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Testing. Advising. Assuring.

Title:

A fire resistance test performed on a specimen of a non-loadbearing composite wall assembly utilising the heating conditions and performance criteria of ASTM E119-14

WF Report No:

351645



Prepared for:

**Alstrong Enterprises
India (PVT) Limited**

E-40/3,
Okhla Industrial Area,
New Delhi,
India

Date:

15th June 2015

Notified Body No:

0833



0249

Summary

Objective To evaluate the fire resistance performance of a specimen of a non-loadbearing composite wall assembly when tested utilising the heating conditions and performance criteria of ASTM E119-14.

Sponsor **Alstrong Enterprises India (PVT) Limited**, E-40/3, Okhla Industrial Area, New Delhi, India

Summary of the Tested Specimen The test assembly had overall nominal dimensions of 3000 mm high by 3000 mm wide by 127 mm thick. The framing comprised 72 mm by 50 mm by 0.5 mm thick galvanised mild steel channel perimeter framework. 2 no. 70 mm by 50 mm by 3 mm thick mild steel box section central framework posts were friction fixed into the perimeter framework at the head and base, at 990 mm centres. The stud frame was faced on each side with a single layer of 15 mm thick 'Knauf Fire Panel'. Each board was screw fixed with 32 mm long, bulge head drill point drywall screws, at nominally 200 mm centres. The cavity included a layer of nominally 50 mm thick mineral wool insulation having a measured density of 17.3 kg/m³, and a layer of 25 mm thick Alkali silicone based insulation with a measured density of 96 kg/m³.

The unexposed surface of the assembly was over clad with Alstrong "Fire rated ACP" panels which was screw fixed through to the framework sections and partition facing boards. Intumescent & Acoustic Acrylic Sealant referenced "Fire Seal 300" was applied to a depth of nominally 22 mm deep around the perimeter edges of the assembly and between each panel.

The assembly was completely retained within the specimen support frame around all four edges.

Test Results:

Passage of flames and hot gases 120 minutes*

Temperature Rise 110 minutes

* The test duration. The test was discontinued after a period of 120 minutes.

Hose Stream Immediately following the fire test, the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-14, Clause 7.6 for a period of 65 seconds.

During the application of the hose stream, the bottom middle panel detached from the assembly on three sides allowing water to project through to the unexposed surface of the specimen. Therefore the specimen was judged to have failed the requirements of this test.

Date of Test 24th April 2015.

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Signatories

Responsible Officer D. Yates* Testing Officer

Approved S. Hankey* Business Unit Head – Fire Resistance Department

* For and on behalf of **Exova Warringtonfire**.

Report Issued
Date : 2015

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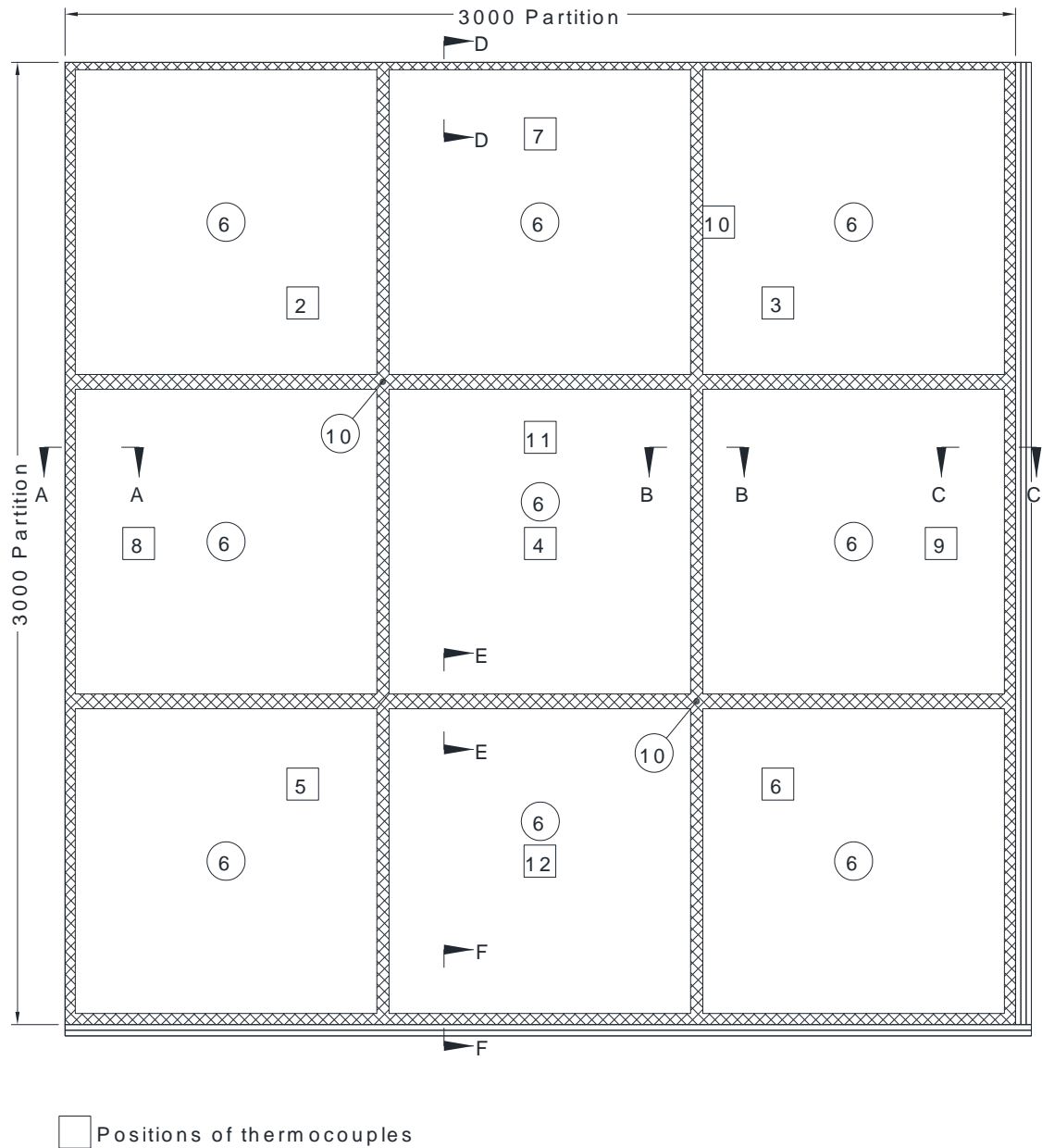
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Test Procedure

Introduction	<p>The test was carried out utilising the general principles of ASTM E119-14 'Standard Test Method for Fire Tests of Building Construction and Materials' to determine the performance of the specimen as defined in that standard.</p> <p>The specimen was assessed against the performance criteria detailed within Clause 8.3 of ASTM E119-14.</p>
Instruction to test	<p>The test was conducted on the 24th April 2015 at the request of Alstrong Enterprises India (PVT) Limited, the test sponsor.</p>
Test Specimen Construction	<p>A comprehensive description of the test construction is given in the Schedule of Components. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.</p>
Installation	<p>The test construction was mounted within a refractory concrete lined steel test frame by representatives of Exova Warringtonfire, commencing on the 27th March 2015.</p>
Sampling	<p>Exova Warringtonfire was not involved in any selection or sampling procedures for the tested specimens.</p>
Conditioning	<p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 28 days. Throughout this period of time both the temperature and the humidity of the laboratory were measured and recorded as being within a range of from 7°C to 20°C and 44% to 73% respectively.</p>

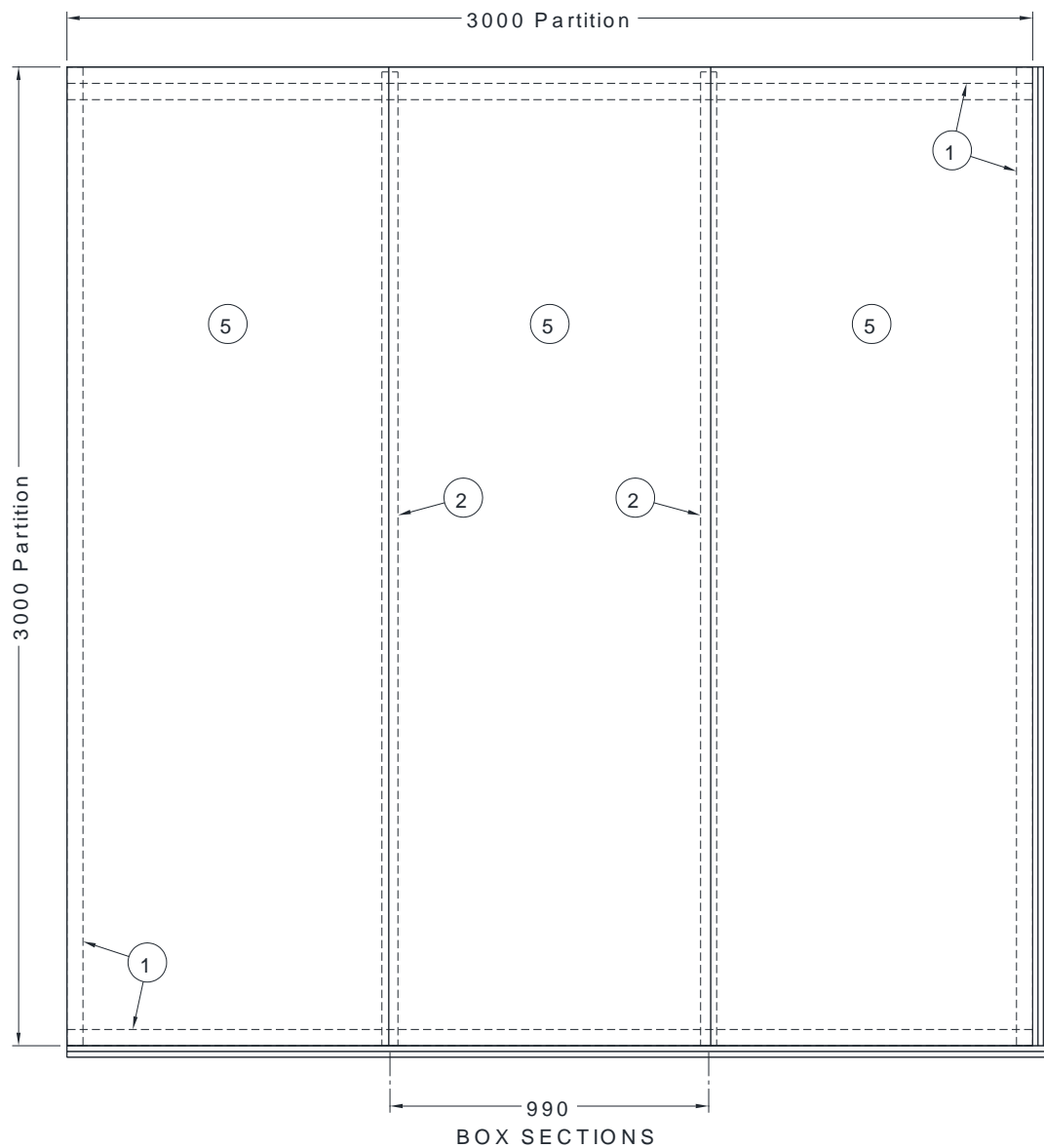
Test Specimen

Figure 1- General Elevation of the Unexposed face of the Test Construction



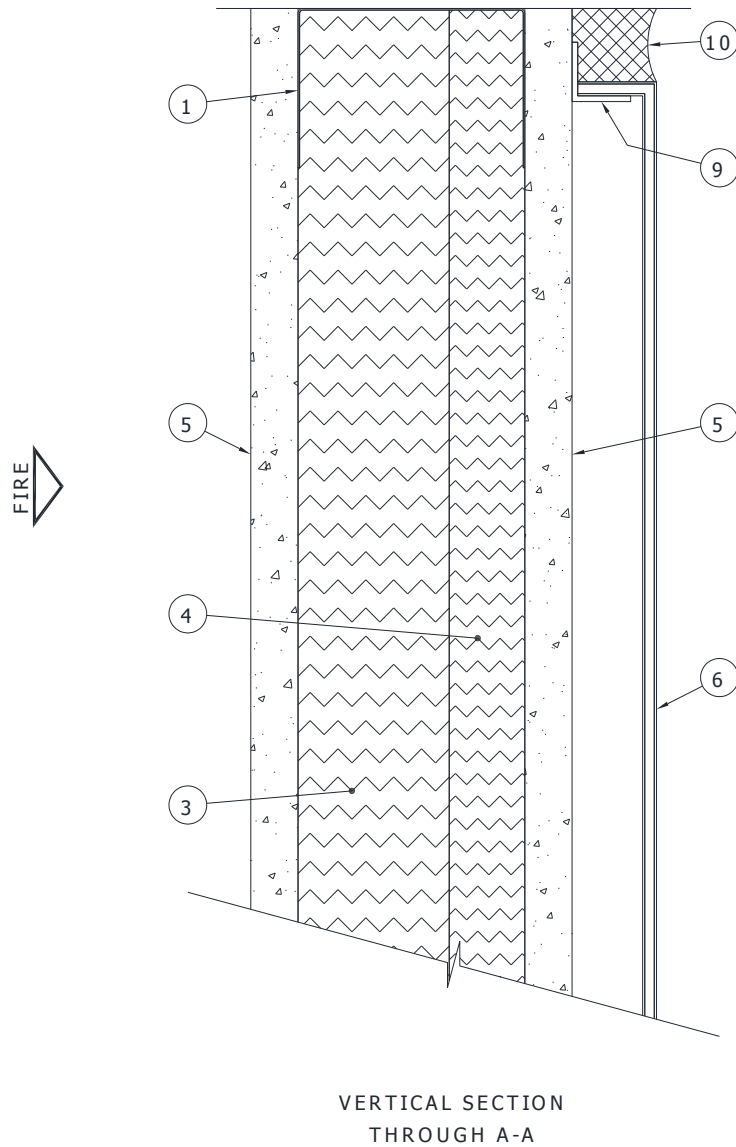
Do not scale. All dimensions are in mm

Figure 2 – General Elevation of the Exposed face of the Test Construction



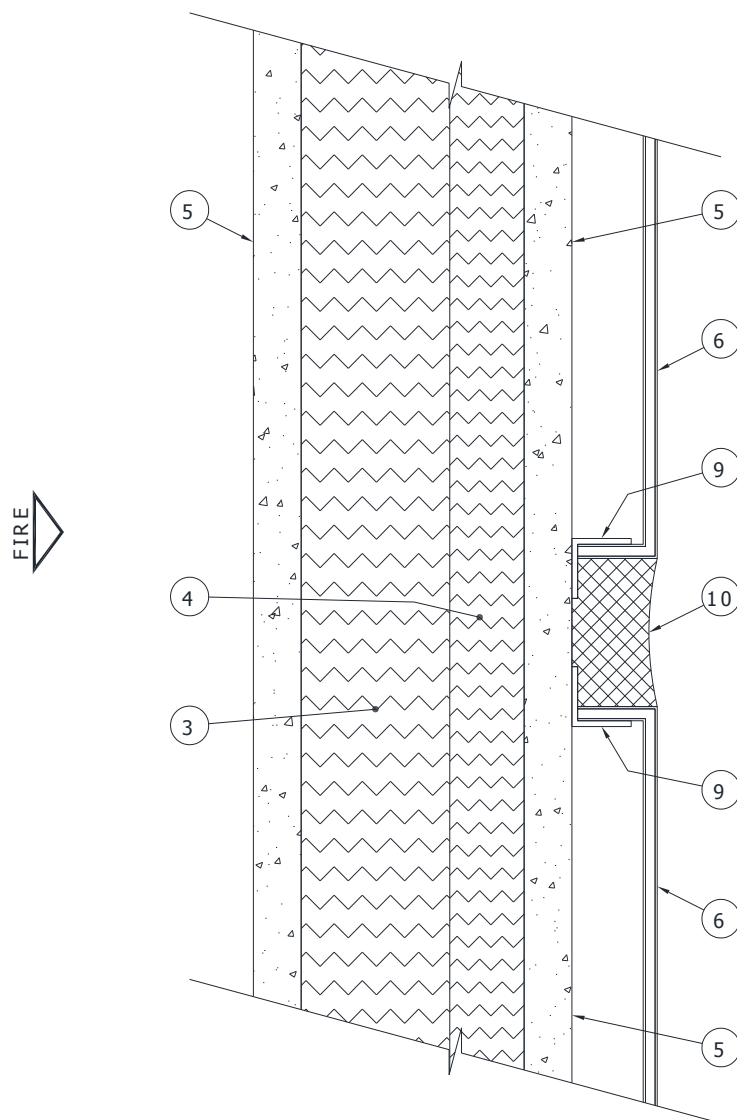
Do not scale. All dimensions are in mm

Figure 3 – Details of Partition



Do not scale. All dimensions are in mm

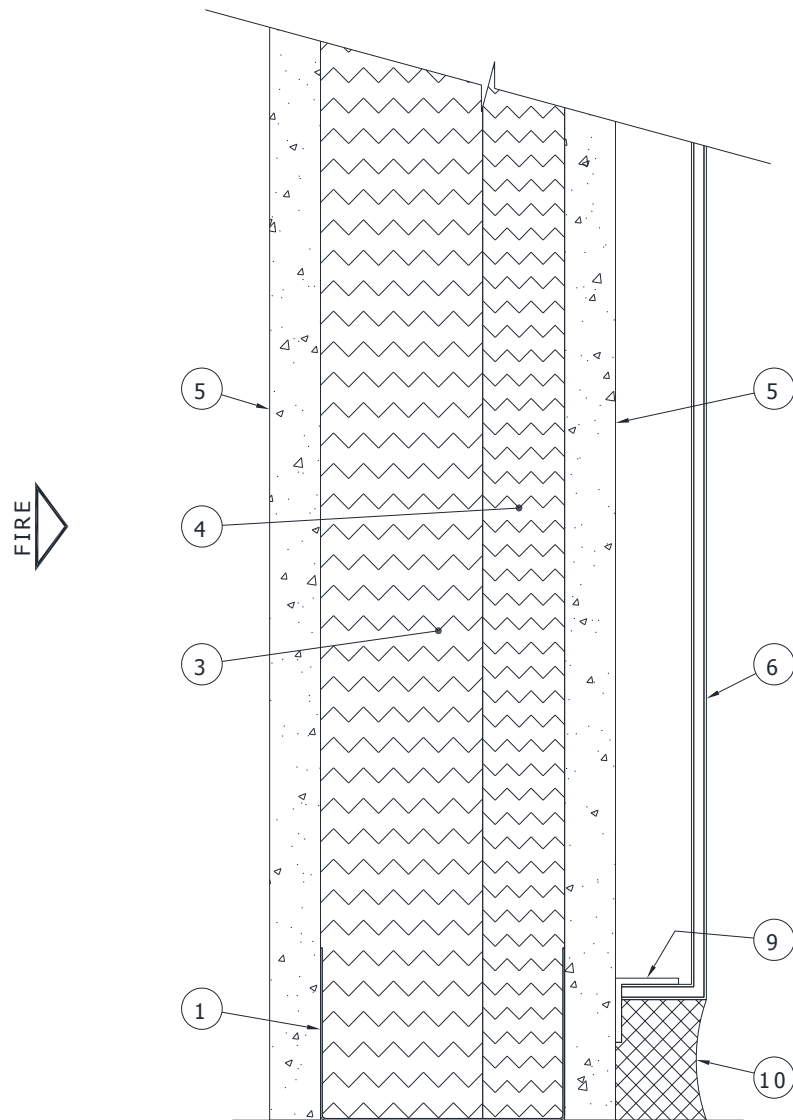
Figure 4 – Details of Partition



VERTICAL SECTION
THROUGH B-B

Do not scale. All dimensions are in mm

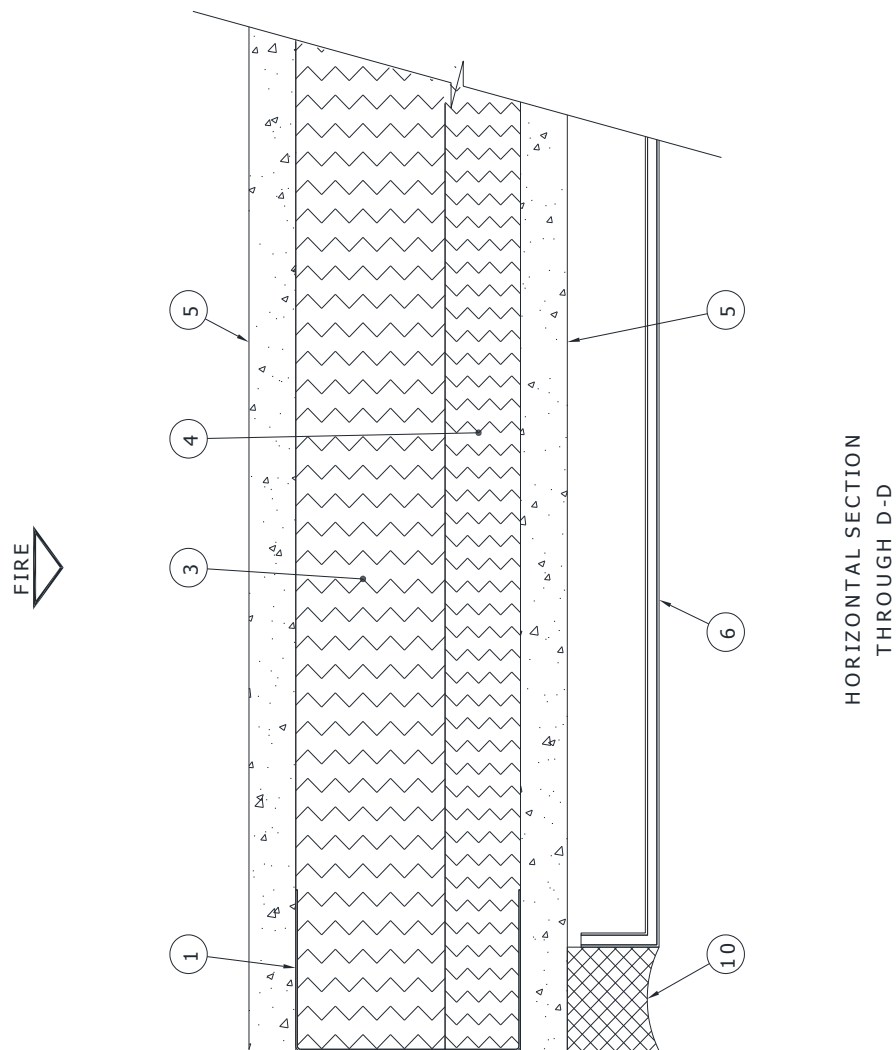
Figure 5 – Details of Partition



VERTICAL SECTION
THROUGH C-C

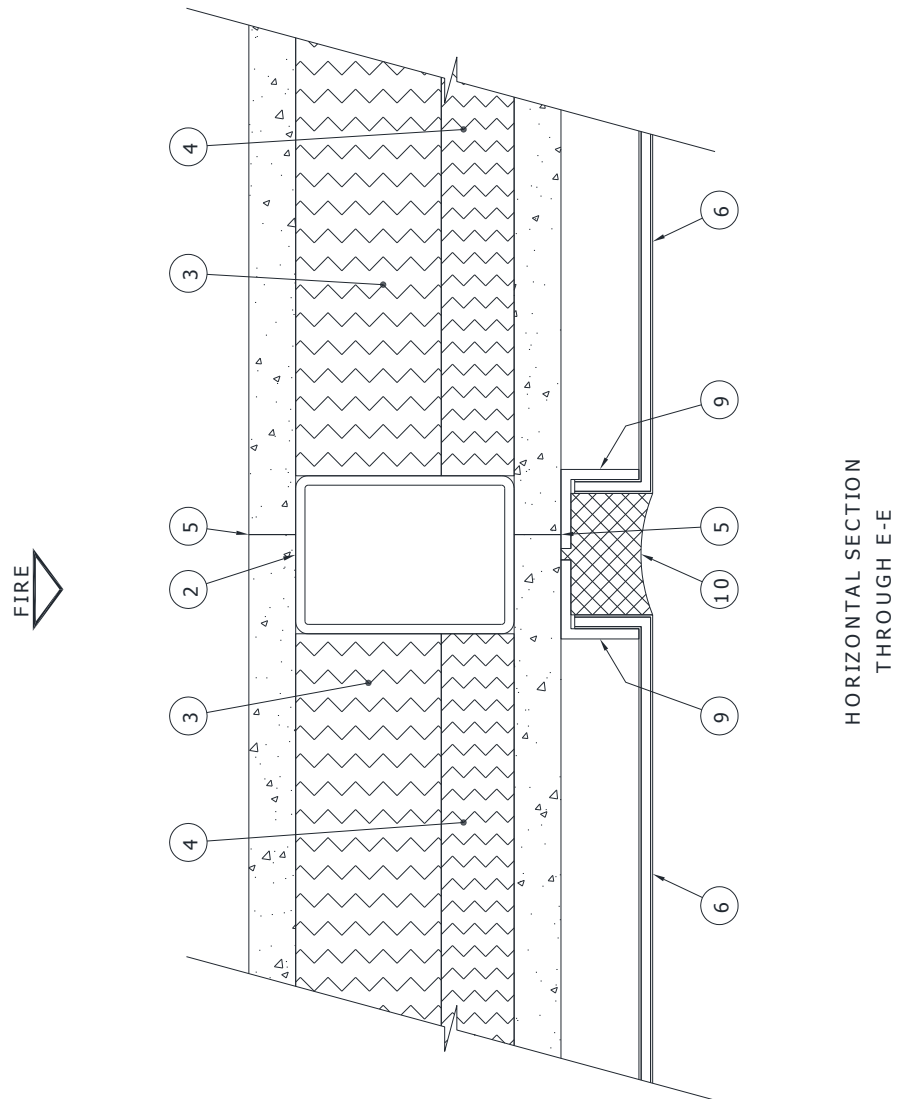
Do not scale. All dimensions are in mm

Figure 6 – Details of Partition



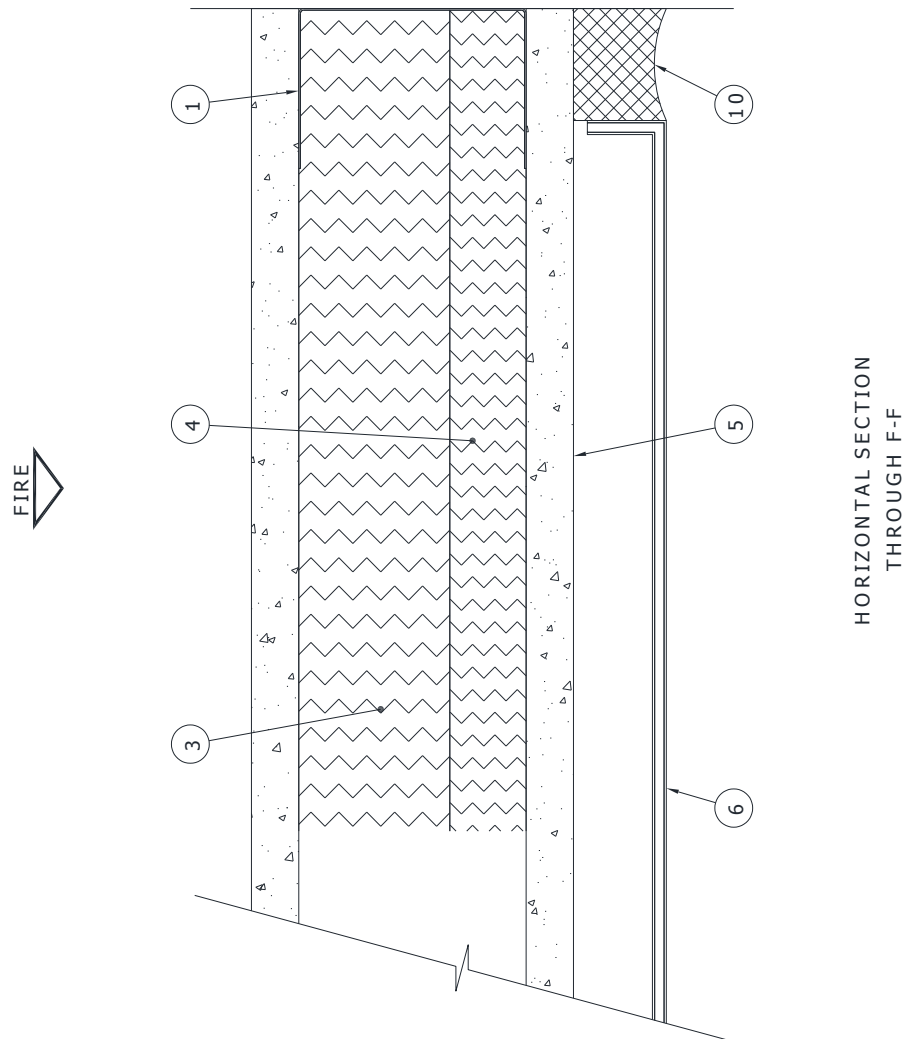
Do not scale. All dimensions are in mm

Figure 7 – Details of Partition



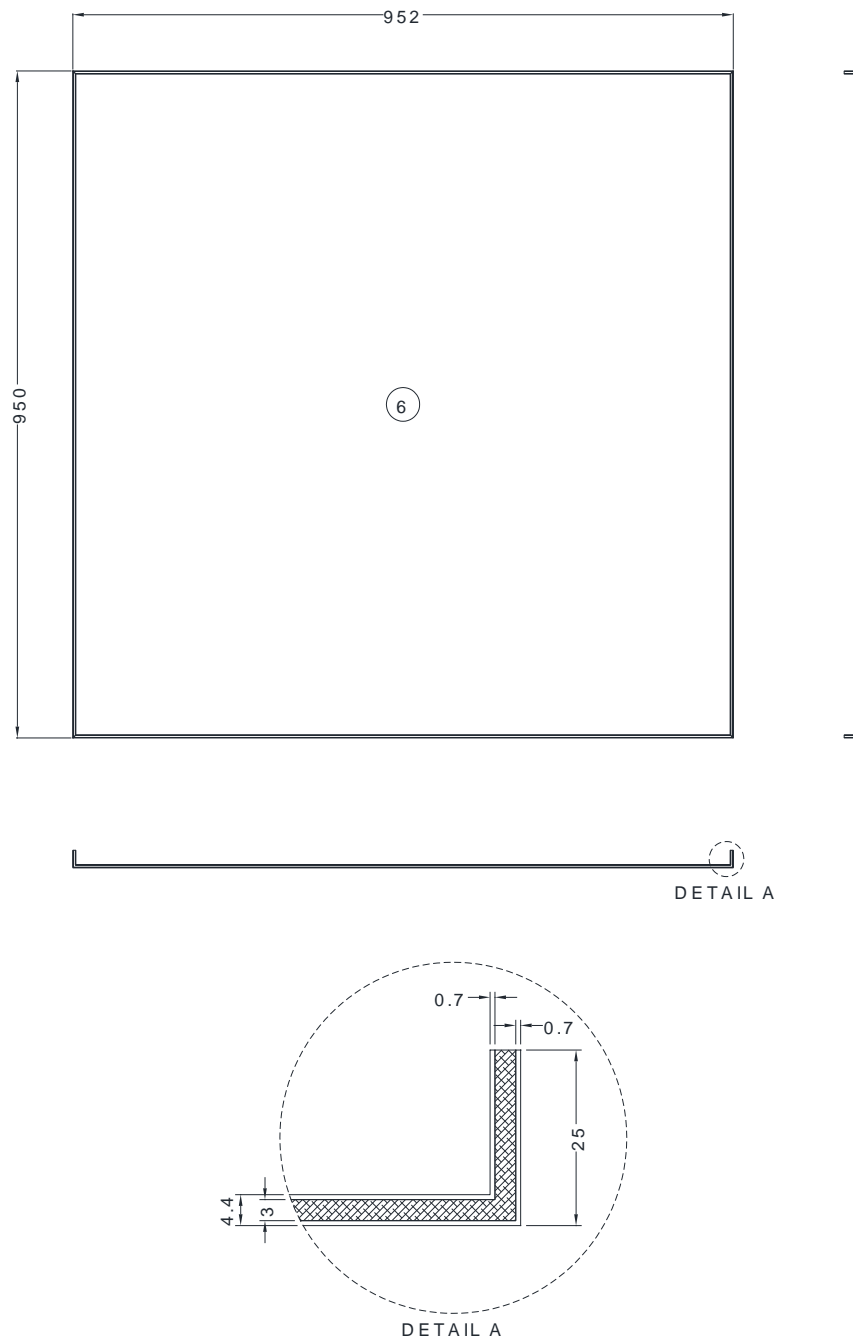
Do not scale. All dimensions are in mm

Figure 8 – Details of Partition



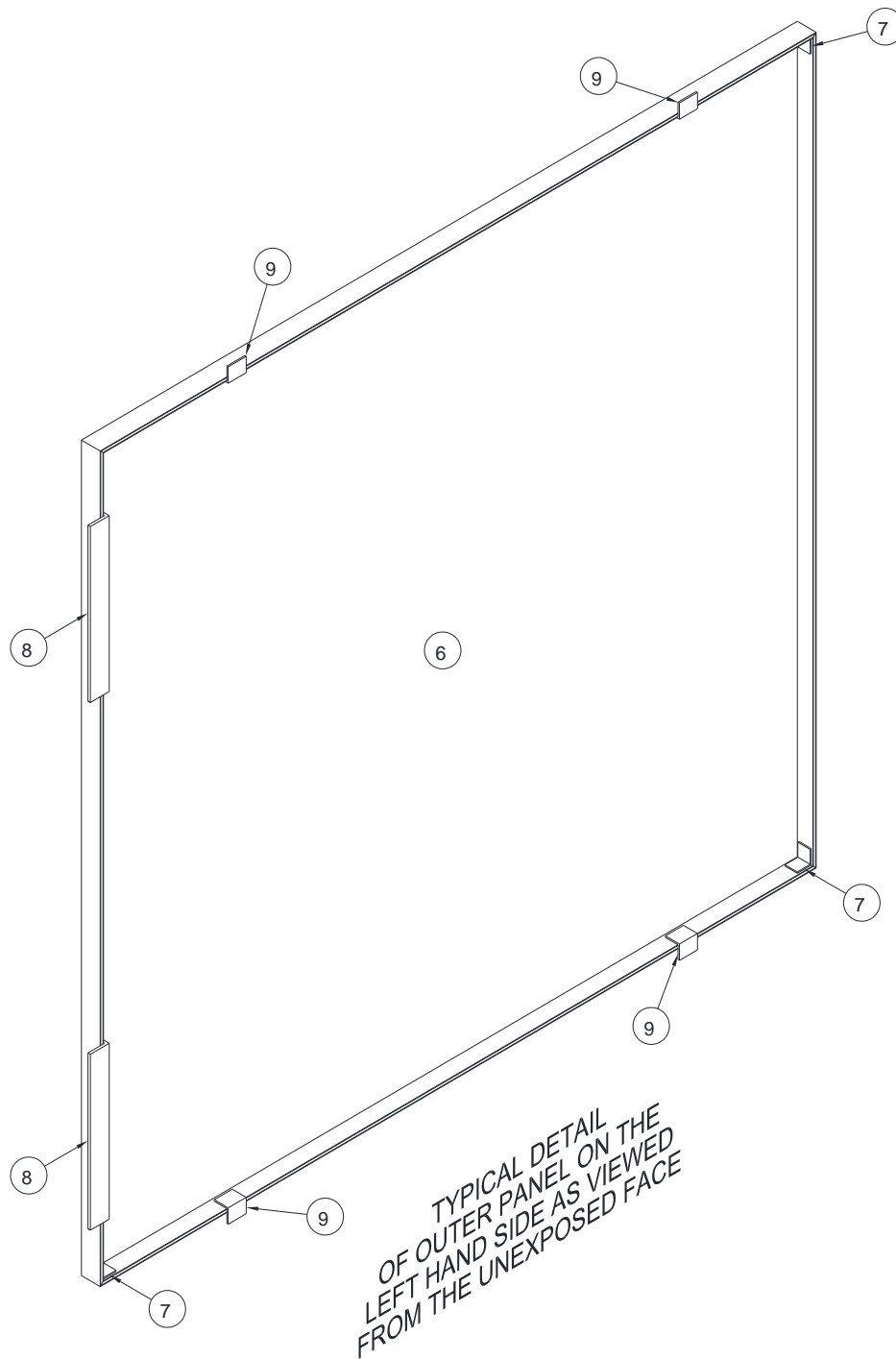
Do not scale. All dimensions are in mm

Figure 9 – Details of Panels



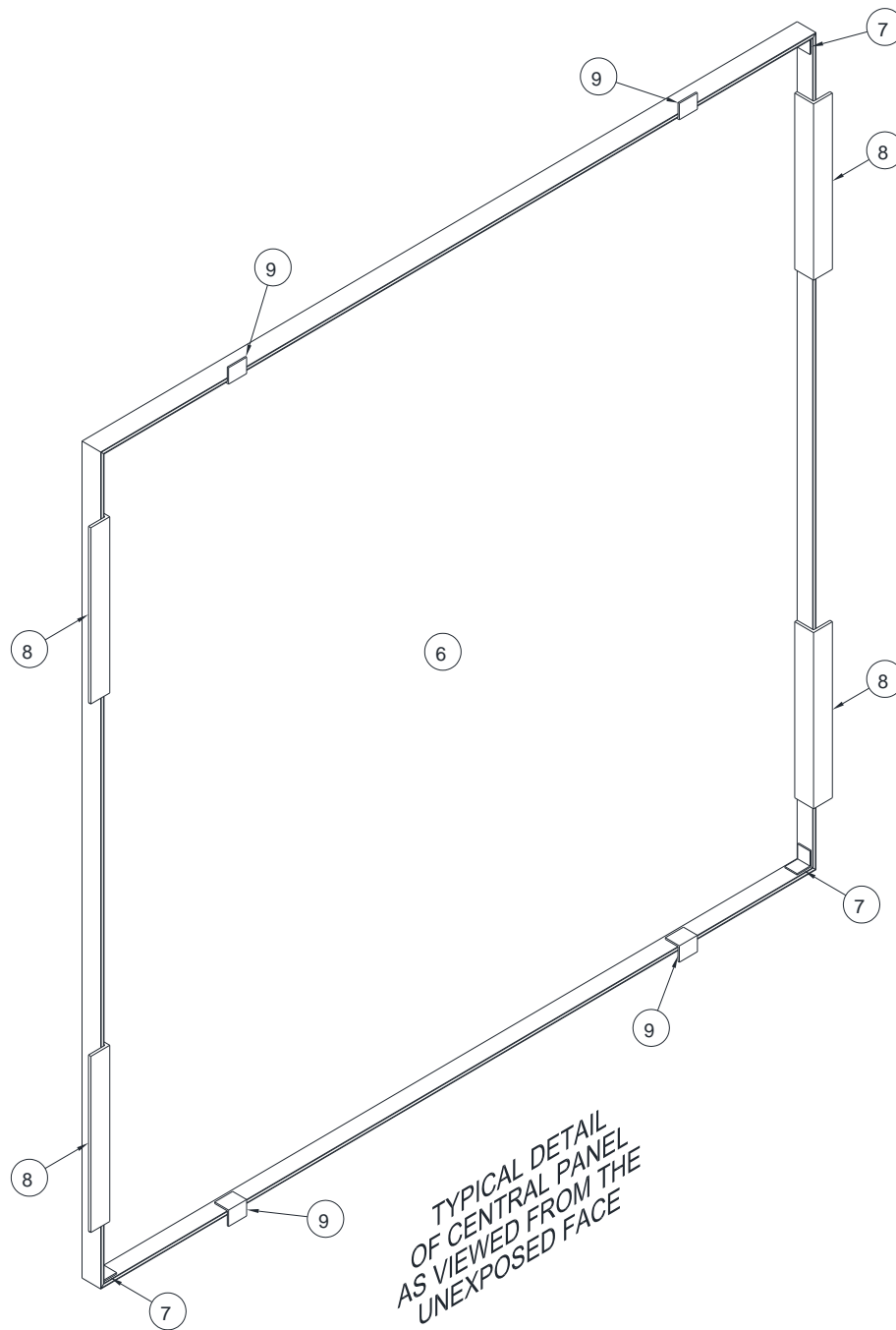
Do not scale. All dimensions are in mm

Figure 10 – Details of Panels



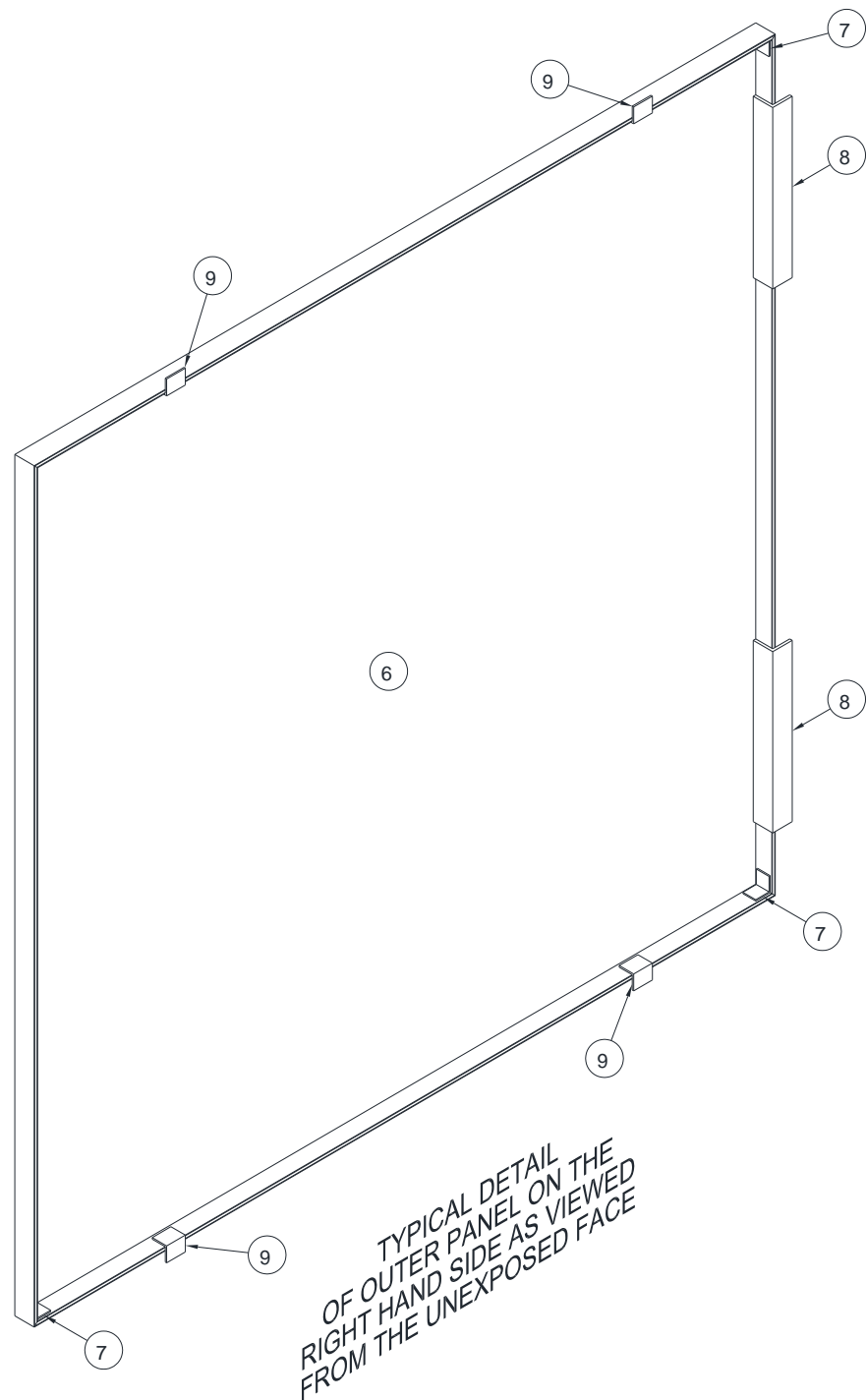
Do not scale. All dimensions are in mm

Figure 11 – Details of Panels



Do not scale. All dimensions are in mm

Figure 12 – Details of Panels



Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 2 to 12)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Perimeter Framework	
Manufacturer	: Speedline
Reference	: SPEDT72
Material	: Galvanised mild steel channel
Thickness	: 0.5 mm
Overall size	: 72 mm wide x 50 mm deep
Fixing method	: Through screwed to all four edges
Fixings	
i. type	: Concrete fixings
ii. material	: Steel
iii. overall size	: 68 mm long x 7.6 mm diameter
iv. centres	: 300 mm
2. Central Framework Post	
Material	: Mild steel box section
Thickness	: 3 mm
Overall size	: 70 mm x 50 mm
Fixing method	: Friction fitted into the top and perimeter framework channels with 20 mm allowance for expansion
3. Partition Insulation	
Manufacturer	: ???
Reference	: ???
Material	: Mineral fibre based insulation
Density	: 17.3 kg/m ³ , measured
Thickness	: 50 mm
Fixing method	: Fitted into voids within framework sections and retained by the partition facing boards, item 5, to each face
4. Partition Insulation	
Manufacturer	: Thermal Ceramics
Reference	: FireMaster 607
Material	: Alkali silicate based insulation
Density	: 96 kg/m ³ , measured
Thickness	: 25 mm
Fixing method	: Fitted into voids within framework sections and retained by the partition facing boards, item 5, to each face

Item

Description

5. Partition Facing Boards

Manufacturer	:	Knauf
Reference	:	Fire Panel
Material	:	Type A & F gypsum to EN520 with paper facings
Density	:	794 kg/m ³ , measured
Thickness	:	15 mm
Fixing method	:	Fitted in a single layer to each face and through screwed to the framework sections, items 1 & 2. All joints were scrimmed and skimmed
Fixings		
i. manufacturer	:	Timber Mate
ii. type	:	Bugle head Drill point drywall screws
iii. material	:	Zinc coated steel
iv. reference	:	Z0003T692
v. overall size	:	32 mm long x 3.5 mm diameter
vi. centres	:	200 mm
Scrim		
i. manufacturer	:	Everbuild Building Products Ltd
ii. material	:	Fiberglass based scrim tape
iii. overall size	:	48 mm wide
iv. application method	:	Self-adhered and fitted over vertical joints of butting facing boards
Skim		
i. manufacturer	:	Everbuild Building Products Ltd
ii. material	:	Fill And Skim
iii. application method	:	Float trowel

6. Panel

Manufacturer	:	Alstrong
Reference	:	Fire rated ACP
Material		
i. facings	:	Aluminium
ii. core	:	Composite (70%) mineral and (30%) low density polyethylene
Thickness'		
i. facings	:	0.7 mm
ii. core	:	3 mm
iii. overall	:	4.4 mm
Overall size	:	952 mm wide x 950 mm high
Fixing method	:	Fitted on the unexposed face of the partition only through to the framework sections and partition facing board, items 1, 2 & 5 respectively via fixing brackets and angle, items 8 & 9 respectively.

7. Panel Corner Reinforcing Angle

Material	:	Aluminium angle
Thickness'	:	1.5 mm
Overall size	:	18.6 mm x 18.6 mm x 16 .4 mm wide
Fixing method	:	Fitted into the inside of each corner of the panels and through fixed by a single pop-rievet per leg. Please see Figures 10, 11 & 12 for positions

<u>Item</u>	<u>Description</u>
8. Panel Fixing Bracket	
Material	: Aluminium angle
Thickness	: 3 mm
Overall size	: 25 mm x 25 mm x 200 mm long
Fixing methods	
i. to back face of panels	: Fitted into the inside of each of the back face of the panel and fixed with 2 off pop-rivet through each leg of the angle. Please see Figures 10, 11 & 12 for positions
ii. to perimeter framework & partition facing boards	: Through screwed
Fixings	
i. manufacturer	: Timber Mate
ii. type	: Bugle head Drill point drywall screws
iii. material	: Zinc coated steel
iv. reference	: Z0003T692
v. overall size	: 32 mm long x 3.5 mm diameter
vi. quantity	: 2 off
9. Panel Fixing Angle	
Material	: Aluminium angle
Thickness	: 1.5 mm
Overall size	: 18.6 mm x 18.6 mm x 16 .4 mm wide
Fixing methods	
i. to back face of panels	: Fitted into the inside of each corner of the panels and through fixed by a single pop-rivet through leg of the angle. Please see Figures 10, 11 & 12 for positions
ii. to perimeter framework & partition facing boards	: Through screwed
Fixings	
i. manufacturer	: Timber Mate
ii. type	: Bugle head Drill point drywall screws
iii. material	: Zinc coated steel
iv. reference	: Z0003T692
v. overall size	: 32 mm long x 3.5 mm diameter
vi. quantity	: 1 off
10. Sealant	
Manufacturer	: Everbuild Building Products Ltd
Reference	: Fire Sealant 300
Material	: Intumescent & Acoustic Acrylic Sealant
Application method	: Cartridge gunned to a depth nominally 22 mm – 25 mm deep. Please see Figures 1, 3, 4, 5, 6, 7 & 8 for positions

Instrumentation

General	The instrumentation was provided in accordance with the requirements of the Standard.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of ASTM E119-14, Clause 7.
Thermocouple Allocation	<p>Thermocouples were provided to monitor the unexposed surface of the specimen. The output of all instrumentation was recorded at no less than one minute intervals as follows:</p> <p>The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1.</p>
Integrity Criteria (Ignition test)	Cotton pads were available to evaluate the impermeability of the specimen where relevant.
Furnace Pressure	After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that the calculated pressure differential relative to the laboratory atmosphere was 16.5 (± 2) Pa at the top of the specimen.

Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	The ambient air temperature in the vicinity of the test construction was 14°C at the start of the test with a maximum variation of $\pm 1^{\circ}\text{C}$ during the test.
00	00	The test commences.
06	10	Slight smoke/steam release issues from the upper right corner of the assembly.
11	30	Viewed from the exposed face, the joint filler and tape begins to detach and fall away from the assembly. Large vertical cracks have formed from top to bottom at mid width of each board, along the internal vertical frame members. The paper face has charred and burnt away.
18	00	Slight steam release issues across the top of the upper central and upper right hand panel.
26	30	Viewed from the exposed face, the surface of the assembly radiates orange in colour. The board joints appear black in colour. The vertical cracks that have formed at mid width of each panel have increased in size now by approximately 4-5mm wide at maximum.
35	00	Viewed from the exposed face, the vertical cracks within the boards continue to open up and increase in size now by approximately 25-30mm wide at maximum.
56	00	Viewed from the exposed face, approximately 15-20% board loss is evident at various locations throughout the assembly. Small openings begin to form within the now exposed layer of mineral wool.
60	00	The assembly continues to satisfy the test criteria for both integrity and insulation. The assembly has visibly bowed toward the furnace chamber at its centre by approximately 30-35mm.
64	20	Viewed from the exposed face, a large section of board has detached and fallen away from the bottom right quarter section of the assembly.
66	30	Viewed from the exposed face, more board loss is evident across the bottom half of the assembly. Approximately 40-45% board loss is evident.
70	55	Slight smoke/steam release begins to issue across the bottom perimeter edge of the middle panel. This is most evident at the right side of the panel.
75	20	Smoke/steam release increases across the bottom perimeter edge of the central panel as the intumescent material begins to separate from the perimeter edge of the panel.
77	00	Viewed from the exposed face, the majority of the board has fallen away from the bottom half of the assembly. The steel box section framework is now visible at the bottom half of the assembly.
80	00	The intumescent material around each panel begins to swell up slightly.

Time		
mins	secs	
87	55	The assembly continues to deflect towards the furnace chamber at its centre now by approximately 65-70mm.
91	50	Smoke/steam release across the bottom perimeter edge of the central panel has stopped as the intumescent material continues to expand causing the separation of the mastic to the panel edges to close back up.
99	40	Slight undulation is evident along the vertical perimeter edges of the middle row of panels.
101	30	Viewed from the exposed face, the internal core insulation has detached and fallen away at the bottom half of the assembly between the central vertical frame posts. This is now evident at mid width of the specimen between the posts. The now exposed plaster board facing appears slightly cracked throughout.
105	05	Smoke/steam release issues across the bottom half perimeter edge of the bottom-middle panel. The middle row of panels continues to deflect and appears heavily distorted
110	45	Thermocouple number 4 records a temperature rise in excess of 181°C. Insulation failure is deemed to occur.
152	06	Viewed from the exposed face, a large horizontal crack has formed within the bottom half of the second layer of board. Flames issue along the crack.
118	30	No significant visible change to exposed face.
120	00	The specimen continues to satisfy the integrity criteria. The fire resistance test is discontinued.

Hose Stream Test

The exposed face of the test assembly is subject to a hose stream test for a 65 second duration. During the application of the hose stream, the bottom middle panel detaches from the assembly on three sides allowing water to project through to the unexposed surface of the specimen. Therefore, the specimen is judged to have failed the requirements of this test.

Test Photographs

The exposed face
of the assembly
prior to testing



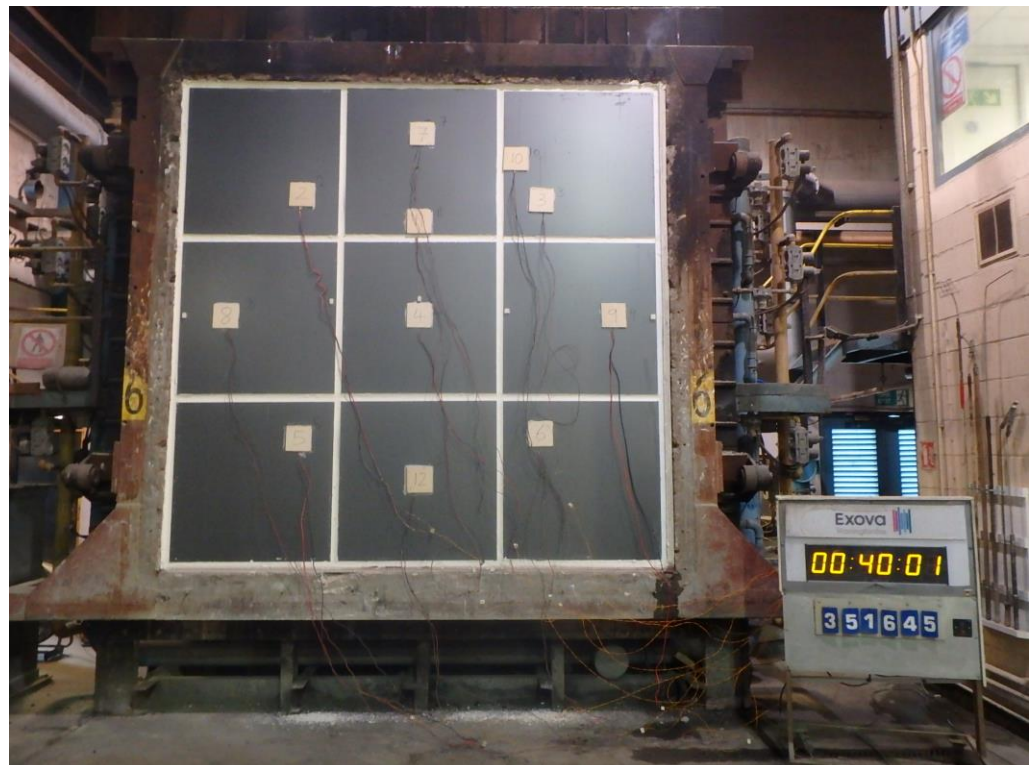
The unexposed
face of the
assembly prior to
testing



The unexposed
face of the
assembly after 20
minutes of testing



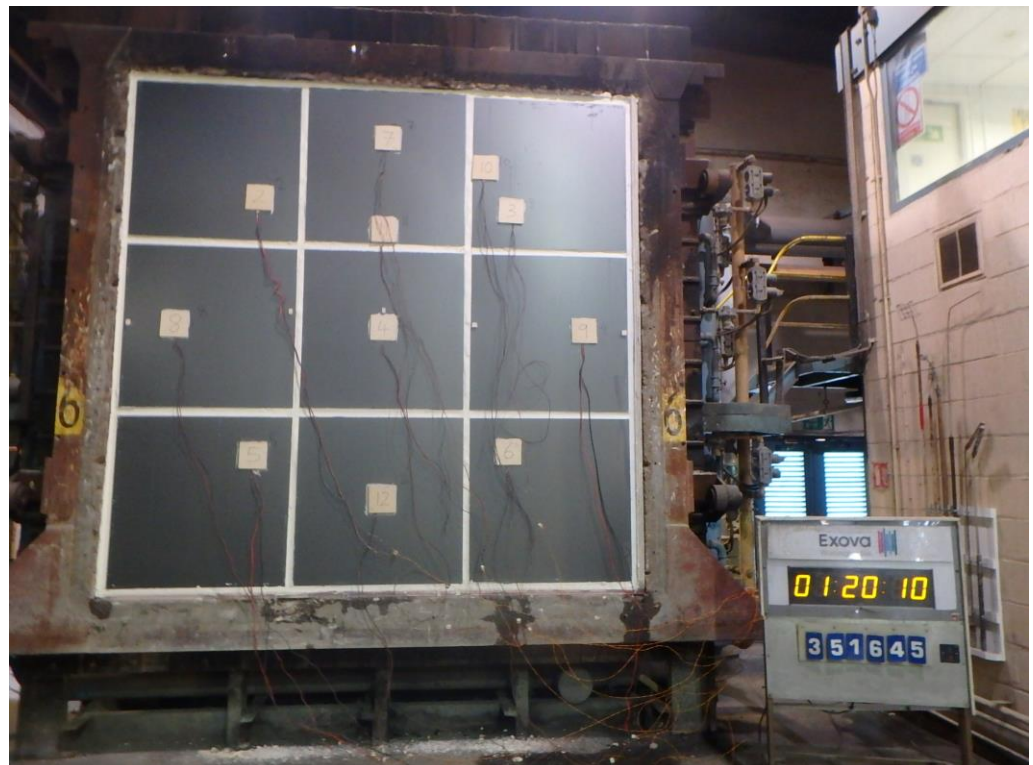
The unexposed
face of the
assembly after 40
minutes of testing



The unexposed
face of the
assembly after 60
minutes of testing



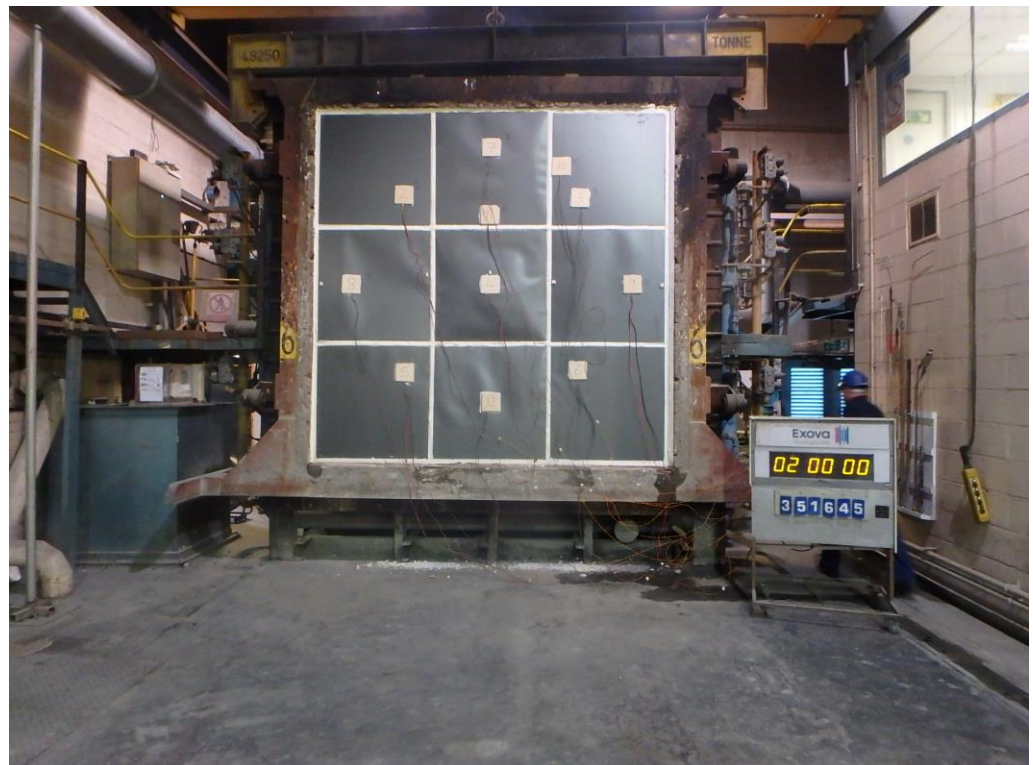
The unexposed
face of the
assembly after 80
minutes of testing



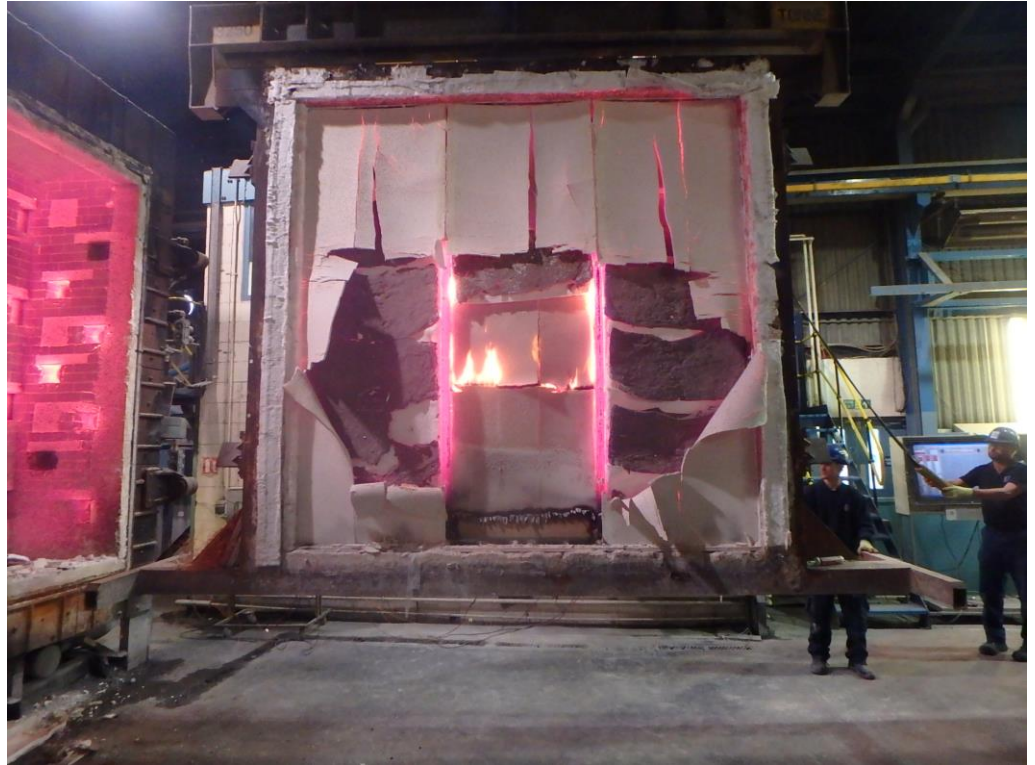
The unexposed
face of the
assembly after 100
minutes of testing



The unexposed
face of the
assembly after 120
minutes of testing



The exposed face
of the assembly
immediately after
the test



The exposed face
of the assembly
during the hose
stream test



The exposed face
of the assembly
immediately after
the hose stream
test



Temperature and Deflection Data

Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	21
5	534	495
10	704	682
15	760	742
20	795	806
25	820	826
30	843	849
35	862	871
40	879	882
45	892	897
50	904	909
55	915	920
60	926	930
65	936	936
70	946	948
75	955	961
80	963	971
85	971	973
90	978	977
95	985	988
100	991	993
105	997	998
110	1002	1003
115	1006	1007
120	1010	1012

**Individual Temperatures Recorded On The Unexposed Surface
Of The Test Assembly**

Time Mins	T/C Number 2 Deg. C	T/C Number 3 Deg. C	T/C Number 4 Deg. C	T/C Number 5 Deg. C	T/C Number 6 Deg. C	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C
0	15	15	15	15	16	16	17	17
5	15	15	15	15	15	16	17	17
10	15	16	15	15	15	17	17	17
15	20	21	19	16	16	24	19	19
20	30	28	27	20	20	39	25	23
25	39	36	38	28	27	50	33	30
30	42	40	41	34	33	53	37	35
35	43	41	43	37	37	52	40	37
40	44	43	45	39	39	52	42	40
45	47	47	51	43	42	55	48	45
50	51	51	58	49	46	60	56	52
55	56	56	64	56	53	66	62	59
60	60	60	69	61	57	70	68	64
65	64	63	72	66	60	72	71	68
70	67	66	74	70	63	74	75	71
75	69	68	79	73	65	76	78	74
80	71	69	83	76	67	78	81	77
85	73	71	86	79	71	80	85	80
90	75	73	88	83	75	81	86	83
95	76	74	89	85	79	83	86	85
100	78	76	90	85	84	84	87	87
105	79	77	114	85	85	87	96	87
110	80	78	190	89	90	90	109	88
111	81	78	198	91	95	90	112	89
115	82	79	200	99	106	98	130	98
120	83	81	277	112	128	120	156	109

**Individual Temperatures Recorded On The Unexposed Surface
Of The Test Assembly**

Time	T/C	T/C	T/C
Mins	Number	Number	Number
	10	11	12
	Deg. C	Deg. C	Deg. C
0	17	17	17
5	17	17	17
10	19	18	17
15	27	24	17
20	36	33	20
25	45	40	25
30	49	43	31
35	50	43	34
40	52	45	36
45	55	48	38
50	59	53	43
55	63	58	49
60	66	62	55
65	69	66	60
70	72	69	63
75	73	71	64
80	75	73	66
85	77	76	71
90	78	78	79
95	80	80	88
100	81	81	90
105	83	82	90
110	85	85	90
111	86	87	94
115	89	91	118
120	94	99	180

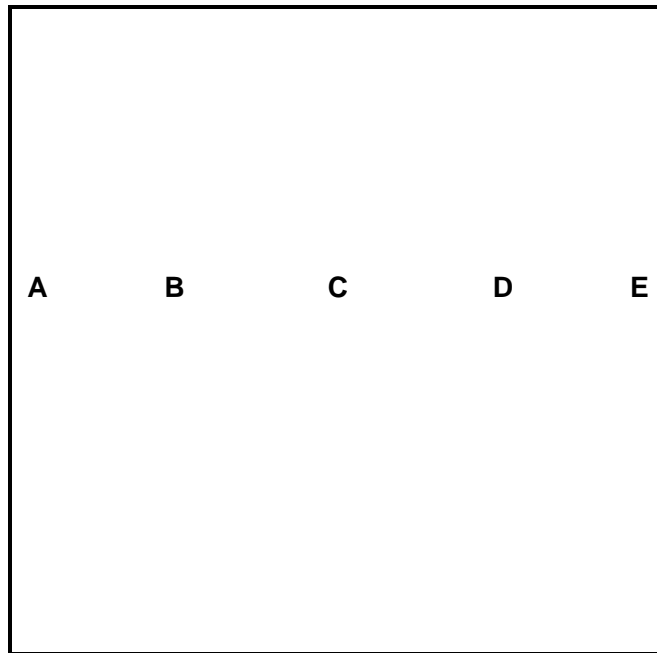
**Mean Temperatures Recorded On The Unexposed Surface
Of The Test Assembly**

Time Mins	Mean Temp Deg. C
0	15
5	15
10	16
15	20
20	27
25	35
30	39
35	41
40	43
45	47
50	52
55	58
60	63
65	66
70	70
75	72
80	75
85	78
90	81
95	83
100	85
105	89
110	99
111	100
115	109
120	130

Pressure Recorded 300 mm Below The Head Of The Test Assembly

Time Mins	Recorded Pressure Pascals
0	0.0
5	17.5
10	15.0
15	16.6
20	16.7
25	14.6
30	15.1
35	15.9
40	14.7
45	15.5
50	15.7
55	15.9
60	15.1
65	14.2
70	14.0
75	14.1
80	12.3
85	13.8
90	13.8
95	15.2
100	14.7
105	14.0
110	14.4
115	13.9
120	14.0

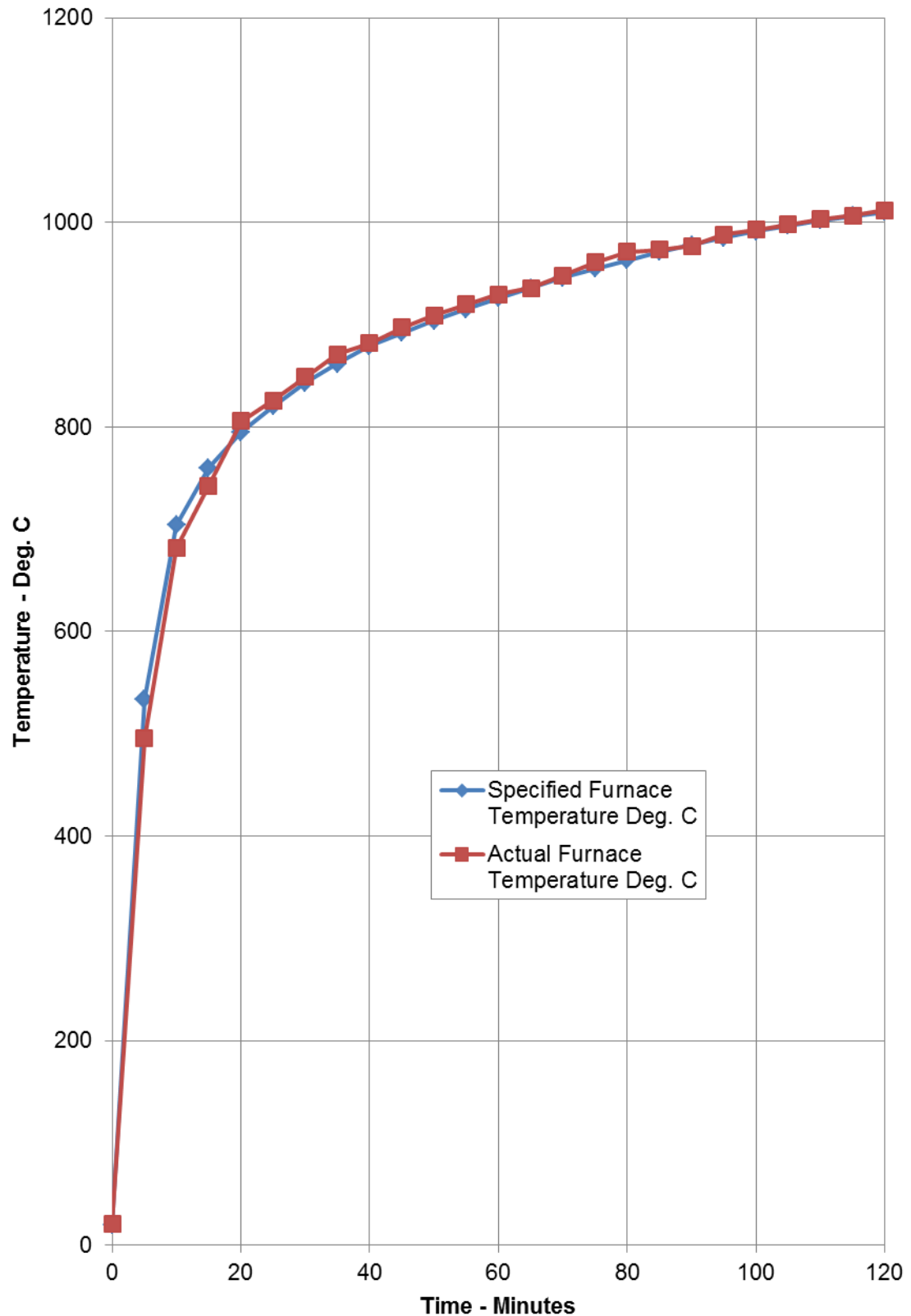
Horizontal Deflections of the Test Assembly During the Test



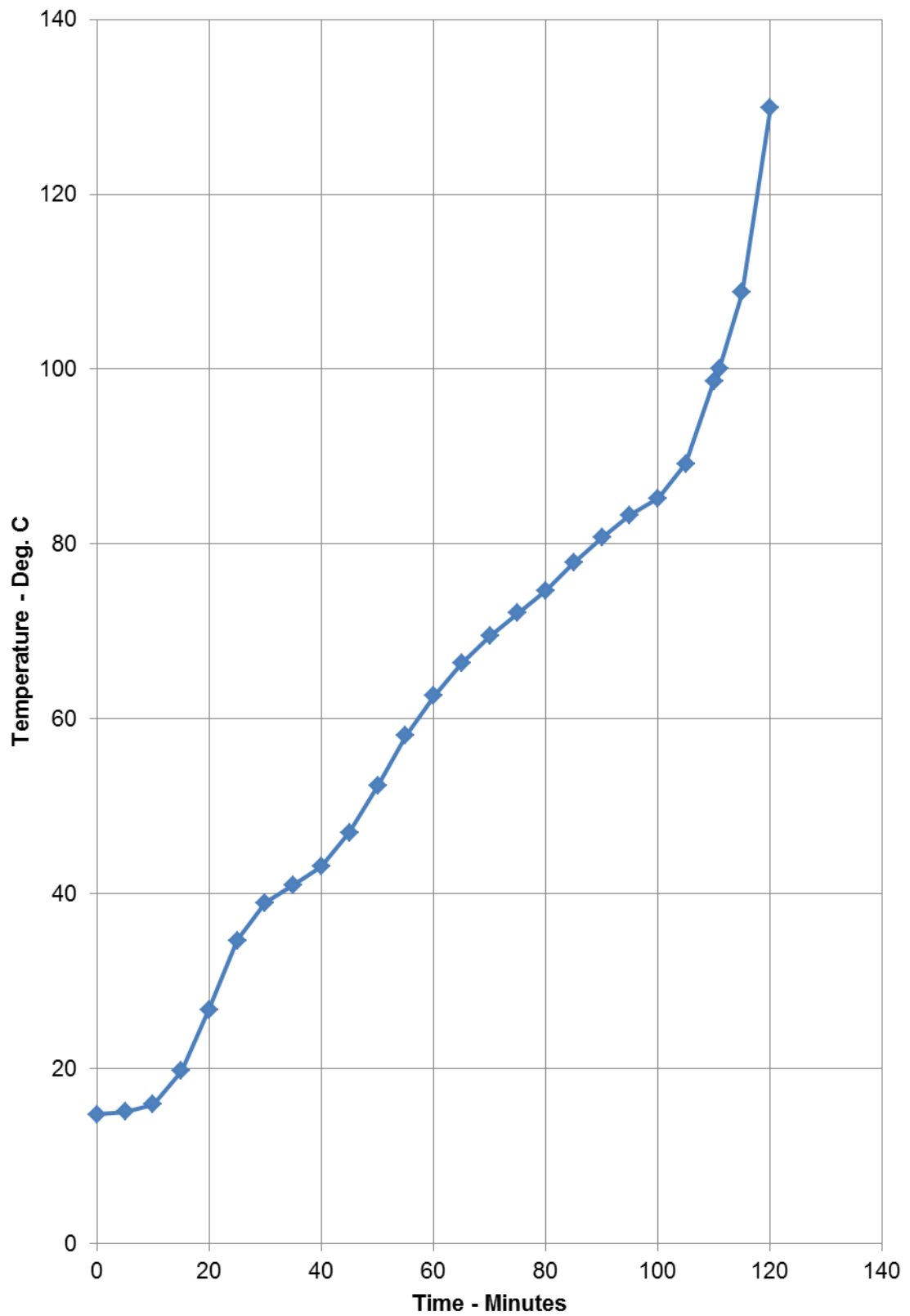
Time Mins	A	B	C	D	E
0	0	0	0	0	0
10	2	6	8	11	6
20	3	3	4	7	2
30	1	15	19	20	5
40	3	26	26	29	2
50	1	30	31	35	4
60	6	32	33	33	2
70	2	45	44	42	3
80	2	57	59	58	5
90	1	66	69	69	6
100	-1	74	70	69	4
110	3	78	87	75	5
120	5	85	82	86	7

Negative values indicate deflection away from the furnace

Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard



Graph Showing Mean Temperature Recorded On The Unexposed Surface Of The Test Assembly



Performance Criteria and Test Results

Passage of flames and hot gases

It is required that the specimen withstands the fire endurance test without passage of flame or gases hot enough to ignite cotton waste. These requirements were satisfied for the test duration of 120 minutes.

Temperature Rise

It is required that the mean temperature rise of the unexposed surface shall not be greater than 139°C and that the maximum temperature rise shall not be greater than 181°C (i.e. 30% greater than the mean temperature rise criteria). These requirements were satisfied for a period of 110 minutes after which time, a temperature rise in excess of 181°C was recorded by Thermocouple Number 4.

Hose Stream

Immediately following the fire test, the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-14, Clause 7.6 for a period of 65 seconds.

During the application of the hose stream, the bottom middle panel detached from the assembly on three sides allowing water to project through to the unexposed surface of the specimen. Therefore the specimen was judged to have failed the requirements of this test.

Ongoing Implications

Limitations

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

Review

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

Conclusions

Evaluation Against Objective

To evaluate the fire resistance performance of a specimen of a non-loadbearing composite panel wall assembly, utilising the heating conditions and performance criteria of ASTM E119-14.

If the performance of the specimen was assessed against the integrity and insulation performance criteria of ASTM E119-14. The results obtained could be expressed as follows:

Test Results:

Passage of flames and hot gases

120 minutes*

Temperature Rise

110 minutes

* The test duration. The test was discontinued after a period of 120 minutes.

Hose Stream

Immediately following the fire test, the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-14, Clause 7.6 for a period of 65 seconds.

During the application of the hose stream, the bottom middle panel detached from the assembly on three sides allowing water to project through to the unexposed surface of the specimen. Therefore the specimen was judged to have failed the requirements of this test.