Acrylic sealant was applied to the edges of FR boards and all joints and gaps between FR board and separating element or beam.	

Test results

Structural adequacy	Not Applicable
Integrity	No failure at 125 minutes
Insulation	95 minutes

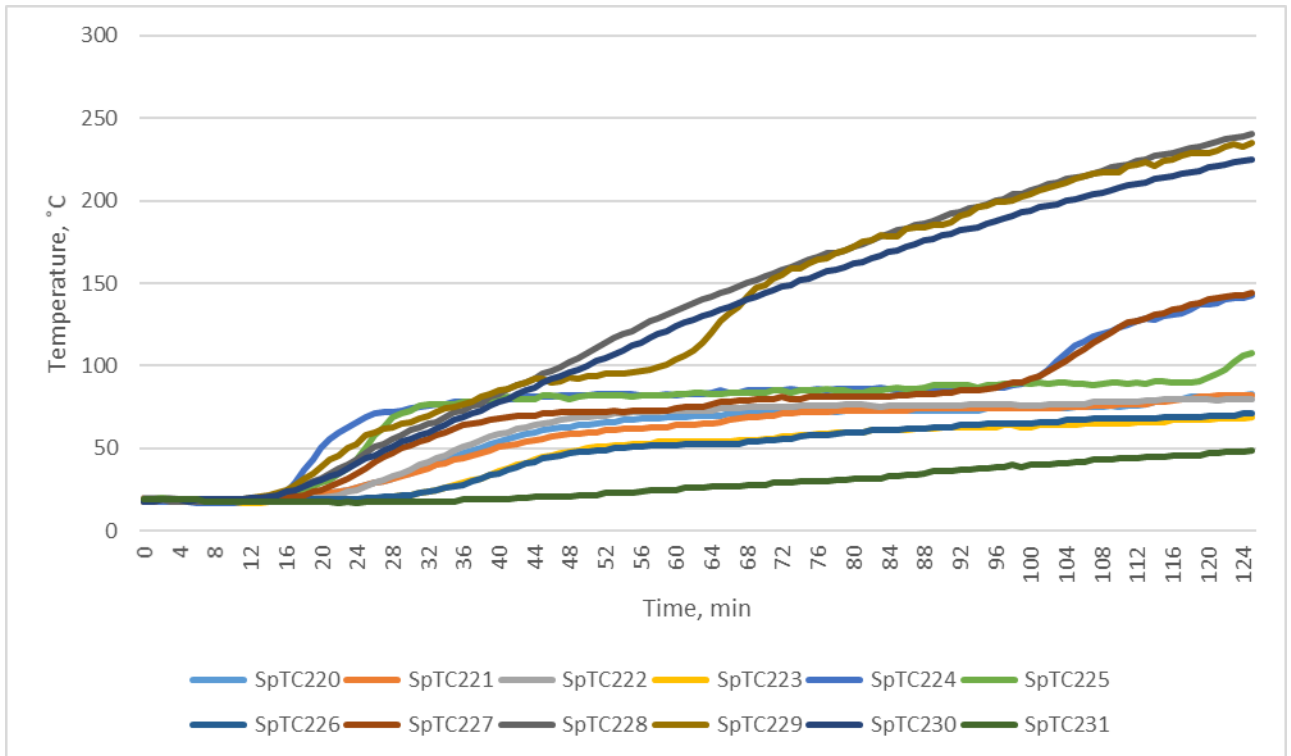


Figure 8 – Specimen D thermocouples readings

11. Additional photographs

11.1 During and after the test

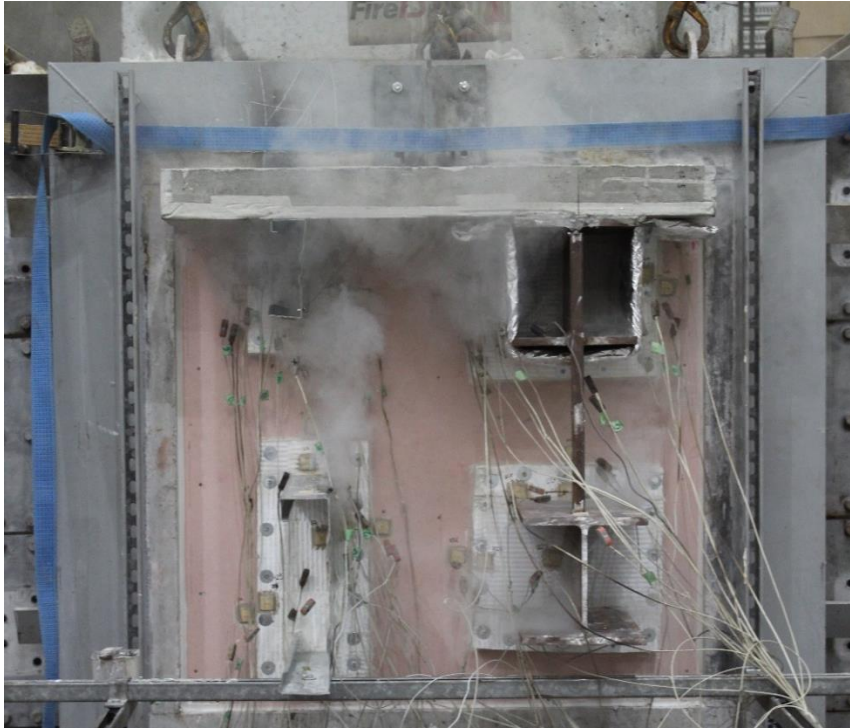


Figure 9 – Unexposed face at 15 minutes

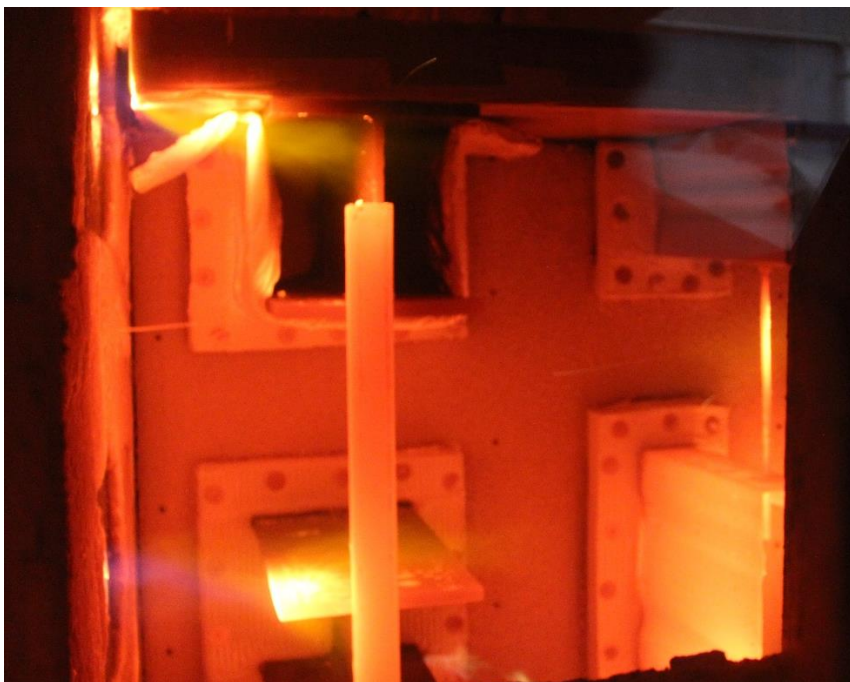


Figure 10 – Exposed face at 15 minutes



Figure 11 – Unexposed face at 30 minutes



Figure 12 – Exposed face at 30 minutes



Figure 13 – Unexposed face at 45 minutes

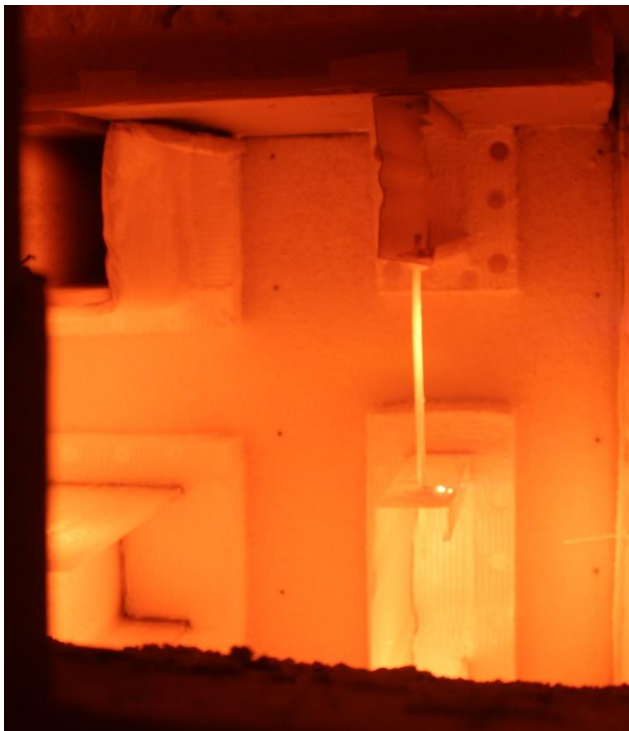


Figure 14 – Exposed face at 45 minutes



Figure 15 – Unexposed face at 60 minutes

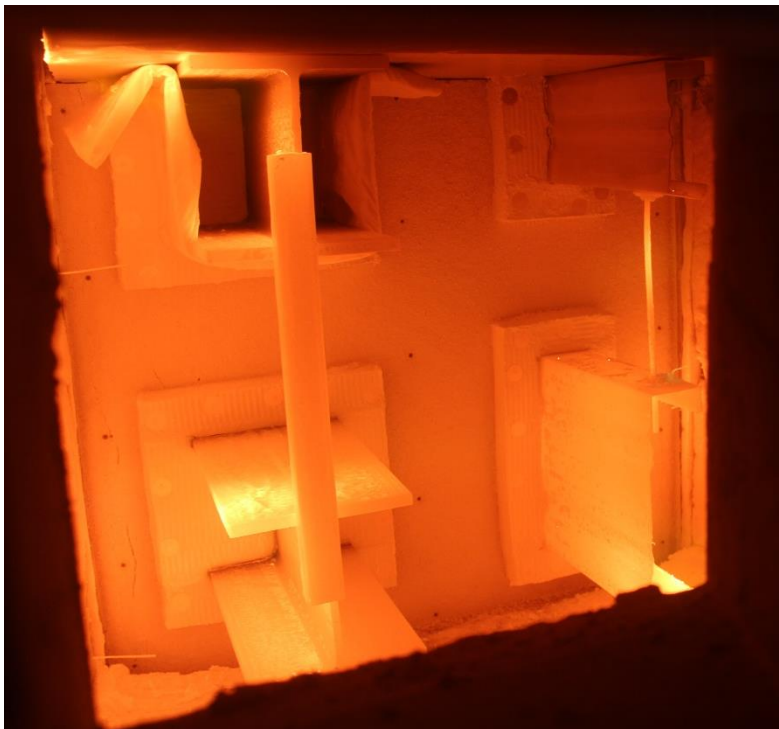


Figure 16 – Exposed face at 60 minutes

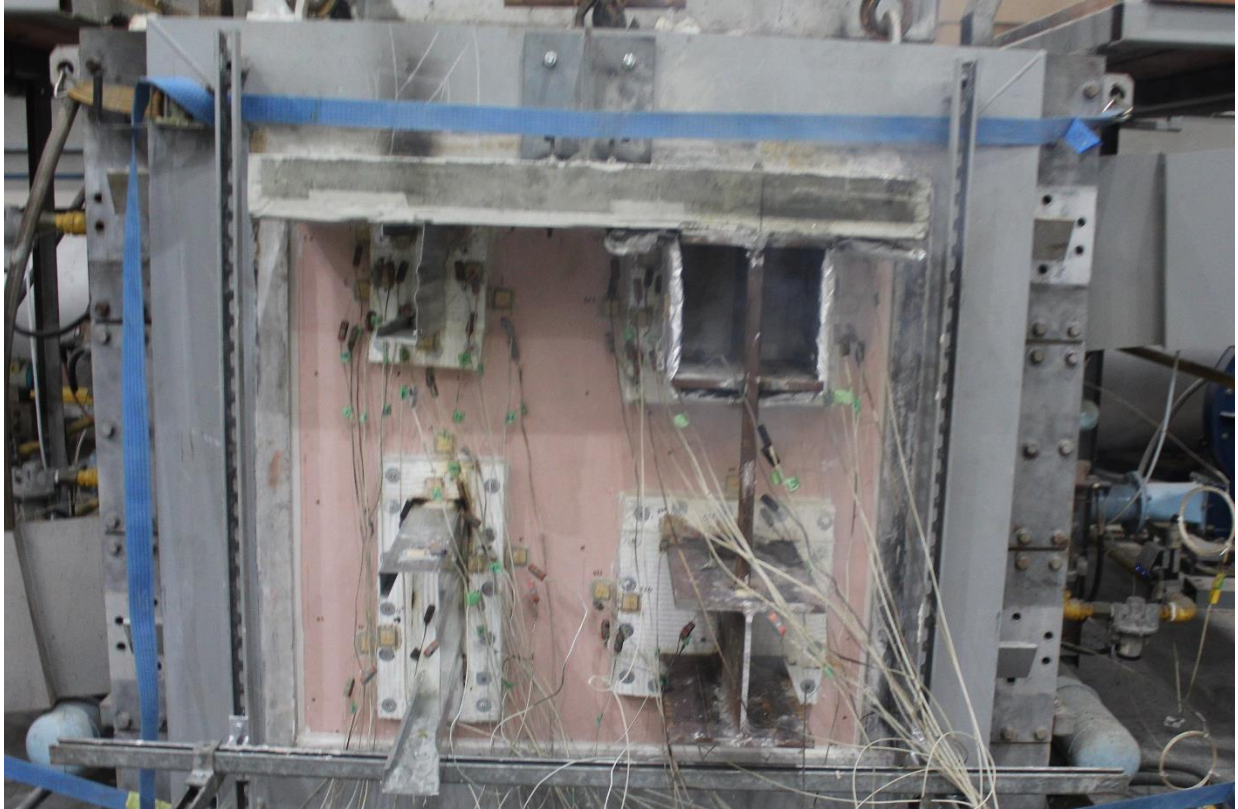


Figure 17 – Unexposed face at 75 minutes

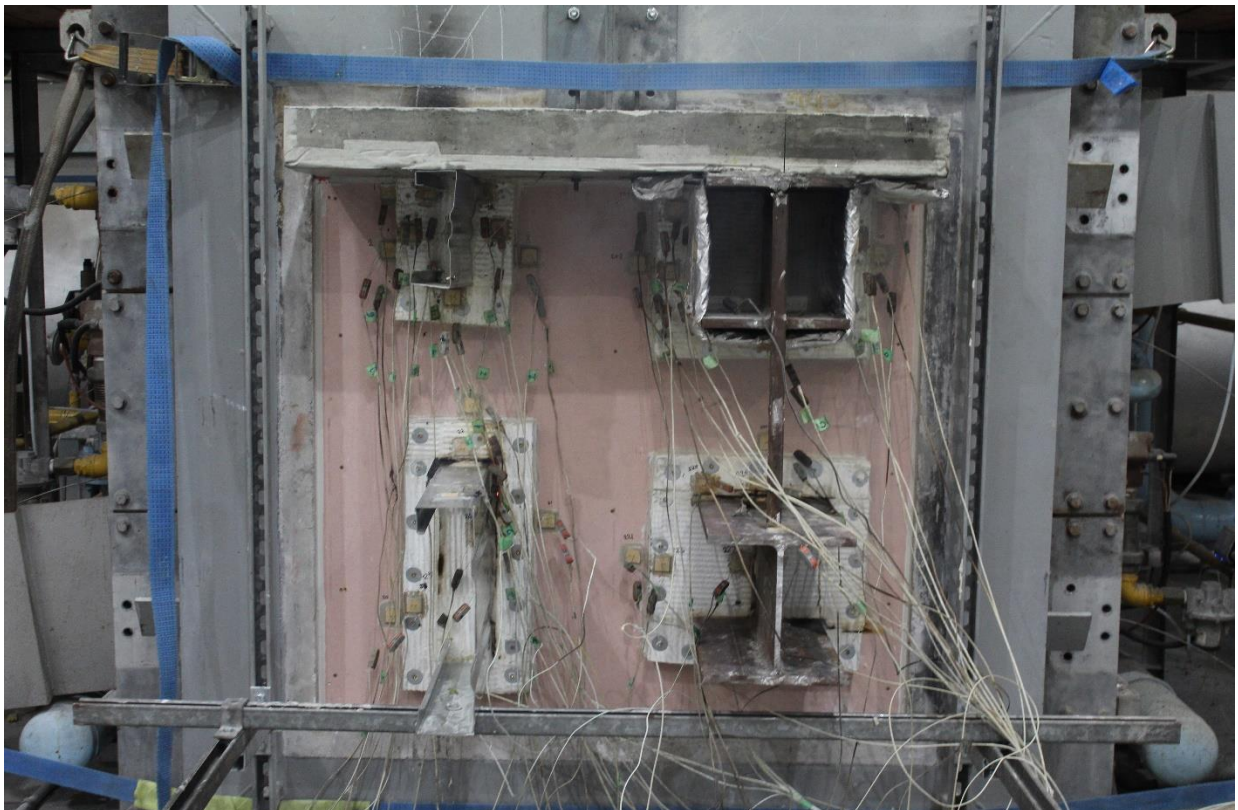


Figure 18 – Unexposed face at 90 minutes



Figure 19 – Unexposed face at 105 minutes



Figure 20 – Unexposed face at 120 minutes



Figure 21 – Exposed face at 120 minutes



Figure 22 – Exposed face after the test