



Fire resistance test report

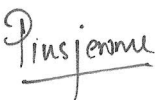
Test standard: Sections 2 and 12 of AS 1530.4:2014 and clause 8.7.4 of AS 2419.1:2005

Test sponsor: TBA Textiles Pty Ltd

Job number: FRT200416

Test date: 14 January 2021 Revision: R1.1

Quality management

Revision	Date	Information about the report			
R1.0	26 February 2021	Description	Initial issue		
		Name	Prepared by Pius Jerome	Reviewed by Kai Loh	Authorised by Mandeep Kamal
R1.1	26 February 2021	Description	Typographical amendment		
		Name	Prepared by Pius Jerome	Reviewed by Mandeep Kamal	Authorised by Mandeep Kamal
		Signature			

Executive summary

This report documents the findings of the fire resistance test of supports of critical services in general accordance with sections 2 and 12 of AS 1530.4:2014 and clause 8.7.4 of AS 2419.1:2005. The testing was done on 14 January 2021.

Warringtonfire performed the test at the request of TBA Textiles Pty Ltd.

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	Concrete floor system	
Nominal separating element size	Length	1760 mm
	Width	1200 mm
	Thickness	120 mm
Number of specimens	Three	
Restraint conditions	Simply supported	

Table 2 Test specimen

Service	Service	Local fire-stopping protection	Support system
A	NB100 mild steel pipe	TBA Firefly Penowrap	Bolted clip, M12 threaded rod, M12 nut and M12 washer
B	NB100 mild steel pipe	TBA Firefly Penowrap	Bolted clip, M12 threaded rod, M12 nut and M12 washer
C	NB100 mild steel pipe	TBA Firefly Penowrap	Bolted clip, M12 threaded rod, M12 nut and M12 washer

Table 3 Test results

Service	Heating regime to	Design capacity	Time to critical temperature failure (min)*	Time to operational (structural adequacy) failure (min)	Mode of failure
A	AS 1530.4	30 kg	38	No failure at 121 minutes	Threaded rod
B	AS 1530.4	60 kg	39	No failure at 121 minutes	Threaded rod
C	AS 1530.4	120 kg	44	No failure at 121 minutes	Threaded rod

Note: '*' the critical failure temperature – 500 °C – was determined by the test sponsor.

Table 4 Further test results

Service	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	No failure at 121 minutes	Not applicable*
	Integrity	Not applicable	
	Insulation	Not applicable	
B	Structural adequacy	No failure at 121 minutes	Not applicable*
	Integrity	Not applicable	
	Insulation	Not applicable	
C	Structural adequacy	No failure at 121 minutes	Not applicable*

Service	Criteria	Results	Fire resistance level (FRL)
	Integrity	Not applicable	
	Insulation	Not applicable	

Note: '*' indicates that an FRL cannot be assigned due to the variations listed in Table 8.

Note: The support systems have been shown to meet the performance of withstanding the loads applied to them and maintained these loads without collapse for a duration of 121 minutes when protected by the TBA Firefly Penowrap when tested in general accordance with sections 2 and 12 of AS 1530.4:2014.

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1. Introduction

This report documents the findings of the fire resistance test of supports of critical services in general accordance with sections 2 and 12 of AS 1530.4:2014 and clause 8.7.4 of AS 2419.1:2005. The testing was done on 14 January 2021.

Warringtonfire performed the test at the request of the test sponsor listed in Table 5.

Table 5 Test sponsor details

Test sponsor	Address
TBA Textiles Pty Ltd	12 / 8 Leighton Place Hornsby NSW 2077 Australia

2. Test specimen

2.1 Schedule of components

Table 6 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 6 Schedule of components

Item	Description		
Separating element (SE)			
1.	Item name	Concrete Floor	
	Product specification	120 mm thick concrete; 40 MPa normal weight concrete	
SE	Overall size	1760 mm long × 1200 mm wide × 120 mm thick	
	Restraint conditions	Not restrained at all	
	Installation	The concrete slab was precast and kept at Warringtonfire. Drilling was done at Warringtonfire to accommodate the varying services.	
Fire-stopping protections			
Wrap			
2.	Item name	Penowrap	
	Product name	TBA Firefly Penowrap	
	Overall size	300 mm wide × 12 mm thick (cut to size)	
	Thickness of foil	0.43 mm	
	Density	198 kg/m³	
Services			
3.	Item name	NB 100 mild steel pipe	
	Product description	Hydrant pipe	
	Material	Mild steel	
	Pipe dimensions	Outer diameter	114 mm

Item	Description		
		Length	300 mm
Fixings			
4.	Item name	Bolted clamp	
	Product description	Bolted clamp with 12 mm nut 100 mm	
	Material	Mild steel	
	Clamp details	Outer diameter	125 mm
		Inner diameter	115 mm
		Width	25 mm
		Thickness	5 mm thick
Bolt details	Outer diameter	M10 mm	
	Length	34 mm	
Nut details	M10 nut		
5.	Item name	M12 threaded rod	
	Material	Mild steel	
	Size	Ø 12 mm × 325 mm long	
6.	Item name	M12 nut	
	Material	Mild steel	
7.	Item name	M12 washers	
	Material	Galvanised steel	
	Size	50 mm long × 50 mm wide × 3 mm thick	
8.	Item name	Cable ties	
	Product description	Stainless steel cable ties	
	Size	8 mm wide × 0.3 mm thick	
9.	Item name	Aluminium foil tape	
	Size	100 mm wide × 0.3 mm thick	
Service A			
A	Service	NB 100 mild steel pipe (item 3) loaded with 30 kg	
	Design capacity	30 kg	
	Service support	A bolted clamp (item 4) was installed at the centre of the NB 100 mild steel pipe (item 3) to which an M12 threaded rod (item 5) was connected and locked using a M12 nut (item 6). The other end of the threaded rod penetrated to the unexposed side of the slab and was fixed using M12 nut and M12 washer (item 7).	
	Local fire-stopping protection		
	Hanger and clamp protection	Four layers of Penowrap (item 2) with aluminium foil tape (item 9) applied on one edge was wrapped around the threaded rod and fixed with aluminium foil tape on the other end. Cable ties (item 8) were used to secure the Penowrap and were fixed at 25 mm from the edges and at mid-height of the threaded rod. One layer of Penowrap (item 2) was wrapped around outside of the bolted clamp (item 4) and the NB 100 mild steel pipe for a distance of 150 mm to the left and right of the centre of the clamp and to a height of 100 mm from the pipe onto the	

Item	Description	
		threaded rod and fixed with aluminium foil tape (item 9) and then secured with 1 × cable tie.
Service B		
B	Service	NB 100 mild steel pipe (item 3) loaded with 60 kg
	Design capacity	60 kg
	Service support	A bolted clamp (item 4) was installed at the centre of the NB 100 mild steel pipe (item 3) to which a M12 threaded rod (item 5) was connected and locked using a M12 nut (item 6). The other end of the threaded rod penetrated to the unexposed side of the slab and was fixed using M12 nut and M12 washer (item 7).
	Local fire-stopping protection	
	Hanger and clamp protection	Four layers of Penowrap (item 2) with Aluminium foil tape (item 9) applied on one edge was wrapped around the threaded rod and fixed with aluminium foil tape on the other end. Cable ties (item 8) were used to secure the Penowrap and were fixed at 25 mm from the edges and at mid-height of the threaded rod. One layer of Penowrap (item 2) was wrapped around outside of the bolted clamp (item 4) and the NB 100 mild steel pipe for a distance of 150 mm to the left and right of the centre of the clamp and to a height of 100 mm from the pipe onto the threaded rod and fixed with aluminium foil tape (item 9) and then secured with 1 × cable tie.
Service C		
C	Service	NB 100 mild steel pipe (item 3) loaded with 120 kg
	Design capacity	120 kg
	Service support	A bolted clamp (item 4) was installed at the centre of the NB 100 mild steel pipe (item 3) to which a M12 threaded rod (item 5) was connected and locked using a M12 nut (item 6). The other end of the threaded rod penetrated to the unexposed side of the slab and was fixed using M12 nut and M12 washer (item 7).
	Local fire-stopping protection	
	Hanger and clamp protection	Four layers of Penowrap (item 2) with Aluminium foil tape (item 9) applied on one edge was wrapped around the threaded rod and fixed with aluminium foil tape on the other end. Cable ties (item 8) were used to secure the Penowrap and were fixed at 25 mm from the edges and at mid-height of the threaded rod. One layer of Penowrap (item 2) was wrapped around outside of the bolted clamp (item 4) and the NB 100 mild steel pipe for a distance of 150 mm to the left and right of the centre of the clamp and to a height of 100 mm from the pipe onto the threaded rod and fixed with aluminium foil tape (item 9) and then secured with 1 × cable tie.

2.2 Installation details

Table 7 lists the installation details for the test specimen.

Table 7 Installation details

Item	Detail
Start date for installation for the service	12 January 2021
Completion date for construction and installation of test specimen	13 January 2021
Separating element constructed by	Representatives of Warringtonfire
Fire protection on services installed by	Representatives of the test sponsor
Symmetry	Asymmetrical – due to the services and supports were installed only on the exposed side.

3. Test procedure

Table 8 details the test procedure for this fire resistance test.

Table 8 Test procedure

Item	Detail						
Statement of compliance	The test was performed in general accordance with the requirements of sections 2 and 12 of AS 1530.4:2014 appropriate for critical services and clause 8.7.4 of AS 2419.1:2005 appropriate for fire hydrant pipework, subject to the variations listed below.						
Variations	- The pressure was up to 6 Pa above the limits prescribed in the standard during the 5-10 minute period. The pressure and temperature were within the limits for the rest of the test. This overpressure resulted in more onerous test conditions, so would not have invalidated the test result. - The critical temperature of failure – 500 °C – was determined by the test sponsor based on the inferred intent of AS 2419.1:2005 clause 8.7.4 however the loading requirements of AS 2419.1:2005 clause 8.7.2 b were not employed.						
Pre-test conditioning	The construction and installation of the test specimen was completed on 13 January 2021. The test specimen was subjected to normal laboratory temperatures and conditions between the completion of construction of the test specimen 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	<table> <tr> <td>Start of the test</td><td>22 °C</td></tr> <tr> <td>Minimum temperature</td><td>22 °C</td></tr> <tr> <td>Maximum temperature</td><td>25 °C</td></tr> </table>	Start of the test	22 °C	Minimum temperature	22 °C	Maximum temperature	25 °C
Start of the test	22 °C						
Minimum temperature	22 °C						
Maximum temperature	25 °C						
Test loading	<table> <tr> <td>Service A:</td><td>30 kg</td></tr> <tr> <td>Service B:</td><td>60 kg</td></tr> <tr> <td>Service C:</td><td>120 kg</td></tr> </table>	Service A:	30 kg	Service B:	60 kg	Service C:	120 kg
Service A:	30 kg						
Service B:	60 kg						
Service C:	120 kg						
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						

Item	Detail
	insulated from the sheath. The thermocouples protruded a minimum of 25 mm from steel supporting tubes. • The internal specimen temperatures on the clamps and rods were measured by mineral insulated metal sheathed (MIMS) Type K thermocouples with overall diameters of 1.5mm with the measuring junction insulated from the sheath. • The thermocouple positions are shown in Table 12 and in Figure 6 to Figure 8 in Appendix C. • The furnace pressure was measured at 100 mm below the underside of the floor system.

4. Test measurements and results

Table 9 summarises the results the specimen achieved against the performance criteria listed in sections 2 and 12 of AS 1530.4:2014, subject to the variations listed in section 3.

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

Table 11 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 E.

Table 9 Test results

Service	Heating regime to	Design capacity	Time to critical temperature failure (min)*	Time to operational (structural adequacy) failure (min)	Mode of failure
A	AS 1530.4	30 kg	38	No failure at 121 minutes	Threaded rod
B	AS 1530.4	60 kg	39	No failure at 121 minutes	Threaded rod
C	AS 1530.4	120 kg	44	No failure at 121 minutes	Threaded rod

Note: '*' the critical temperature of failure – 500 °C – was determined by the test sponsor.

Table 10 Further test results

Service	Criteria	Results	Fire resistance level (FRL)
A	Structural adequacy	No failure at 121 minutes	Not applicable*
	Integrity	Not applicable	
	Insulation	Not applicable	
B	Structural adequacy	No failure at 121 minutes	Not applicable*
	Integrity	Not applicable	
	Insulation	Not applicable	
C	Structural adequacy	No failure at 121 minutes	Not applicable*
	Integrity	Not applicable	
	Insulation	Not applicable	

Note: '*' indicates that an FRL cannot be assigned due to the variations listed in Table 8.

Note: The support systems have been shown to meet the performance of withstanding the loads applied to them and maintained these loads without collapse for a duration of 121 minutes when protected by the TBA Firefly Penowrap when tested in general accordance with sections 2 and 12 of AS 1530.4:2014.

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 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 drawings of the test assembly in Figure 1 to Figure 8 were provided by the test sponsor and marked up by Warringtonfire. These mark-ups to the drawings were:

- insertion of dimensions
- naming the parts

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

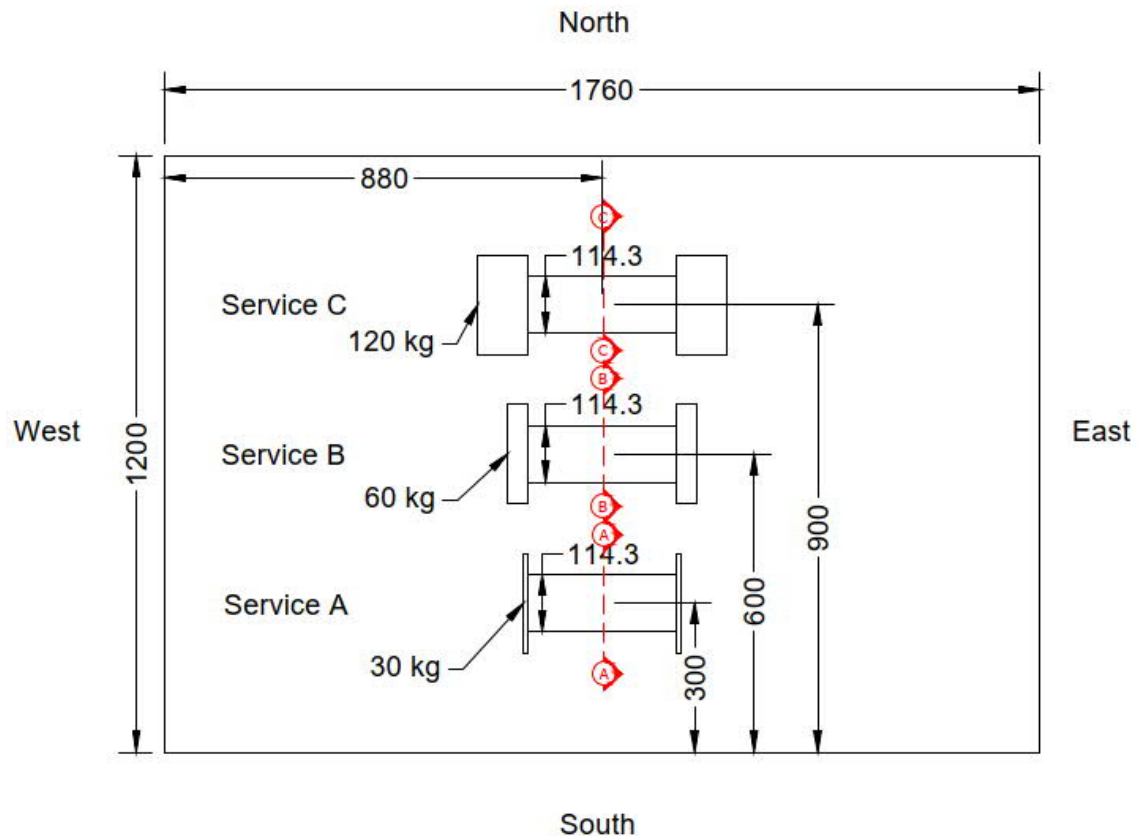
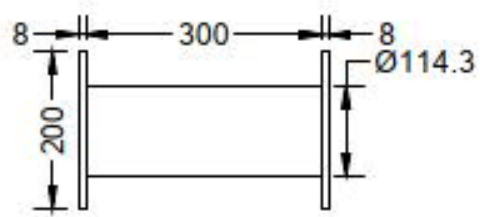
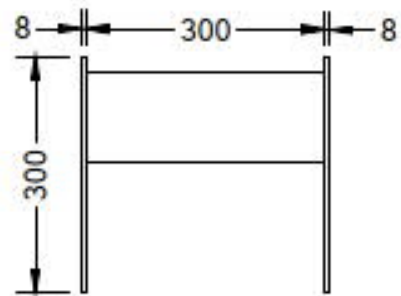


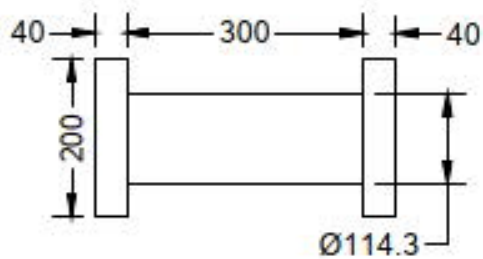
Figure 1 Plan view of test specimen (exposed side)



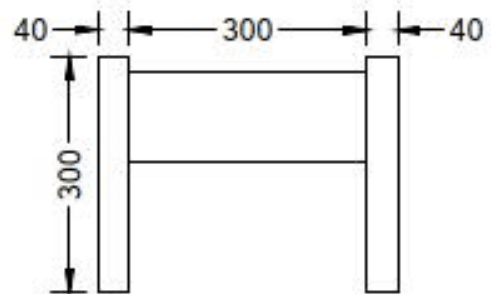
Top view of Service A



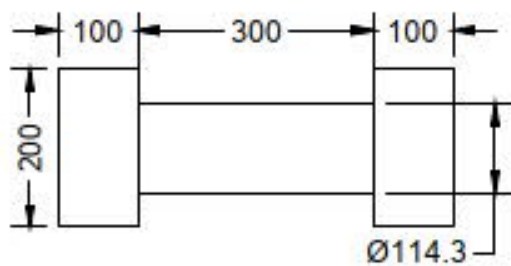
Side view of Service A



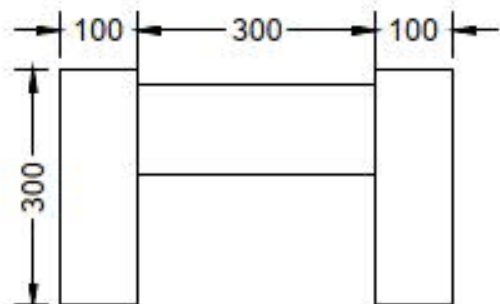
Top view of Service B



Side view of Service B

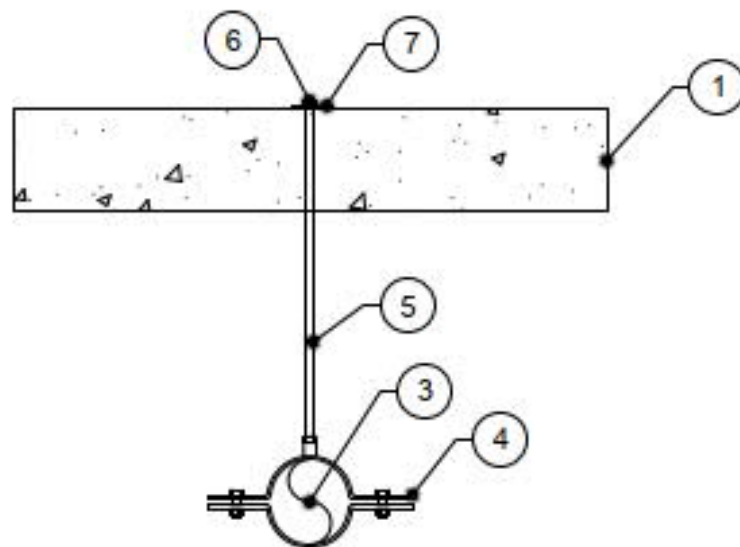


Top view of Service C

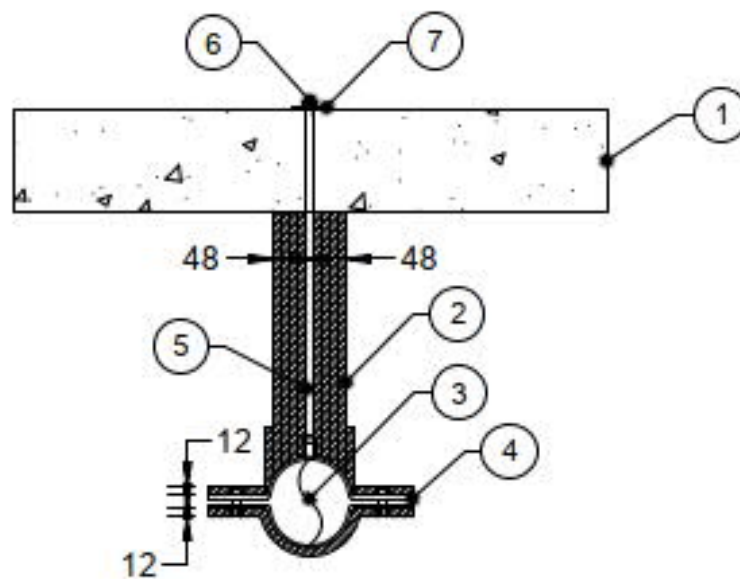


Side view of Service C

Figure 2 Top and side view of test specimen

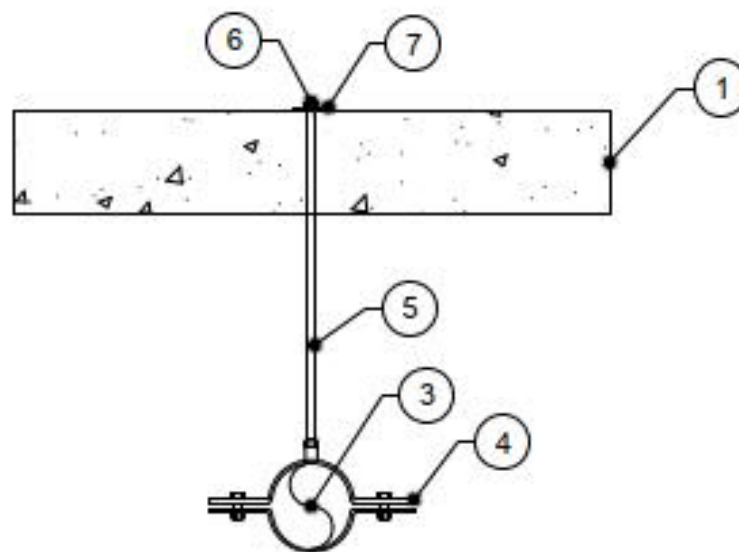


Service A without fire protection

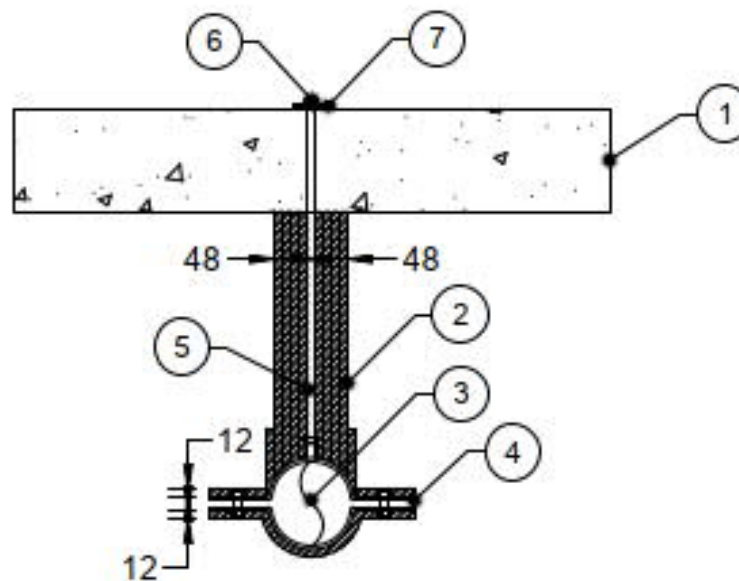


Service A with fire protection

Figure 3 Cross-section A-A

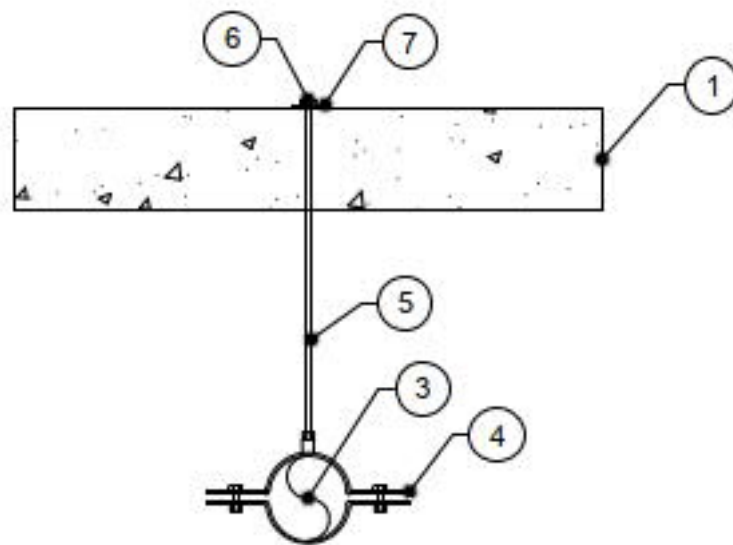


Service B without fire protection

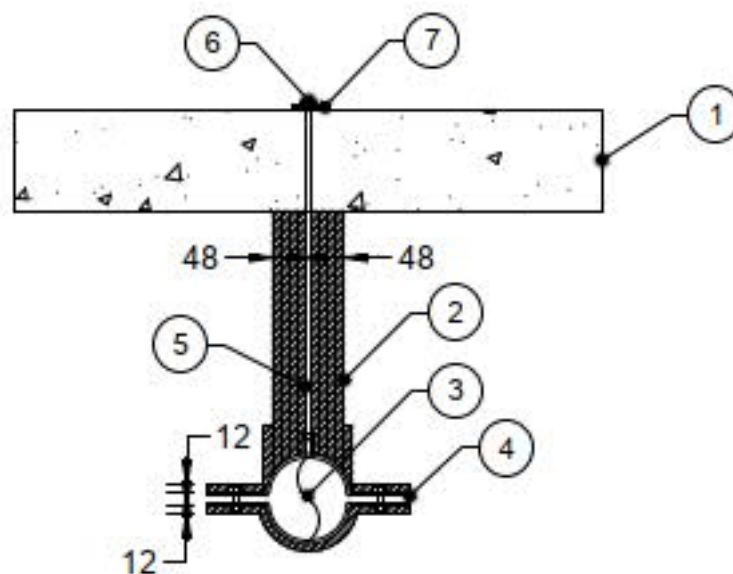


Service B with fire protection

Figure 4 Cross-section B-B



Service C without fire protection



Service C with fire protection

Figure 5 Cross-section C-C

Appendix B Test observations

Table 11 shows the observations of any significant behaviour of the specimen during the test.

Table 11 Test observations

Time		Observation
Min	Sec	
Service A		
00	00	The fire resistance test started. The ambient laboratory temperature of the test specimen was approximately 22°C.
15	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
30	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
38	15	TC002, at mid-height of the threaded rod recorded a temperature of 501°C. Failure of critical temperature as determined by test sponsor.
45	00	No signs of damage and significant deflection in the pipe support systems.
60	00	No signs of damage and significant deflection in the pipe support systems.
90	00	No signs of damage and significant deflection in the pipe support systems.
120	00	No signs of damage and significant deflection in the pipe support systems.
121	00	Test stopped.
Service B		
00	00	The fire resistance test started. The ambient laboratory temperature of the test specimen was approximately 22°C.
15	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
30	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
39	00	TC004, at mid-height of the threaded rod recorded a temperature of 500°C. Failure of critical temperature as determined by test sponsor.
45	00	No signs of damage and significant deflection in the pipe support systems.
60	00	No signs of damage and significant deflection in the pipe support systems.
90	00	No signs of damage and significant deflection in the pipe support systems.
120	00	No signs of damage and significant deflection in the pipe support systems.
121	00	Test stopped.
Service C		
00	00	The fire resistance test started. The ambient laboratory temperature of the test specimen was approximately 22°C.
15	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
30	00	No signs of damage and significant deflection in the pipe support systems. The pipe support system continued to maintain critical temperature.
44	25	TC006, at mid-height of the threaded rod recorded a temperature of 500°C. Failure of critical temperature as determined by test sponsor.
45	00	No signs of damage and significant deflection in the pipe support systems.

Time		Observation
Min	Sec	
60	00	No signs of damage and significant deflection in the pipe support systems.
90	00	No signs of damage and significant deflection in the pipe support systems.
120	00	No signs of damage and significant deflection in the pipe support systems.
121	00	Test stopped.

Appendix C Instrumentation locations

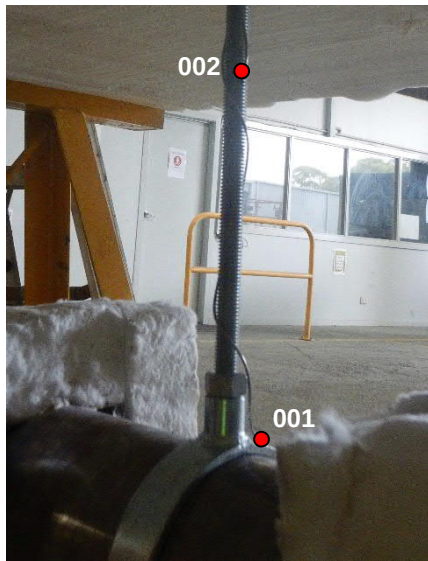


Figure 6 Service A

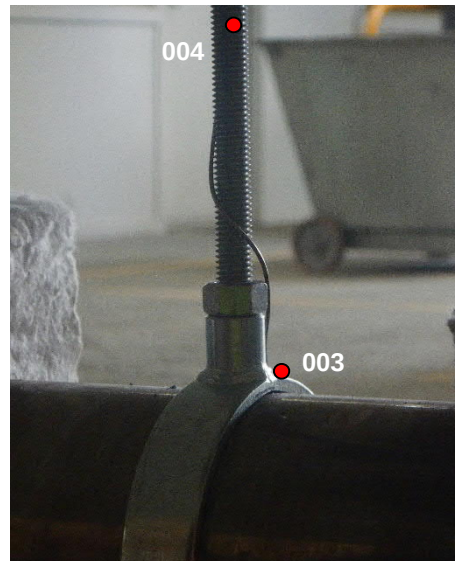


Figure 7 Service B



Figure 8 Service C

Table 12 Thermocouple locations

Service	T/C #	Description
A	001	On the bolted clip.
	002	At mid-height of the threaded rod.
B	003	On the bolted clip.
	004	At mid-height of the threaded rod.
C	005	On the bolted clip.
	006	At mid-height of the threaded rod.

Appendix D Test data

D.1 Furnace temperature and severity

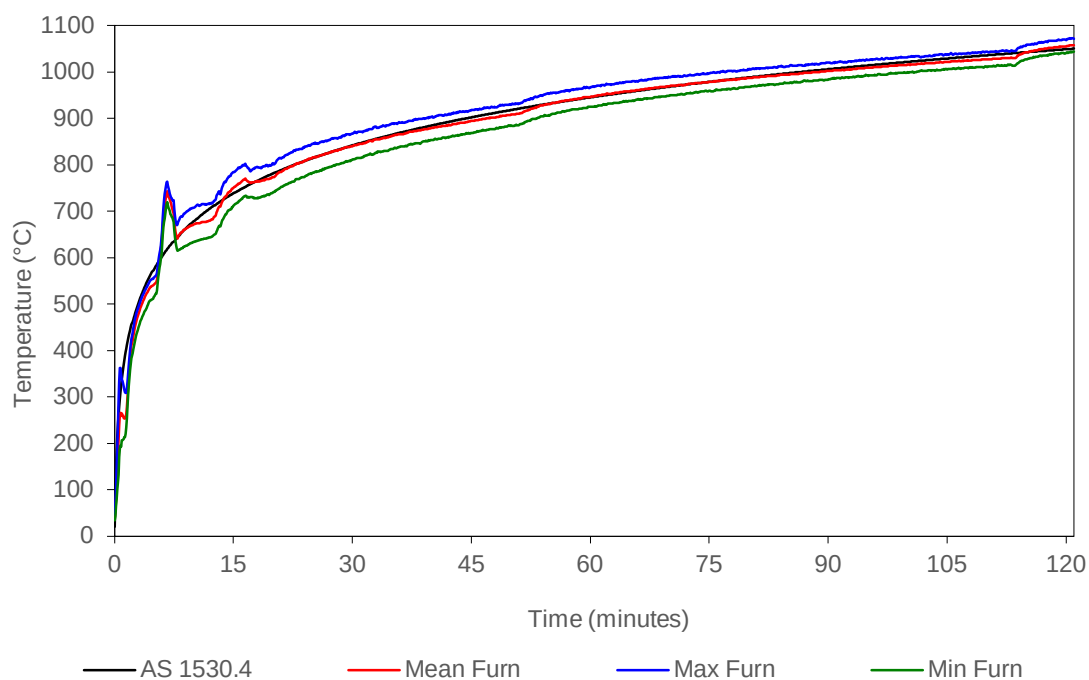


Figure 9 Furnace thermocouple temperature vs time

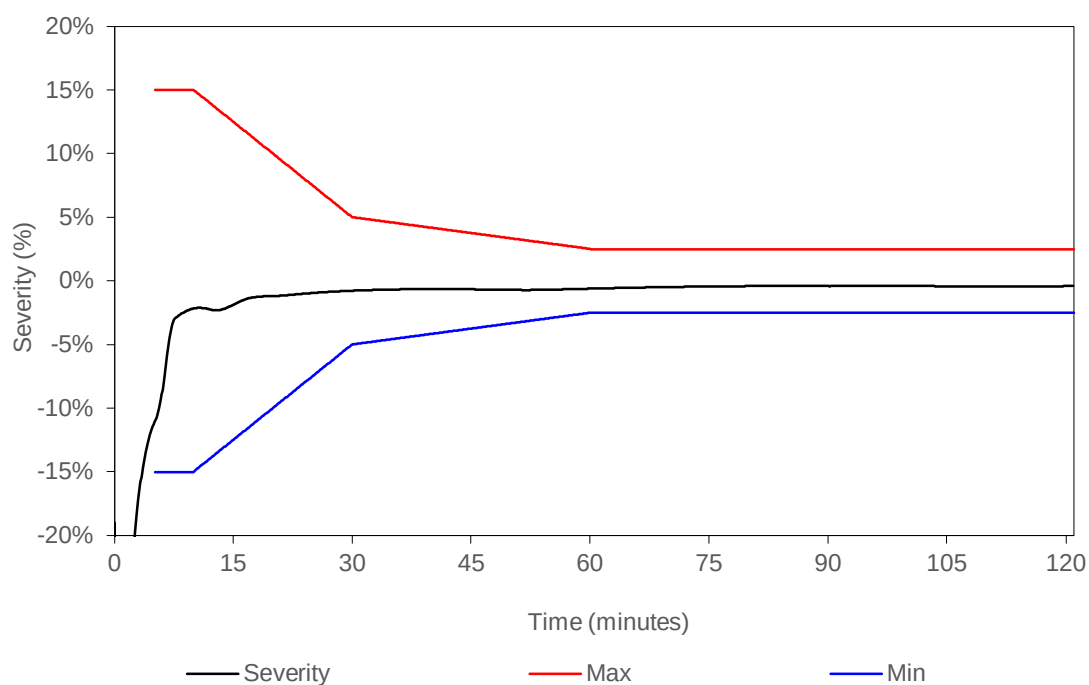


Figure 10 Percentage deviation of exposure severity vs time

D.2 Furnace pressure

The furnace pressure was measured 100mm below the underside of the floor system.

Table 13 Furnace pressure

Time (minutes)	Average pressure (Pa)	Time (minutes)	Average pressure (Pa)	Time (minutes)	Average pressure (Pa)
5-10	31	45-50	19	85-90	21
10-15	20	50-55	20	90-95	21
15-20	19	55-60	20	95-100	20
20-25	21	60-65	20	100-105	21
25-30	21	65-70	21	105-110	21
30-35	20	70-75	21	110-115	22
35-40	21	75-80	21	115-120	20
40-45	21	80-85	21		

D.3 Specimen temperatures

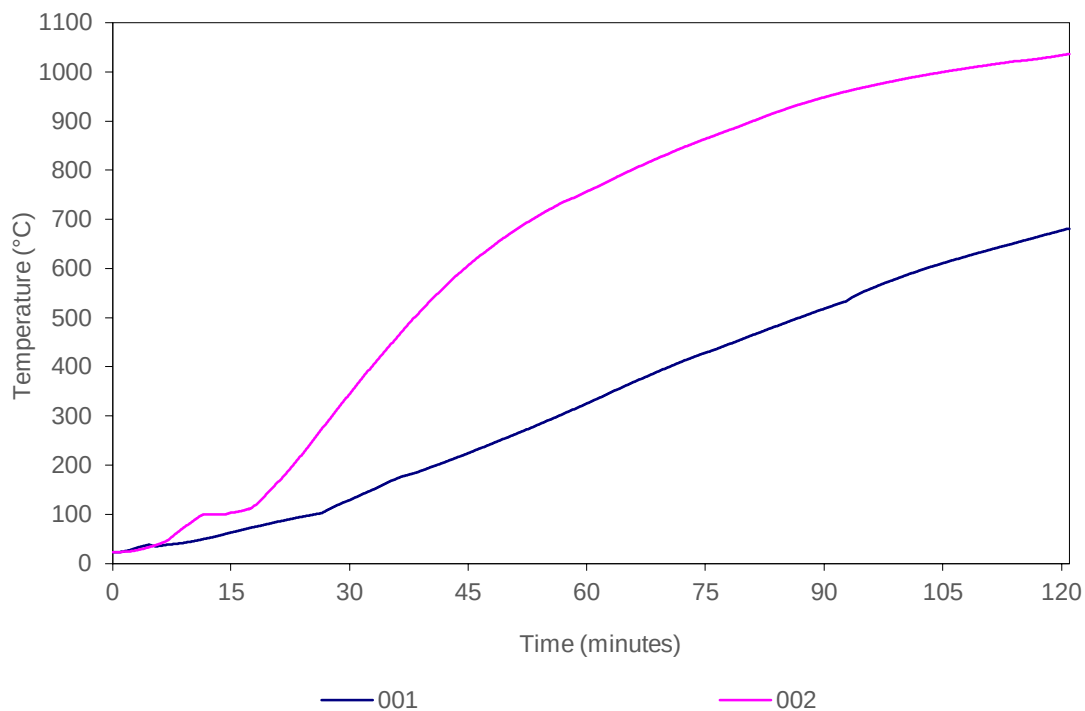


Figure 11 Service A – temperature vs time

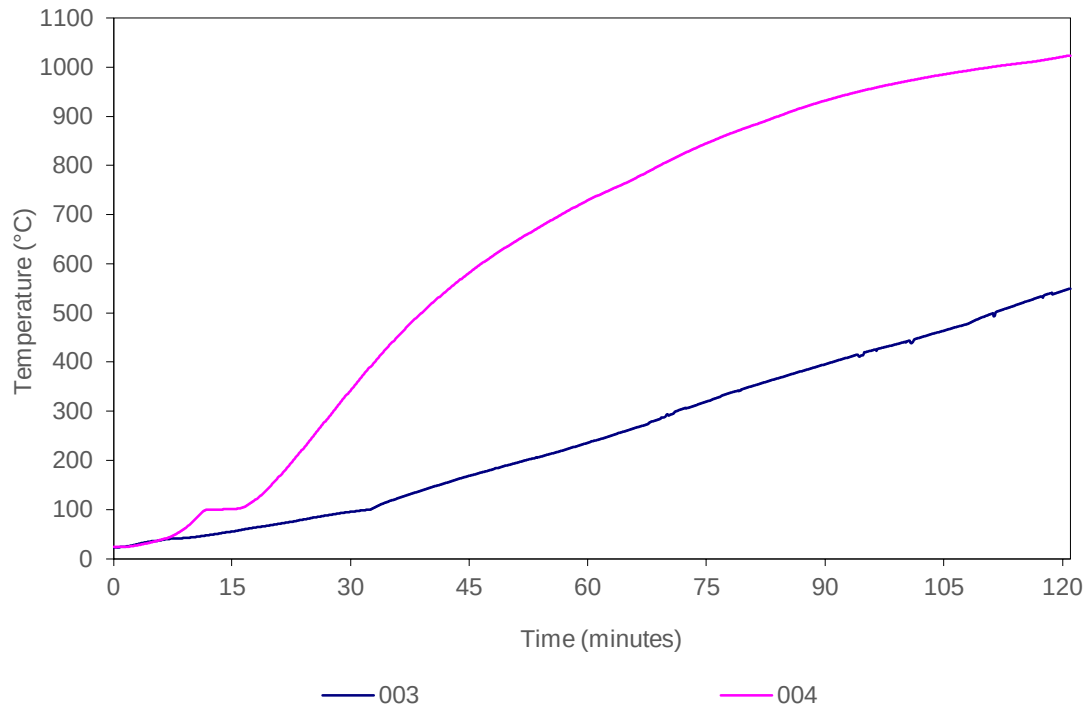


Figure 12 Service B – temperature vs time

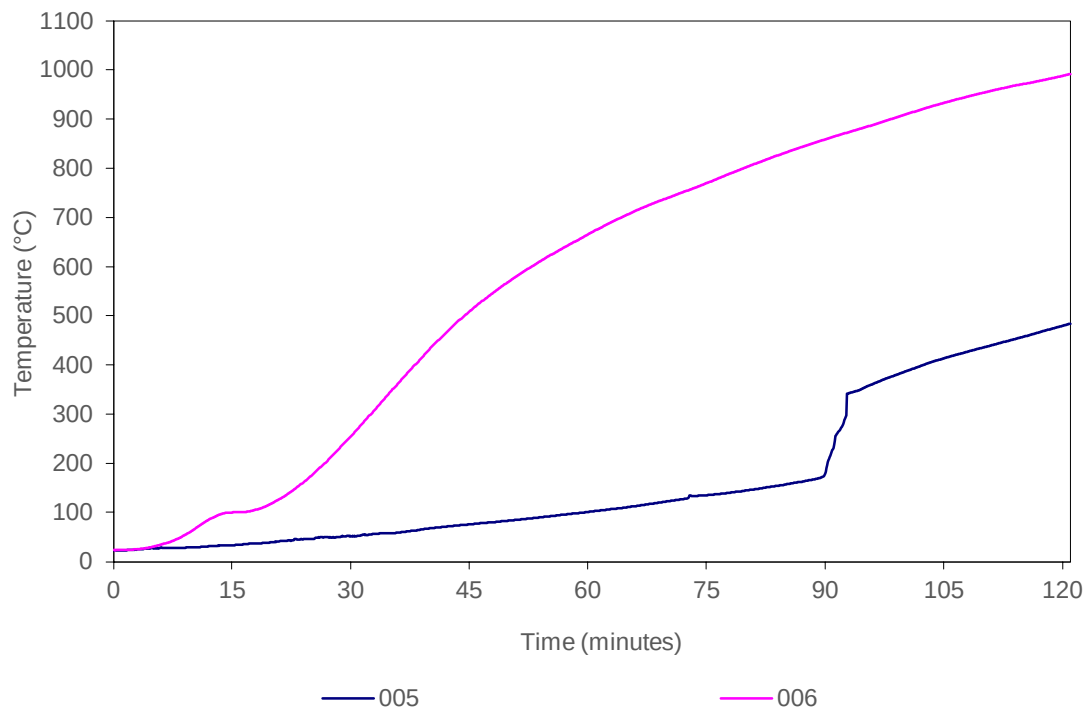


Figure 13 Service C – temperature vs time

Table 14 Test specimen temperatures

Service	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 bolted clip.	23	129	325	518	677	86
	002	At mid-height of the threaded rod.	24	345	756	948	1034	38
B	003	On the bolted clip.	24	95	236	396	544	111
	004	At mid-height of the threaded rod.	24	342	729	932	1021	39
C	005	On the bolted clip.	23	52	101	179	479	-
	006	At mid-height of the threaded rod.	24	254	665	859	988	44

- Note:**
- ¹ Refer to Table 12 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 exceeded 500 °C.
 - 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 E Photographs

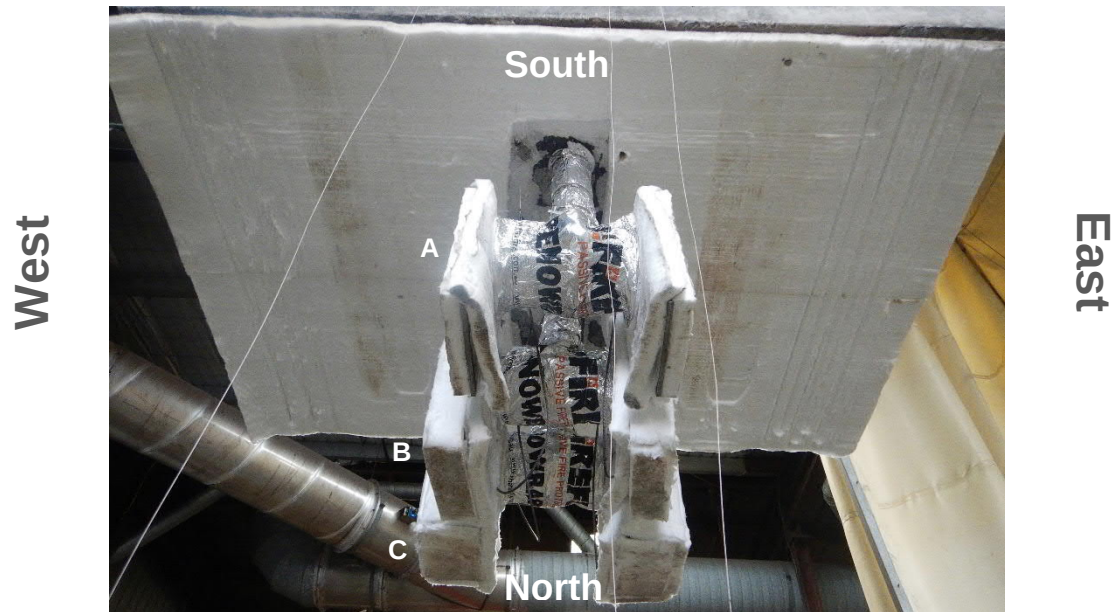


Figure 14 Exposed face of the specimen before the start of the test

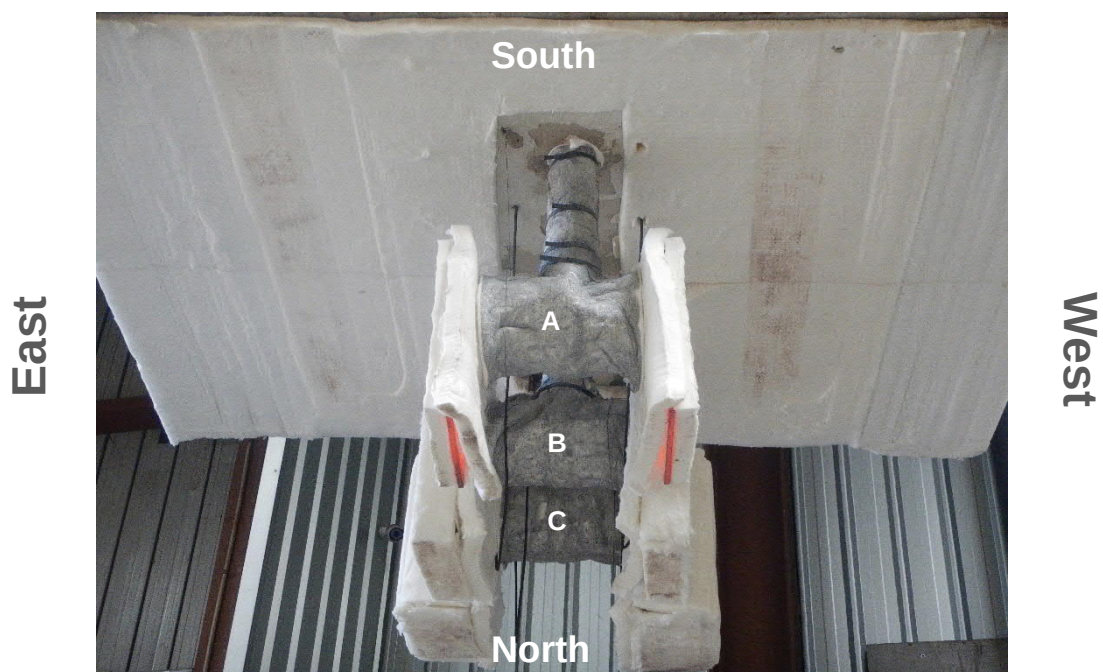


Figure 15 Exposed face of the specimen at the end of the test

warringtonfire

Proud to be part of  element



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