

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 E119-18

WF Report No:

403240 Issue 3



Prepared for:

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

Date: 24th January 2019



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 E119-18.

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

Summary of the Tested Specimens The test assembly had overall nominal dimensions of 3035 mm high by 3050 mm wide by 104 mm thick. The framing comprised 50 mm by 50 mm by 0.9 mm thick galvanised mild steel channel perimeter framework and 50 mm by 50 mm by 0.9 mm thick galvanised mild steel channel central framework posts friction fixed into the perimeter framework at the head and base.

The stud frame was covered with a cover strip 100mm wide by 9mm thick piece of calcium silicate board. Two layers of 9mm thick calcium silicate board were layered onto both the exposed and unexposed faces. The first layer of board was screw fixed with 32 mm long drywall screws second layer, the second layer was screw fixed with 42mm long drywall screws, at nominally 200 mm centres. The cavity included a layer of nominally 50 mm thick 'Rockwool Fire Barrier' mineral wool insulation having a measured density of 145 kg/m³.

The unexposed surface of the assembly was over clad with 4mm thick Alstrong "Fire rated ACP" panels which were screw fixed through to the framework sections and partition facing boards. Intumescent & Acoustic Silicone Sealant referenced "DOWSIL™ 700 Firestop weather sealant" 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 120 minutes*


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

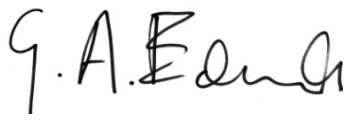
Hose Stream Immediately following the fire test, the exposed face of the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-18, clause 7.6 applied in accordance with practice E2226 for a duration of 150 seconds. The specimen is judged to have passed the requirements of this test.

Date of Test 17th August 2018

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

Report Issued
Date : 24 th January 2019

Issue 2: Page 2 summary text updated to new density 145 kg/m³. Amended by C. Hoyle (20th February 2019)
Issue 3: Page 2 summary text updated with correct test date. Amended by C. Hoyle (10th April 2019)

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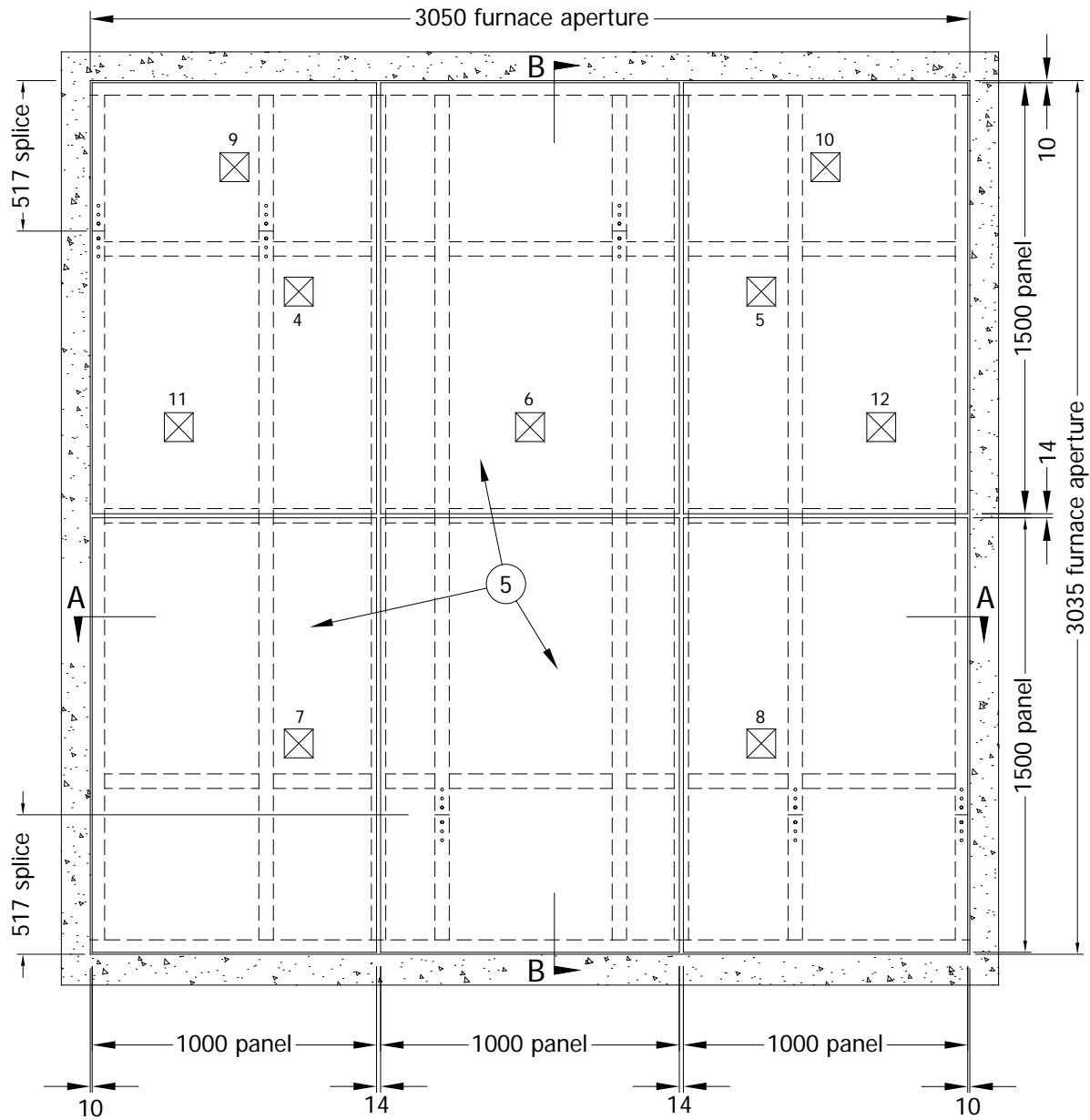
CONTENTS	PAGE NO.
SUMMARY	2
SIGNATORIES.....	3
TEST PROCEDURE	5
TEST SPECIMEN	6
SCHEDULE OF COMPONENTS	13
INSTRUMENTATION.....	15
TEST OBSERVATIONS	16
TEST PHOTOGRAPHS.....	17
TEMPERATURE AND DEFLECTION DATA.....	23
PERFORMANCE CRITERIA AND TEST RESULTS.....	30
ON-GOING IMPLICATIONS.....	30
CONCLUSIONS.....	31

Test Procedure

Introduction	<p>The test was carried out utilising the general principles of ASTM E119-18 '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 E119-18.</p>
Fire Test Study Group/EGOLF	<p>Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.</p>
Instruction to test	<p>The test was conducted on the 17th August 2018 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 specimens 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 Warringtonfire, commencing on the 13th August 2018.</p>
Sampling	<p>Warringtonfire was not involved in any selection or sampling procedures of the tested specimen.</p>
Conditioning	<p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 5 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 19°C to 25.5°C and 50% to 77.5% respectively.</p>

Test Specimen

Figure 1- General elevation of test specimen and unexposed face thermocouples

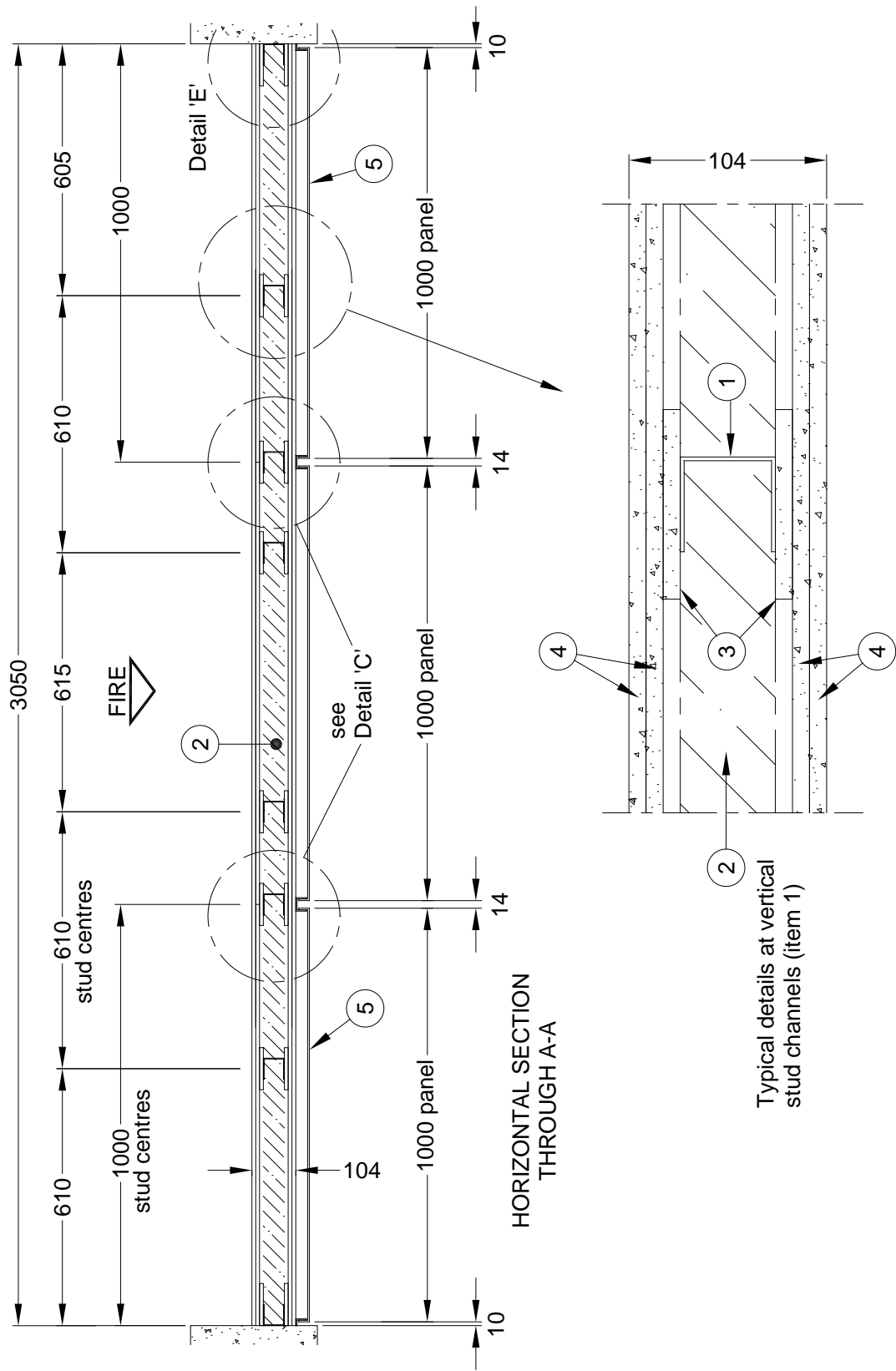


GENERAL ELEVATION OF TEST SPECIMEN
AND THERMOCOUPLE POSITIONS AT UNEXPOSED FACE

☒ Positions of surface mounted thermocouples

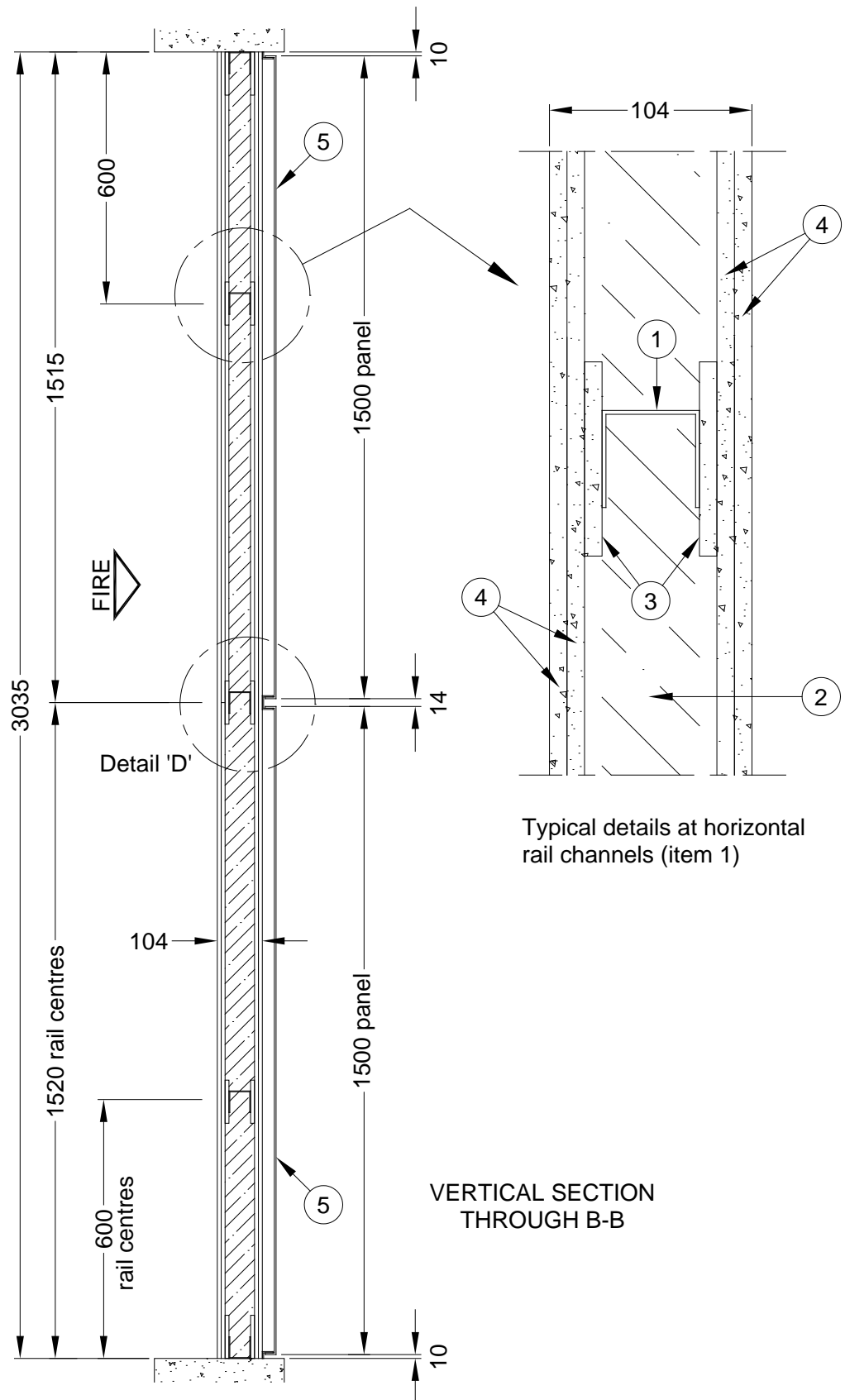
Do not scale. All dimensions are in mm

Figure 2 – Horizontal section through test specimen



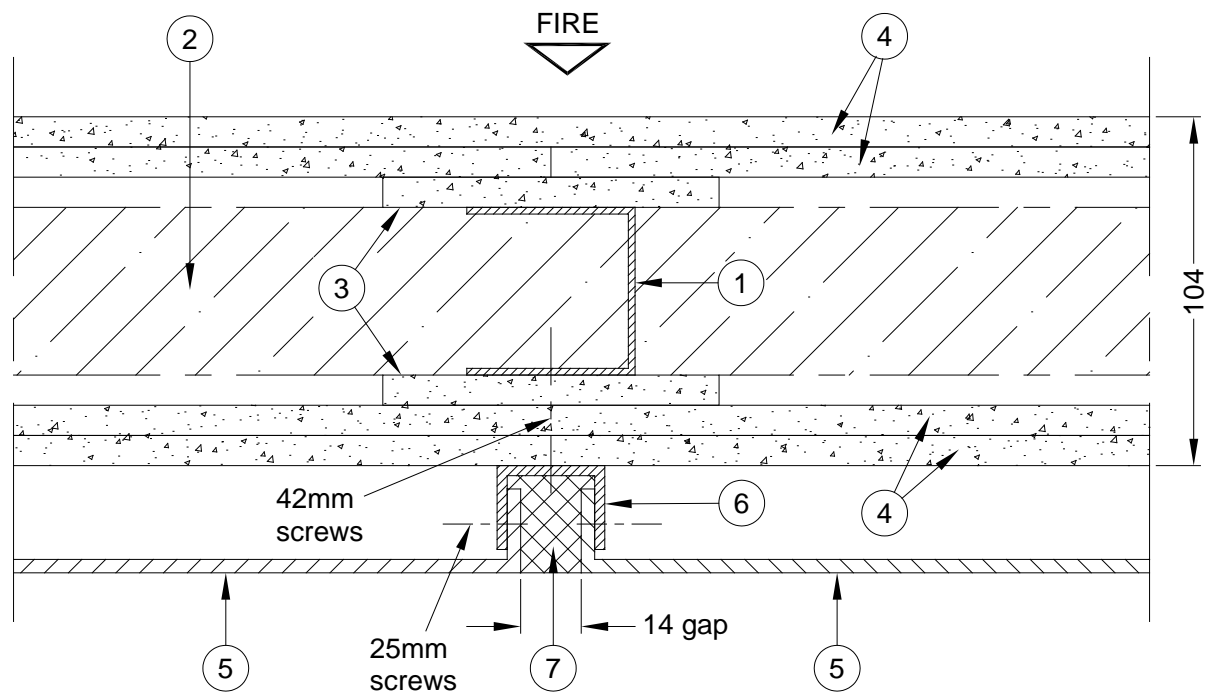
Do not scale. All dimensions are in mm

Figure 3 – Vertical section through test specimen

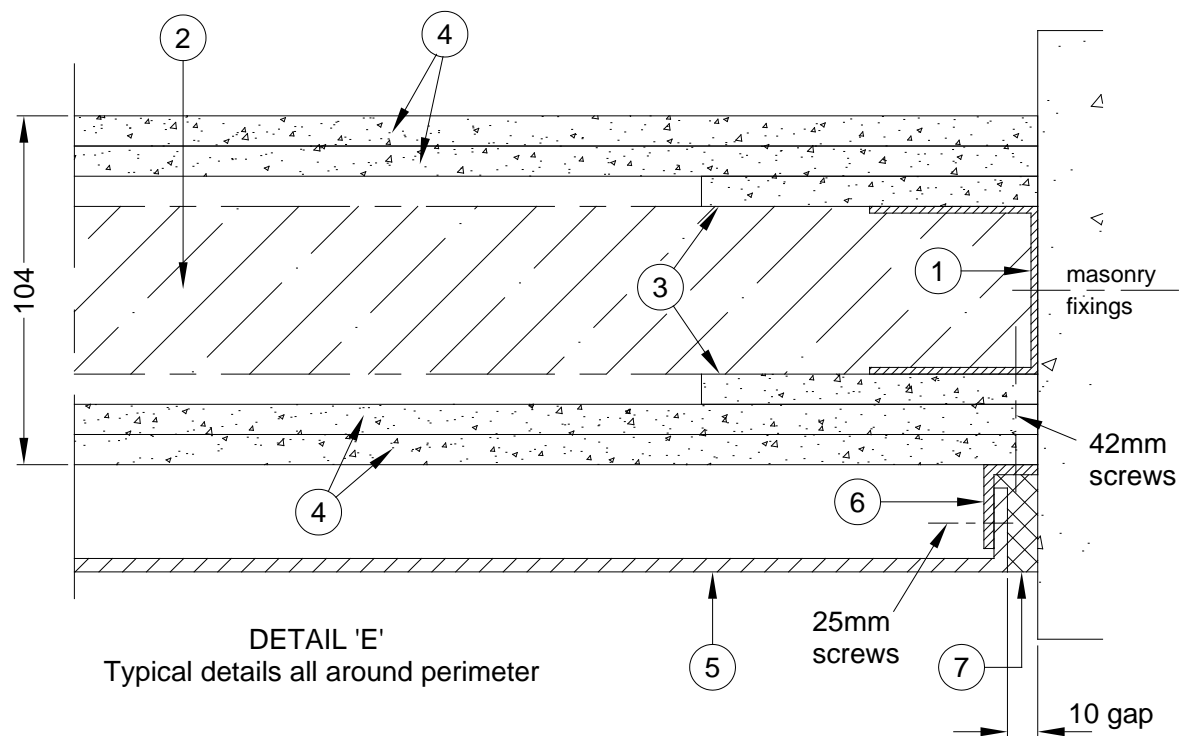


Do not scale. All dimensions are in mm

Figure 4 – Typical details of test specimen



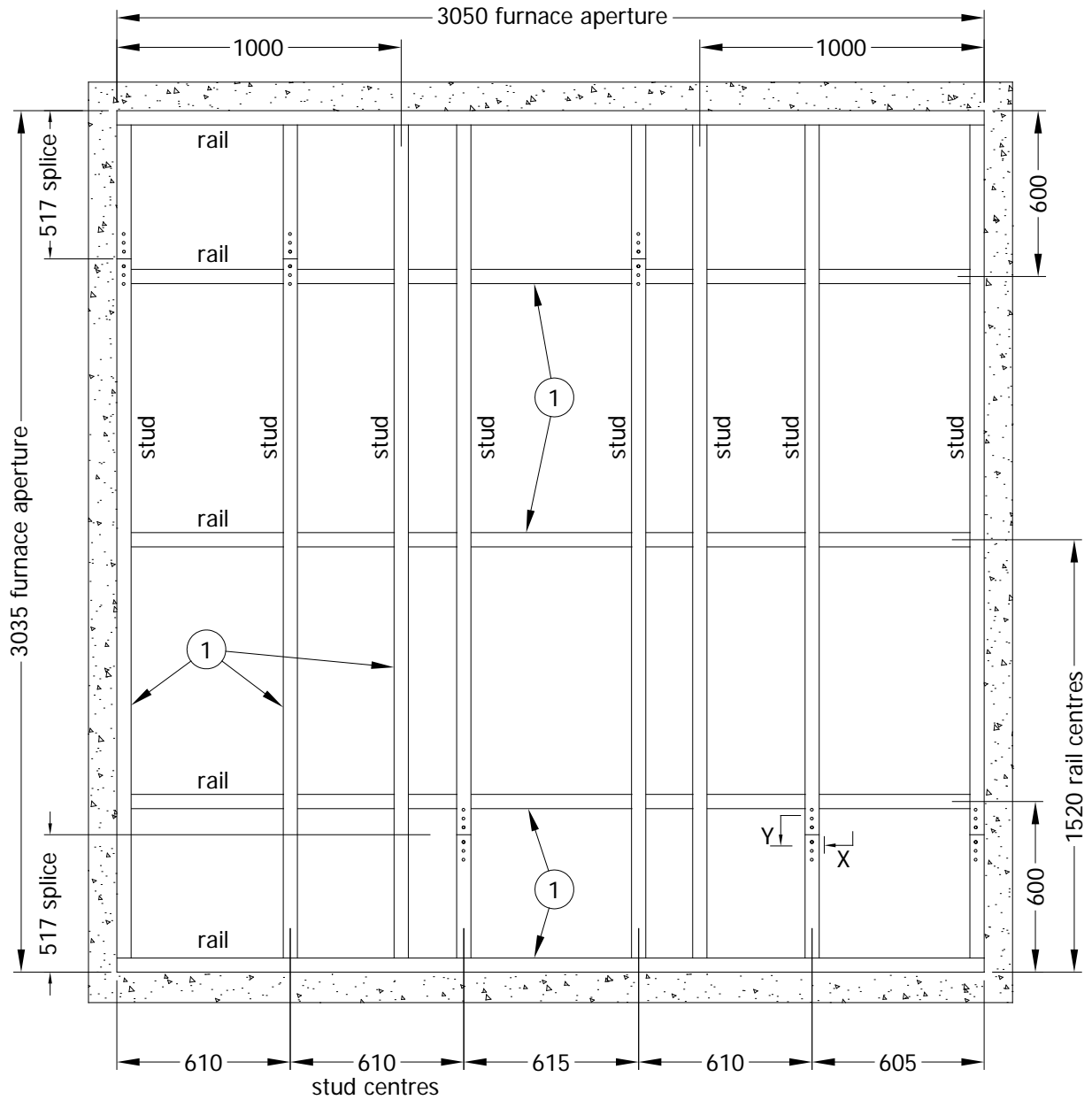
DETAIL 'C' & 'D'
Typical details along gaps
between panels



DETAIL 'E'
Typical details all around perimeter

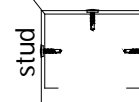
Do not scale. All dimensions are in mm

Figure 5 – General elevation showing internal framework layout

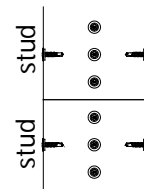


GENERAL ELEVATION OF FRAMEWORK LAYOUT

32x50 'c' section



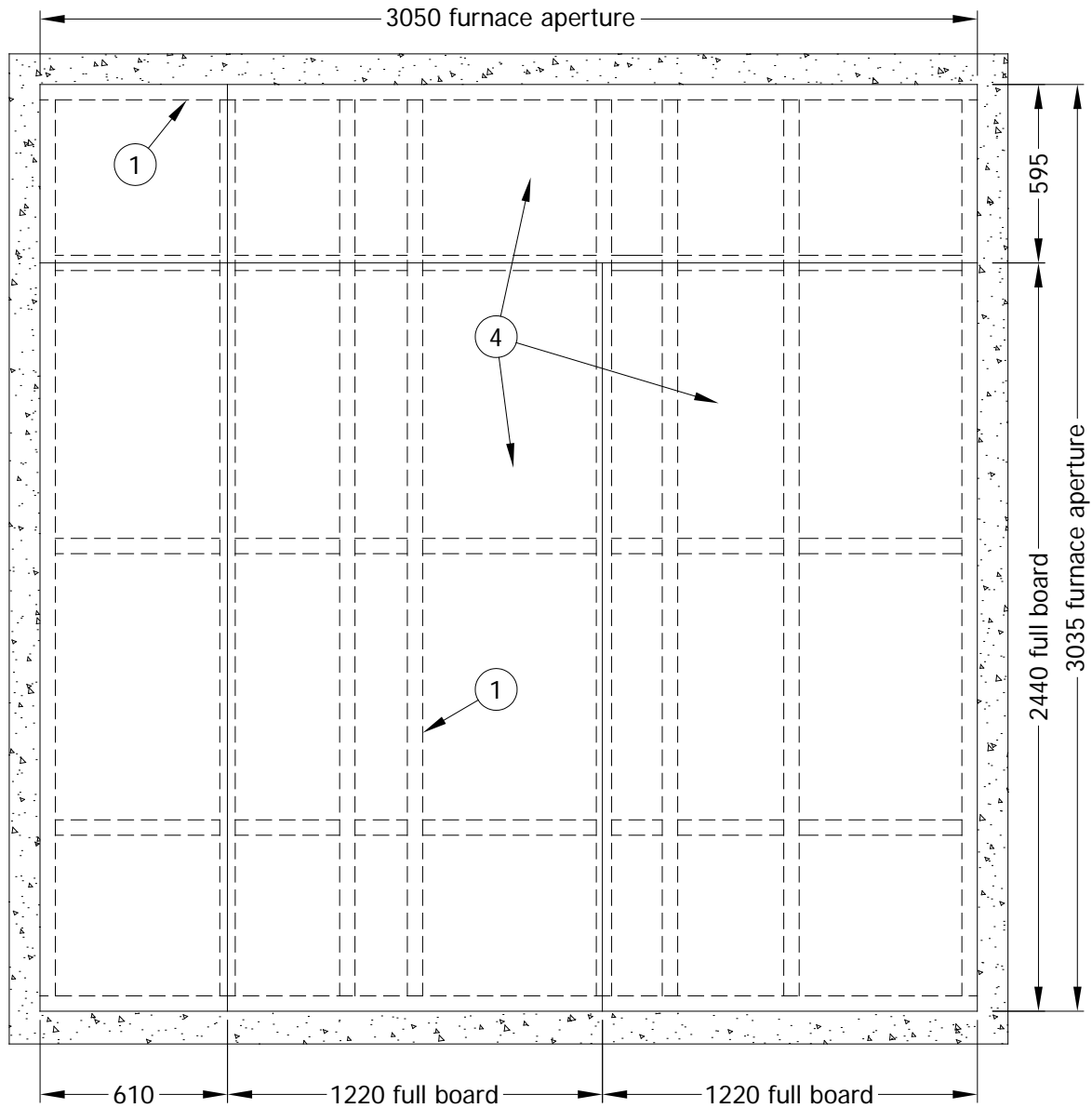
View 'X'
 Typical on all
 splice's



View 'Y'
 Typical on all
 splice's

Do not scale. All dimensions are in mm

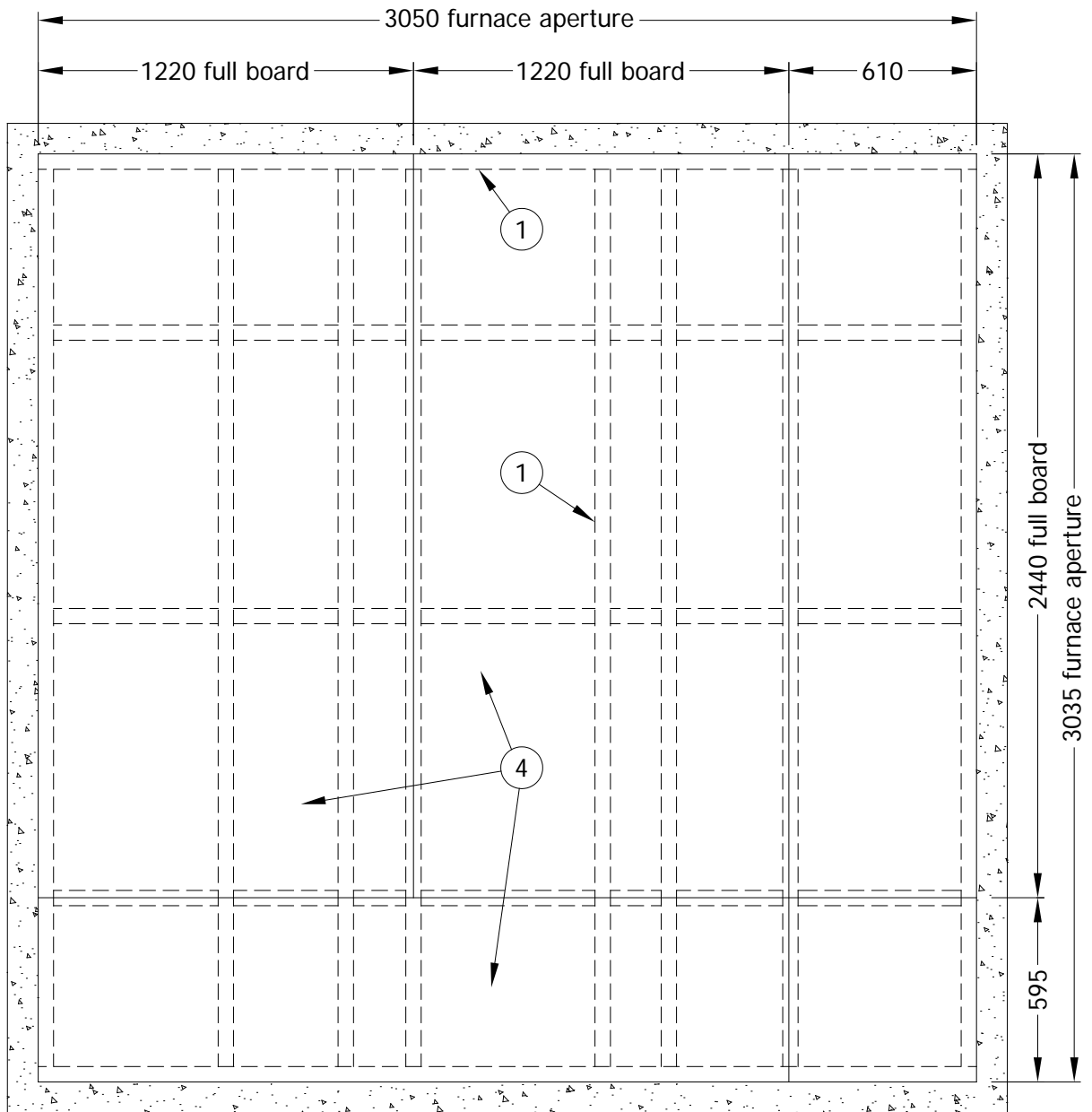
Figure 6 – General elevation of first layer cladding boards



LAYOUT OF FIRST LAYER CLADDING BOARDS AT UNEXPOSED FACE
AS VIEWED FROM UNEXPOSED FACE
(ALSO LAYOUT OF FIRST LAYER BOARDS AT EXPOSED FACE
AS VIEWED FROM EXPOSED FACE)

Do not scale. All dimensions are in mm

Figure 7 – General elevation of second layer cladding boards



LAYOUT OF SECOND LAYER CLADDING BOARDS AT UNEXPOSED FACE
AS VIEWED FROM UNEXPOSED FACE
(ALSO LAYOUT OF SECOND LAYER BOARDS AT EXPOSED FACE
AS VIEWED FROM EXPOSED FACE)

Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 7)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Internal framework	
Material	: Mild steel formed 'C' section studs and rails
Thickness	: 0.9 mm
Section size	: 50 mm x 50 mm
Framework joints	: All framework members fixed together with 13 mm long wafer head self-tapping steel screws.
Fixing method	: All perimeter studs and rails were fixed to the concrete lining of the furnace aperture using masonry anchor bolts.
2. Insulation	
Manufacturer	: Rockwool
Manufacturers product reference	: Roxul Rockwool
Material	: Rock fibre batt with Calcium silicate to both faces of the batt.
Thickness	: Single layer, 50 mm thick batt
Density	: 145 kg/m ³ (stated)
Fixing method	: Friction fit between all the framework members (item 1)
3. Framework protection strip	
Material	: Calcium Silicate board
Thickness	: 9 mm
Overall size	: 100 mm wide
Fixing method	: Screw fixed along both faces of all the framework members using 25 mm long drywall screws at 300 mm centres.
4. Cladding boards	
Material	: Calcium Silicate board
Thickness	: 2 no. layers, each 9 mm thick at both sides of the framework (item 1).
Fixing method	: Drywall screws at 300 mm centres along all of the vertical studs of the framework. 3.5 mm diameter x 32 mm long screws (first layer). 3.5 mm diameter x 42 mm long screws (second layer). All board butt joints were staggered with respect to the boards on the adjacent layer and with respect to the boards on the opposite face.
Finish to board joints	: All second layer board butt joints were finished with Soudal FR sealant, at both faces.
5. Panels	
Material	: Aluminium composite panel
Thickness	: 4 mm
Overall panel size	: 1000 mm wide x 1500 mm high x 25 mm routing edges
Quantity	: 6 no. panels
Fixing method	: Fixed to support brackets (item 6) using 2 no. 25 mm long drywall screws per bracket.

<u>Item</u>	<u>Description</u>
6. Panel support brackets	
Material	: Aluminium channel section
Thickness	: 3 mm
Overall section size	: 32 mm wide x 25 mm deep channel. (The outer perimeter channel brackets adjacent to the furnace aperture were cut in half to form angle brackets approx 17 mm x 25 mm, in order to fit within the aperture). See Figure 4.
Length	: 100 mm
Quantity	: 4 no. brackets along the vertical sides of the panels (item 5) and 3 no. brackets along top and bottom sides of the panels.
Fixing method	: Each bracket fixed through to the internal framework (item 1) using 2 no. 42 mm long drywall screws.
7. Panel sealant	
Manufacturer	: Dow
Reference	: DOWSIL™ 700 Firestop weather sealant
Material	: One component, moisture curing, high movement silicone sealant.
Application method	: Cartridge gunned along full depth of all gaps between the aluminium panels. See Figure 4.

Instrumentation

General	The instrumentation was provided in accordance with the requirements of ASTM E119-18.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of ASTM E119-18, Clause 7.
Thermocouple Allocation	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:
Integrity Criteria (Ignition Test)	Cotton pads were available to evaluate the passage of hot gasses through 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 13 (± 2) Pa at the top of the specimen.

Hose Stream Test

Immediately following the fire test, the exposed face of the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-18 clause 7.6 applied in accordance with practice E2226 for duration of 150 seconds. The specimen is judged to have passed the requirements of this test.

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 19°C at the start of the test with a maximum variation of 3°C during the test.
00	00	The test commences.
12	36	When viewed from the exposed face the screw heads have darkened in colour and the vertical joints have started to darken in colour.
20	36	Steam/smoke release is observed from along the perimeter edge, location mid-height left hand side.
32	00	Steam/smoke release continues in the same location as time 20:36
43	00	When viewed from the exposed face the surface glows orange in colour. No cracks or distortion is observed across the surface of the specimen.
47	00	Slight deflection towards the furnace across mid-height horizontally.
61	00	Specimen is maintaining its fire endurance.
67	00	When viewed from the exposed face a small crack has developed vertically on the far left hand board.
70	00	Specimen continues to bow towards the furnace horizontally at mid-height.
78	30	When viewed from the exposed face no changes are observed.
80	00	Specimen is maintaining its fire endurance.
88	00	When viewed from the exposed face the vertical crack on the far left hand side has widened slightly. No other cracks are observed on the specimen.
100	00	No significant visible change.
103	00	When viewed from the exposed face no significant visible change.
115	00	No significant visible change.
120	00	Test specimen is maintaining its fire endurance. Test discontinued.

Hose Stream Test

Immediately following the fire test, the exposed face of the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-18 clause 7.6 applied in accordance with practice E2226 for a duration of 150 seconds. The specimen is judged to have passed the requirements of this test.

Test Photographs

The exposed face of the specimen prior to testing.



The unexposed face of the specimen prior to testing.



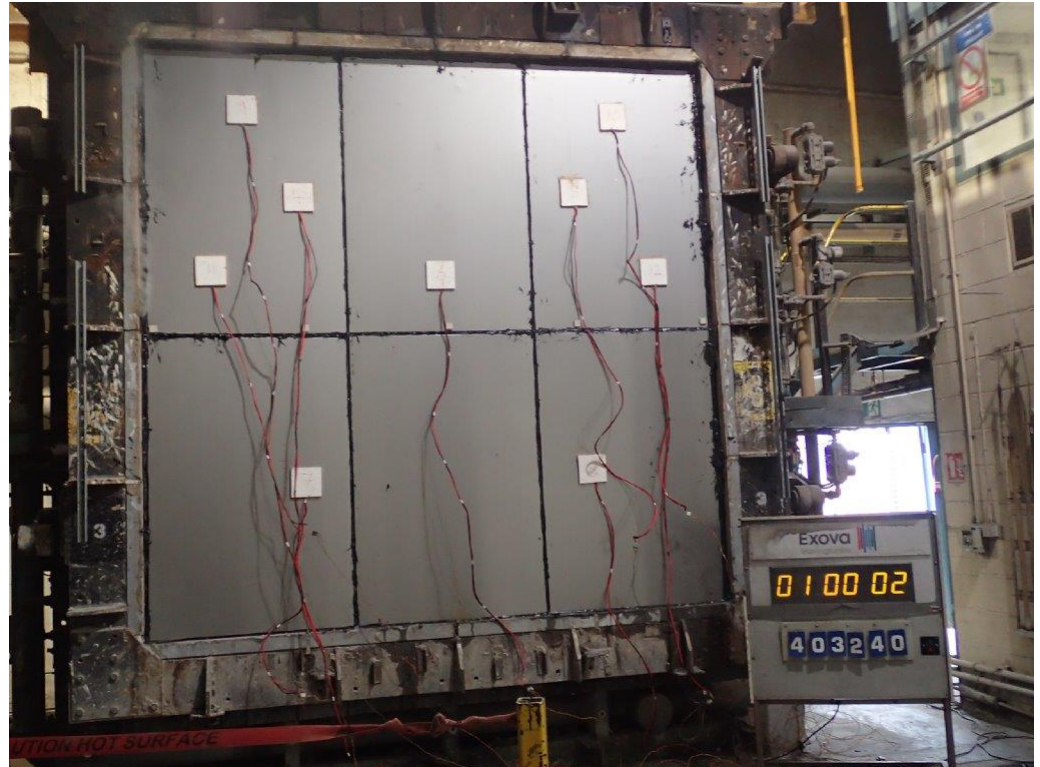
The unexposed face of the specimen after a test duration of 10 minutes.



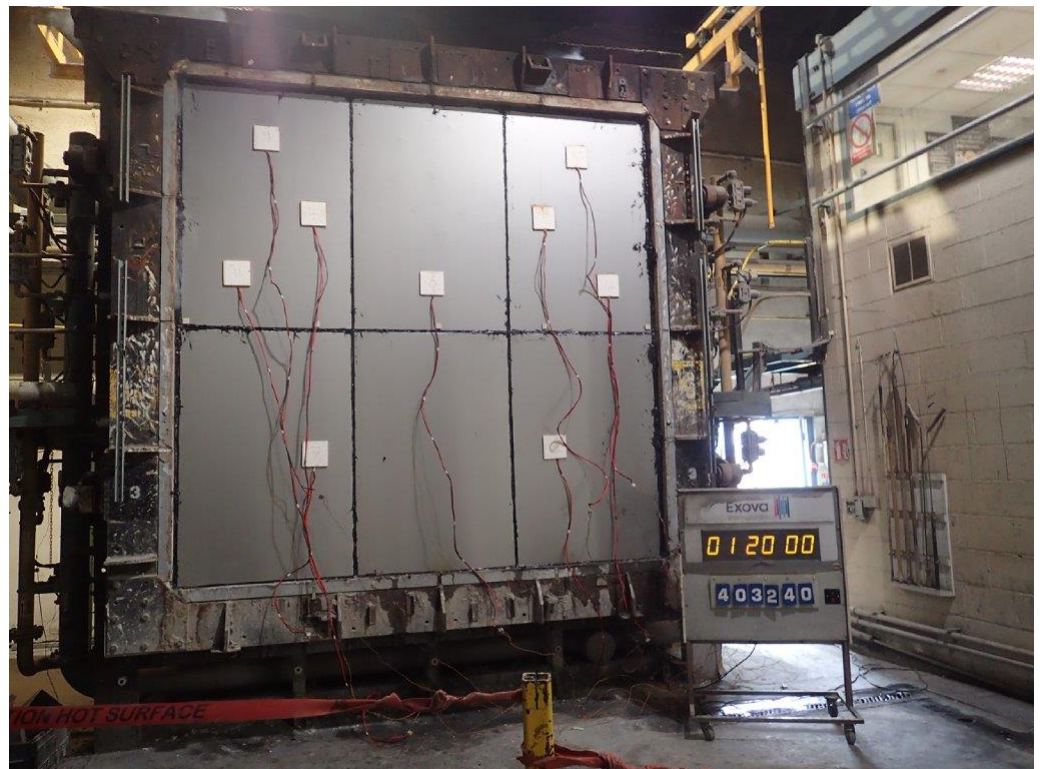
The unexposed face of the specimen after a test duration of 30 minutes.



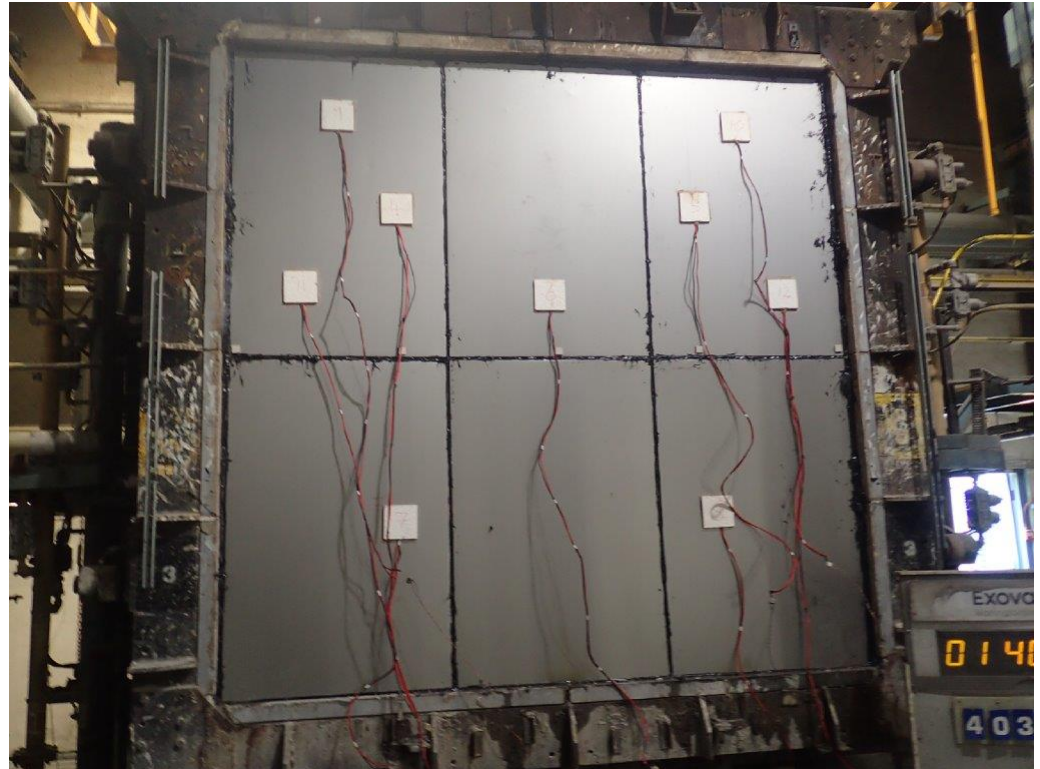
The unexposed face of the specimen after 60 minutes of testing.



The unexposed face of the specimen after 80 minutes of testing.



The unexposed face of the specimen after 100 minutes of testing.



The unexposed face of the specimen after 120 minutes of testing.



The exposed face of the specimen immediately after testing.



The unexposed 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 E119-18

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	25
5	538	534
10	704	700
15	760	766
20	795	804
25	820	825
30	843	844
35	862	865
40	879	882
45	892	890
50	904	907
55	915	916
60	927	929
65	936	940
70	946	951
75	955	955
80	963	965
85	971	975
90	978	979
95	985	987
100	991	995
105	997	1001
110	1002	1003
115	1006	1010
120	1010	1017

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

Time Mins	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	Mean Temp Deg. C
0	18	19	19	19	18	19
5	18	19	19	18	18	18
10	18	19	19	18	18	18
15	20	22	21	18	18	20
20	25	28	25	19	18	23
25	36	38	31	21	22	30
30	50	50	38	29	34	40
35	62	57	43	39	48	50
40	66	61	47	49	56	56
45	65	62	50	54	58	58
50	64	62	53	57	58	59
55	63	61	55	57	57	59
60	63	61	56	57	57	59
65	64	61	57	58	57	59
70	65	62	59	59	58	61
75	66	63	60	60	59	62
80	68	66	62	63	62	64
85	70	68	64	64	64	66
90	72	70	66	66	65	68
95	75	72	68	67	66	70
100	79	75	70	69	68	72
105	81	77	71	72	69	74
110	83	79	72	73	71	76
115	84	81	74	74	71	77
120	85	83	76	75	72	78

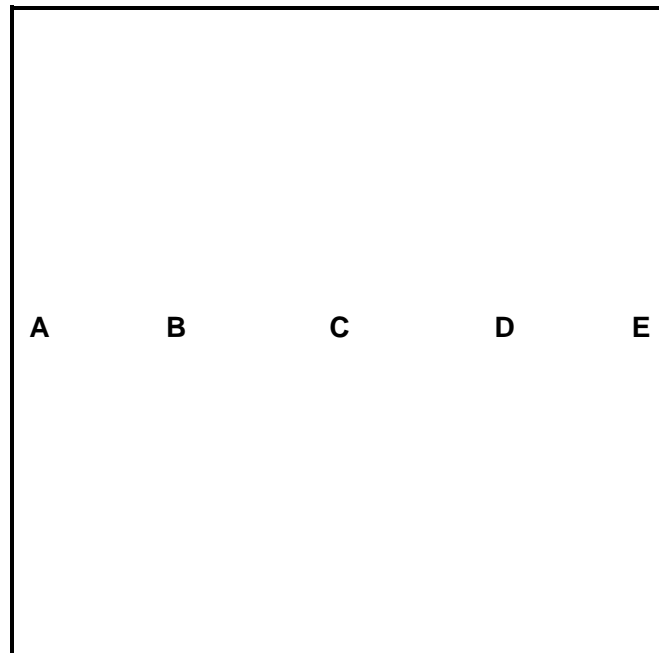
**Individual Temperatures Recorded On The Unexposed Surface
Of The Test Assembly**

Time Mins	T/C Number 9 Deg. C	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C
0	19	19	19	19
5	19	19	19	19
10	19	19	19	19
15	23	22	19	20
20	37	30	22	25
25	74	47	29	33
30	81	60	38	44
35	81	67	46	53
40	80	67	52	58
45	79	67	56	60
50	77	66	57	60
55	75	65	57	60
60	74	65	57	60
65	74	65	58	60
70	74	66	59	61
75	77	67	60	61
80	81	69	61	63
85	83	71	63	65
90	84	73	65	67
95	85	75	67	69
100	86	77	69	71
105	86	79	70	73
110	86	80	72	75
115	86	81	73	76
120	86	82	74	78

Pressure Recorded 300 mm Below The Head Of The Test Assembly

Time Mins	Recorded Pressure Pascals
0	0.0
5	9.6
10	10.3
15	10.3
20	8.8
25	12.2
30	9.0
35	11.2
40	12.4
45	10.6
50	11.0
55	9.2
60	10.8
65	11.3
70	11.9
75	10.9
80	9.8
85	11.5
90	10.7
95	9.5
100	10.7
105	9.3
110	9.9
115	10.3
120	10.9

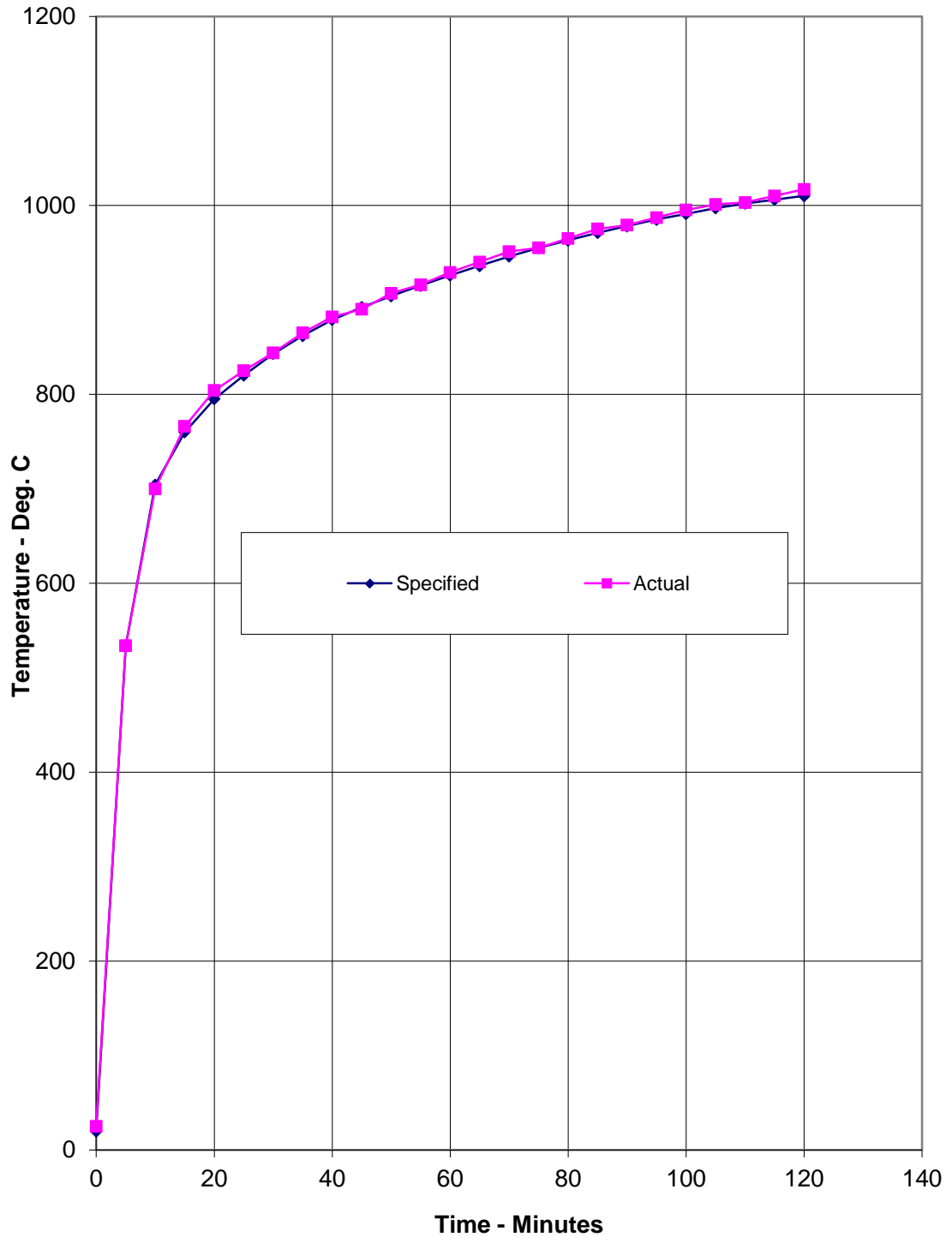
Recorded Deflection Of The Specimen During The Test



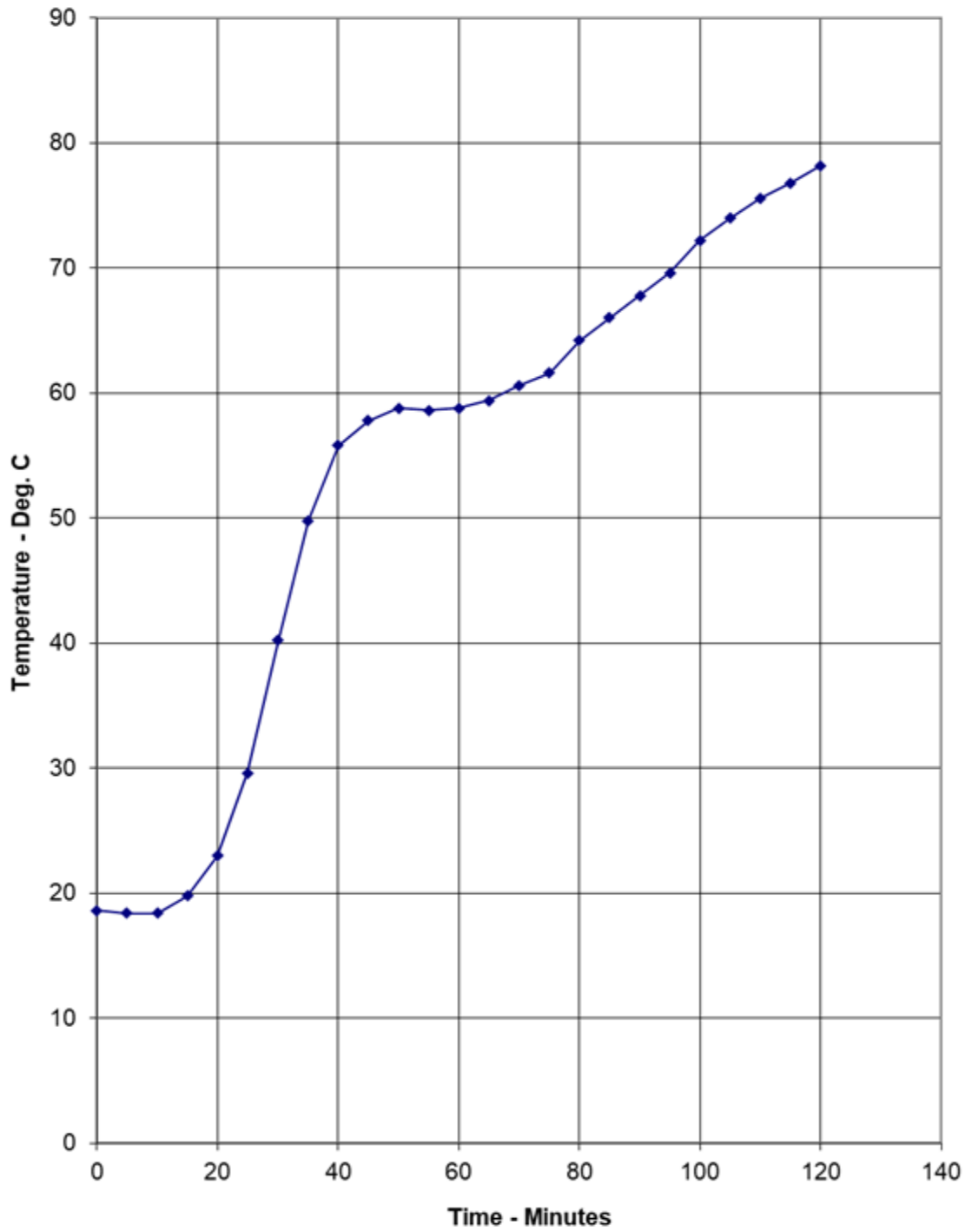
Time Mins	A	B	C	D	E
0	0	0	0	0	0
10	2	4	4	5	-1
20	2	6	5	7	3
30	0	6	11	9	-2
40	-5	17	21	17	-2
50	-2	25	35	27	3
60	2	34	42	31	-4
70	-1	34	43	31	1
80	-2	33	43	32	1
90	-2	42	42	32	3
100	-2	34	43	31	3
110	-4	33	42	29	3
120	-6	33	40	29	-2

Positive values indicate movement towards the furnace chamber

Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard E119-18



**Graph Showing Mean Temperatures
Recorded On The Unexposed Surface Of The Specimen**



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 120 minutes.

Hose Stream

Immediately following the fire test, the exposed face of the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-18 clause 7.6 applied in accordance with practice E2226 for a duration of 150 seconds.

The specimen is judged to have passed the requirements of this test.

On-going 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 E119-18.

If the performance of the specimen was assessed against the integrity and insulation performance criteria of ASTM E119-18. The results obtained could be expressed as follows:

Test Results:

Passage of flames and hot gases

120 minutes*

Temperature Rise

120 minutes*

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

Hose Stream

Immediately following the fire test, the exposed face of the specimen was subjected to a hose stream test conducted in accordance with the principles given in E119-18 clause 7.6 applied in accordance with practice E2226 for a duration of 150 seconds.

The specimen is judged to have passed the requirements of this test.
