TEST REPORT NUMBER CFR1907151

CAMBRIDGE FIRERESEARCH

FIRE RESISTANCE TEST
IN ACCORDANCE WITH BS 476: Part 22: 1987

Sponsor:	Hadley Group
Address:	Downing Street Smethwick West Midlands B66 2PA
Date of test:	15th July 2019

Results:

Test duration:	132 minutes
Integrity:	132 minutes
Insulation:	132 minutes

Summary of test specimen:

A steel double stud plasterboard partition with deflection head detail comprising HRP 5426 52mm deep head tracks, HRP 5305 52mm sole tracks and braced HRP 5297 50mm vertical studs at 600 mm centres. Clad with a double layer of 15mm British Gypsum Duraline board to both sides with steel strap at outer horizontal joints, 50mm mineral wool insulation, joints taped and skimmed with a gypsum based jointing compound.

Overall nominal size:
3000 high x 2975 wide x 207 thick overall.

This test report is only valid when presented in full.

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1 PREPARATION FOR TESTING

1.1 Specimen conditioning

The specimen was received by Cambridge Fire Research on 10/07/2019. The specimen was on site for a total period of 5 days and during this time the temperature and relative humidity were measured and recorded within the range of 18 to 29 ºC and 44 to 64% respectively.

1.2 Supporting construction

No supporting construction was required as the specimen was installed directly into the restraint frame, as described in Section 1.5.

1.3 Specimen construction

The specimen was constructed at Cambridge Fire Research from its component parts by Cambridge Fire Research, following the instructions of the sponsor.

1.4 Specimen verification

Cambridge Fire Research carried out a detailed survey of the specimen to verify the information provided by the sponsor. This included verifying the weight, densities, materials and dimensions of construction components wherever possible.

Details and drawings of the construction are shown in Appendix 1.

Photographs of details of the construction taken before the test are shown in Appendix 2.

1.5 Specimen installation and restraint

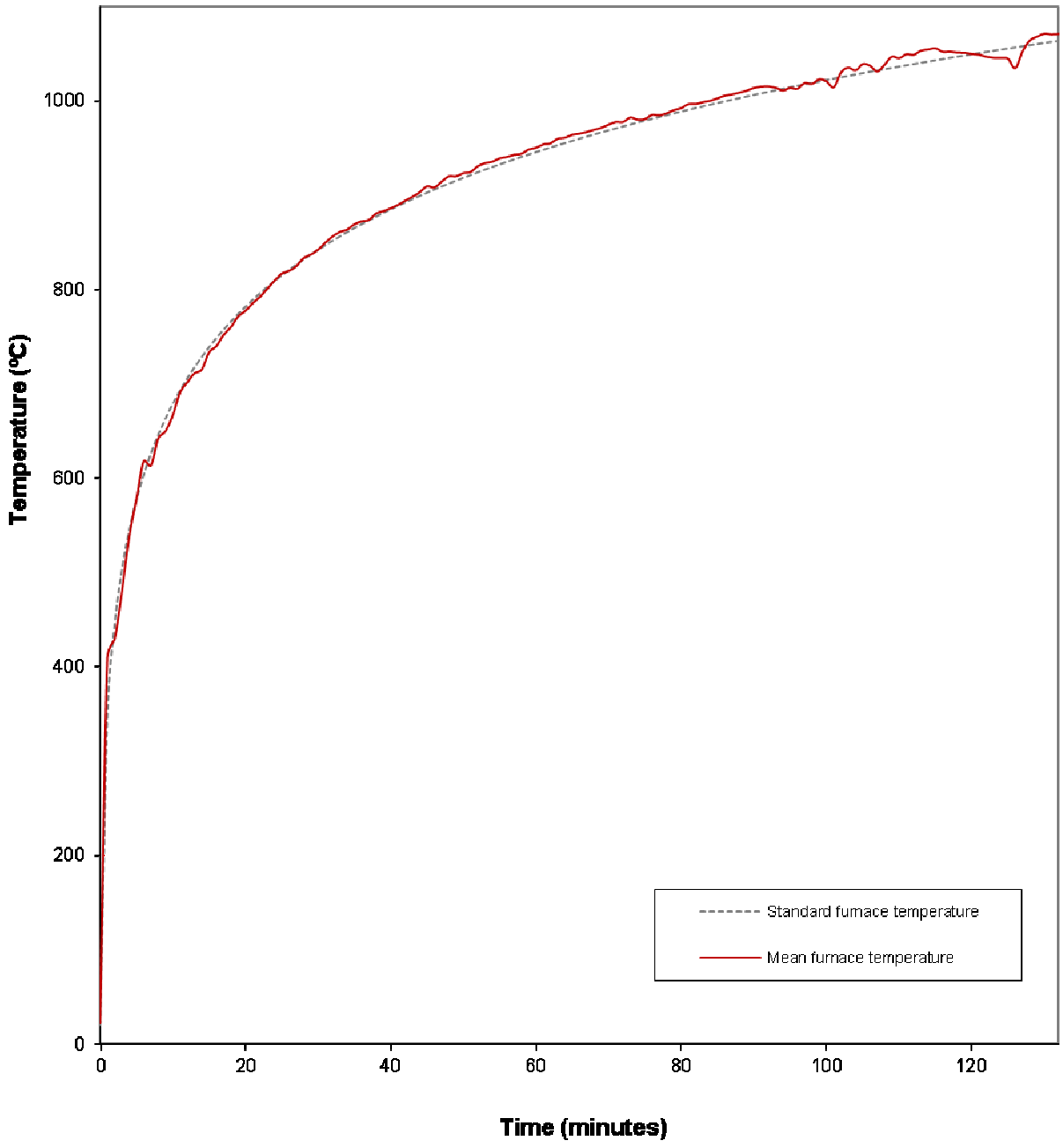
The specimen was installed into the restraint frame by Cambridge Fire Research.

The specimen was affixed such that three edges were installed as in practice and the right hand vertical edge had freedom of movement.

2 TEST CONDITIONS, INSTRUMENTATION AND MEASURING

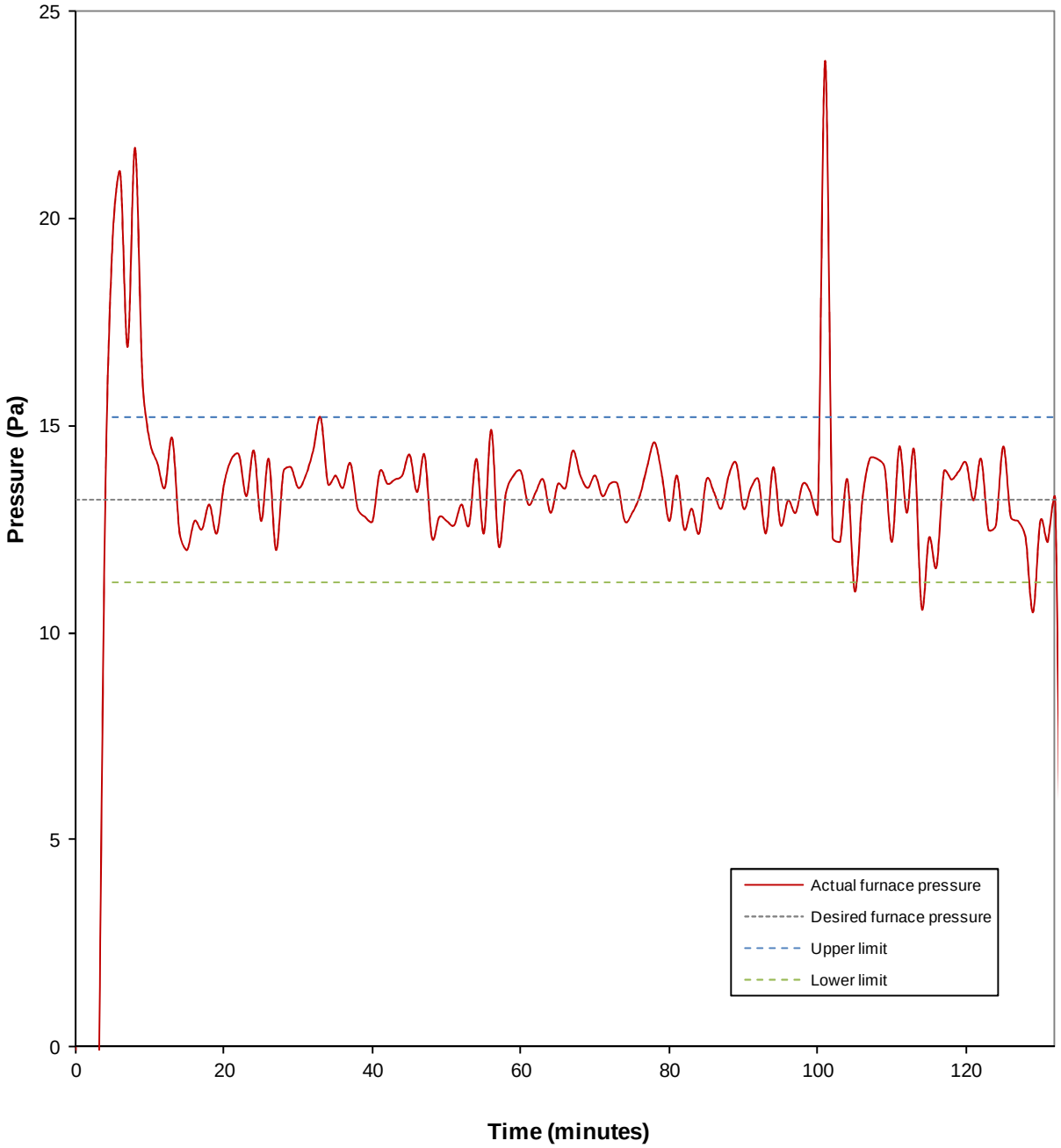
2.1 Furnace temperature

Furnace temperature was controlled so as to follow the standard temperature/time curve defined in the test standard and within the tolerances permitted. The furnace mean temperature was calculated from the output recorded using nine furnace thermocouples of the design specified in the test standard. The following graph shows the standard and mean furnace temperature/time data.



2.2 Furnace pressure

Furnace pressure was maintained for the duration of the test at a nominal + 13.2 Pa measured at the pressure sensing head. When a linear pressure gradient of 8.5 Pa/m is applied this equates to + 20 Pa at the top of the specimen and + 0 Pa at 1.0 m above the notional floor level. The furnace pressure was controlled within the tolerances permitted in the test standard, except for 9 instantaneous occasions which were regarded as transient events. The following graph shows the actual and desired furnace pressure/time data.



2.3 Ambient temperature

Ambient temperature at the start of the test was 20°C.
Ambient temperature ranged between 20°C and 21°C during the test.

2.4 Unexposed face specimen thermocouples

Surface temperature measuring thermocouples of the design specified in the test standard were affixed to the unexposed face of the specimen to monitor the temperature rise as follows:

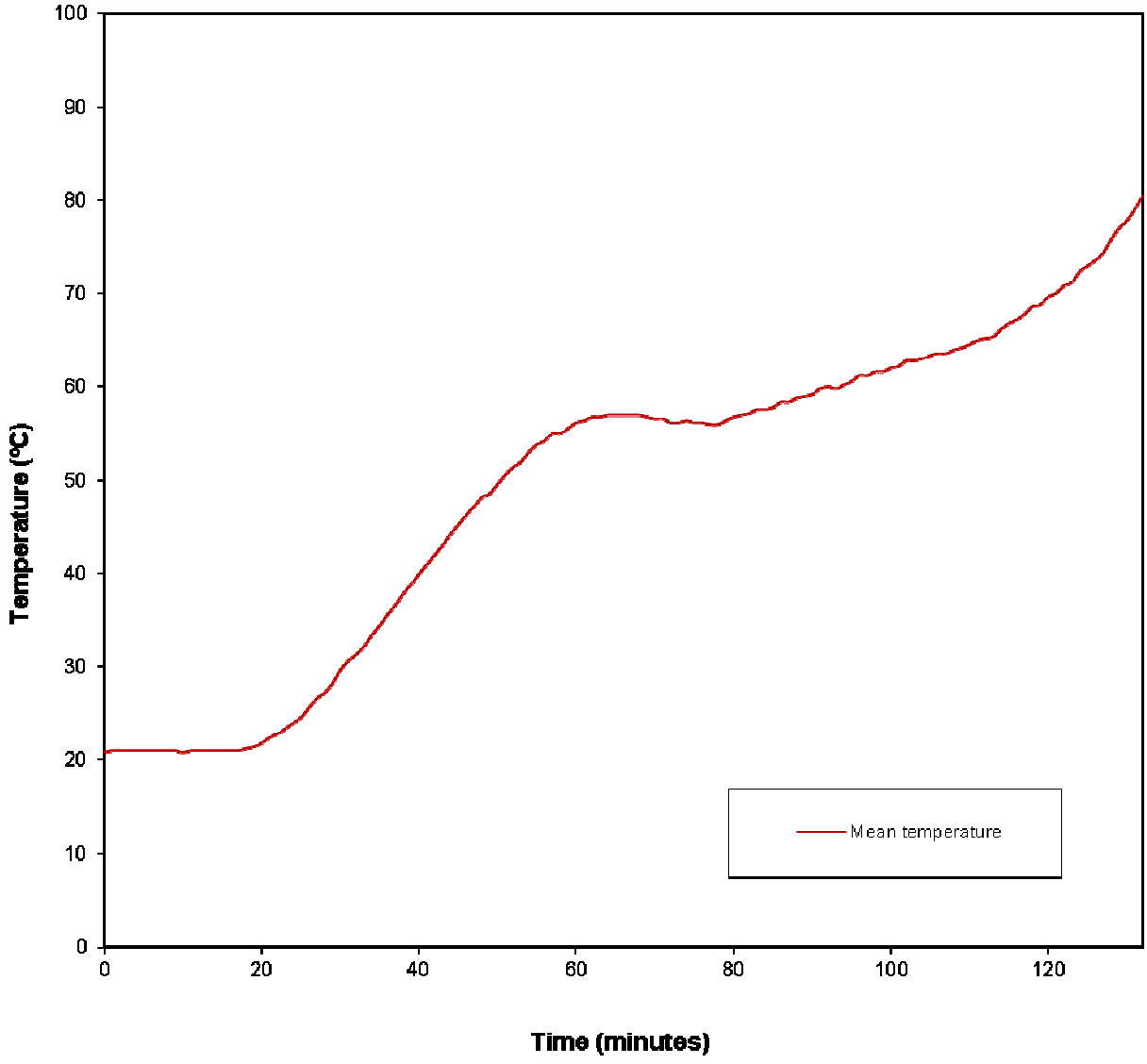
Wall	Channels 16 to 20	(mean & maximum)
	Channels 21 to 27	(maximum only)

The positions of these thermocouples are shown in Appendix 3.

A roving thermocouple was available for measurement of any specific hotspots. Any instances of the use of the roving thermocouple are noted in the observations in Section 3.

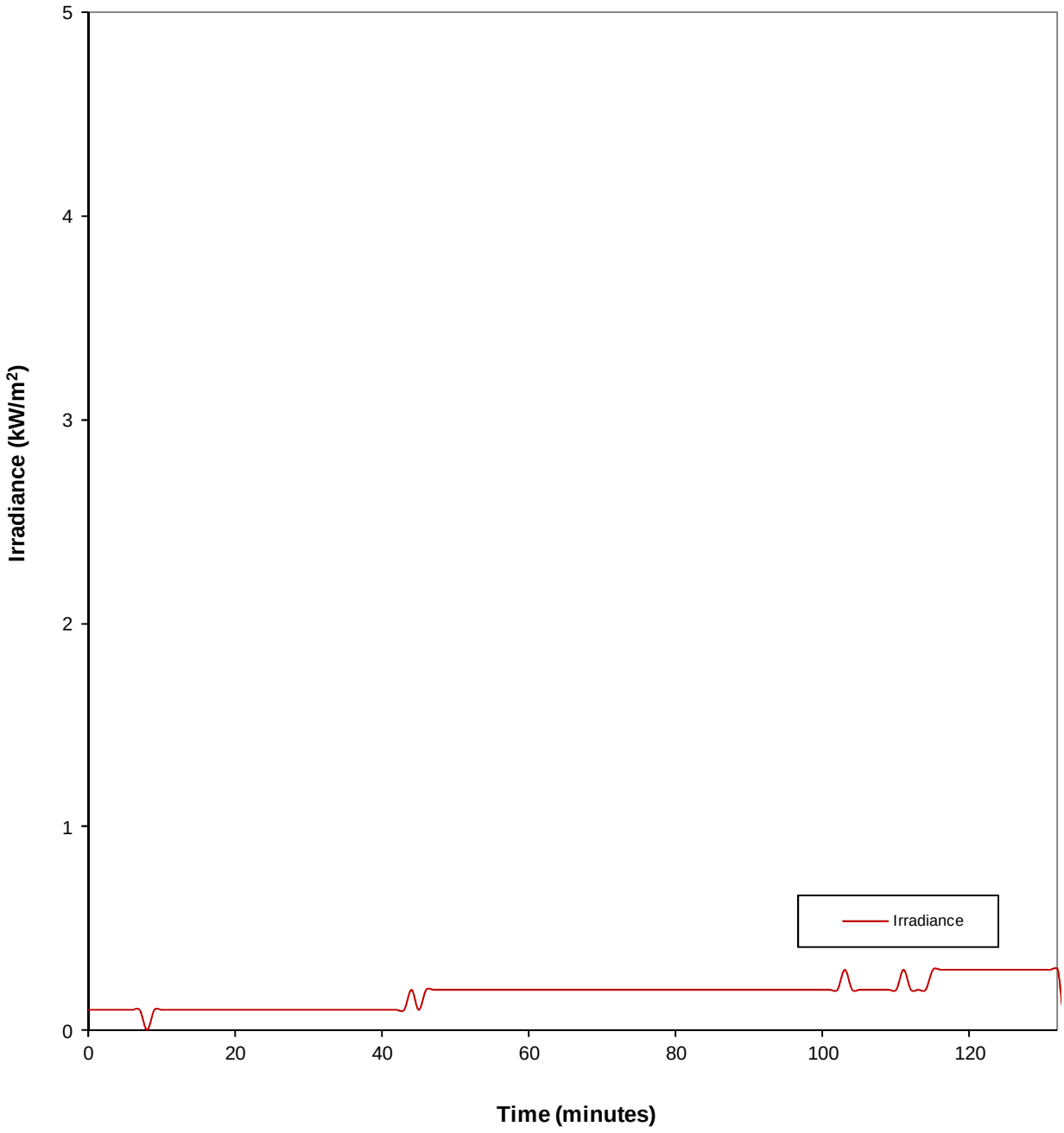
The recorded data of all individual thermocouples is shown in the tables in Appendix 4.

The following time/temperature graph shows the mean partition temperature.



2.5 Irradiance

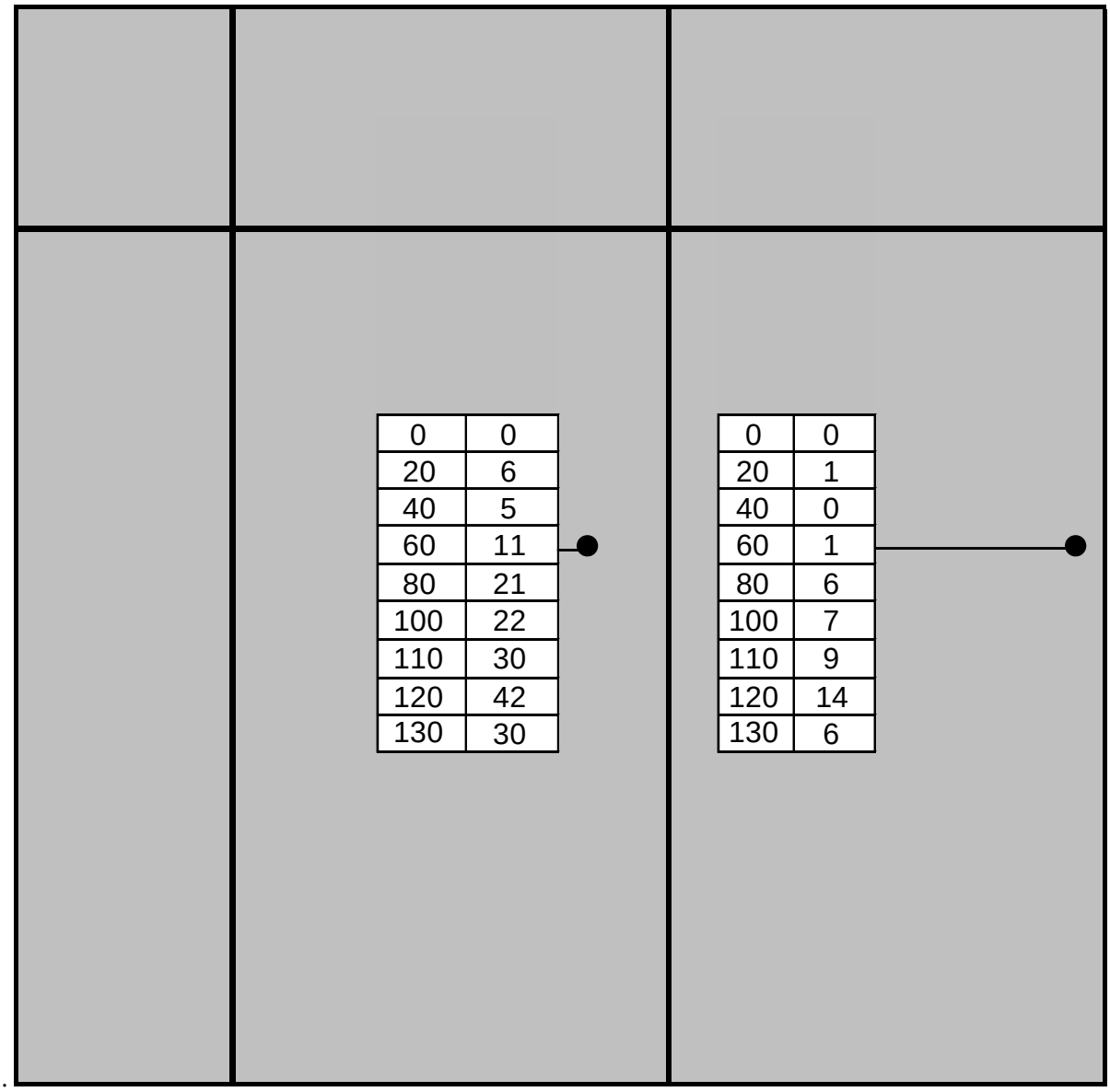
Irradiance from the unexposed face was monitored during the test. A 180° field of view water cooled heat flux meter was positioned with its target 1m from and parallel to the unexposed face of the specimen and at its geometric centre. The following graph shows the recorded radiation/time data.



It should be noted that the recorded value of radiation drops when the field of view is physically interrupted during the measurement of deflection.

2.6 Deflection

A taut stainless steel wire was anchored horizontally at mid-height across the unexposed face of the specimen such that any deflection experienced by the test construction could be measured. The following figure shows the position with the elapsed time (minutes) in the left hand column and the recorded deflection (mm) in the right hand column. Positive values indicate deflection towards the heating conditions of the test**.**



3 TEST OBSERVATIONS

Test photographs are shown in Appendix 2.

(E = Exposed face: U = Unexposed face)		
Time	Face	Observation
(min:sec)		
00:00		Start of the test.
26:00	E	Plaster skim detached.
30:30	E	Vertical joint of centre and fixed edge exposed boards open nominally 8mm. Vertical joint of centre and free edge exposed boards open nominally 5mm.
69:30	E	Medium smoke/steam issues at top of upper free edge board.
92:45	E	Exposed lower free edge board cracks horizontally.
102:40	E	Nominally 50% outer layer centre board missing.
106:40	E	Nominally 50% outer layer free edge board missing.
108:00	U	Medium smoke/steam issues across the head.
110:00	E	Nominally 80% outer layer free edge board missing. Cracks visible in inner layer boards.
119:30	E	Fixed edge outer layer boards missing.
121:45	U	Gaps opening between plasterboards and steel angle.
123:30	U	Medium smoke/steam issues at top edge of upper fixed edge board to restraint frame.
128:30	E	Inner layer centre board missing.
130:00	E	Nominally 20% inner layer fixed edge board missing.
131:00	U	Medium smoke/steam issues at edge of lower fixed edge board to restraint frame at mid height.
132:40	U	The test is terminated.

4 LIMITATIONS

1. This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested. The test results relate only to the specimens tested. Appendix A of BS476: Part 22: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the results to specimens of different dimensions, orientation or incorporating different components should be the subject of a design appraisal or further testing.

2. 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.

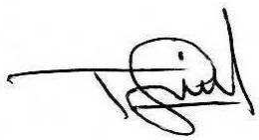
3. The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

4. The specimen was asymmetrical and was tested with the frame and panels oriented as described. The test results may not be appropriate to situations where the heating conditions are from the other side.

5. The results apply to the specimen(s) as received from the sponsor.

6. Cambridge Fire Research is not responsible for the content of this report where information has been identified (using **) as supplied by the sponsor.

Report prepared by:



T Smith
Technical Officer

Report checked by:

E Southern
Deputy Head of Testing

Report issued: **23rd August 2019**

APPENDIX 1 SPECIMEN CONSTRUCTION

The item numbers listed in Appendix 1 Table 1 and shown in the figures in Appendix 1 refer to the components of the specimen construction. Any photo numbers refer to those in Appendix 2.

Please note that unless otherwise indicated the following applies:

a) All dimensions and materials of construction were verified by the laboratory.
b) Figures are not to scale.
c) All dimensions are given in mm.

Appendix 1 Table 1

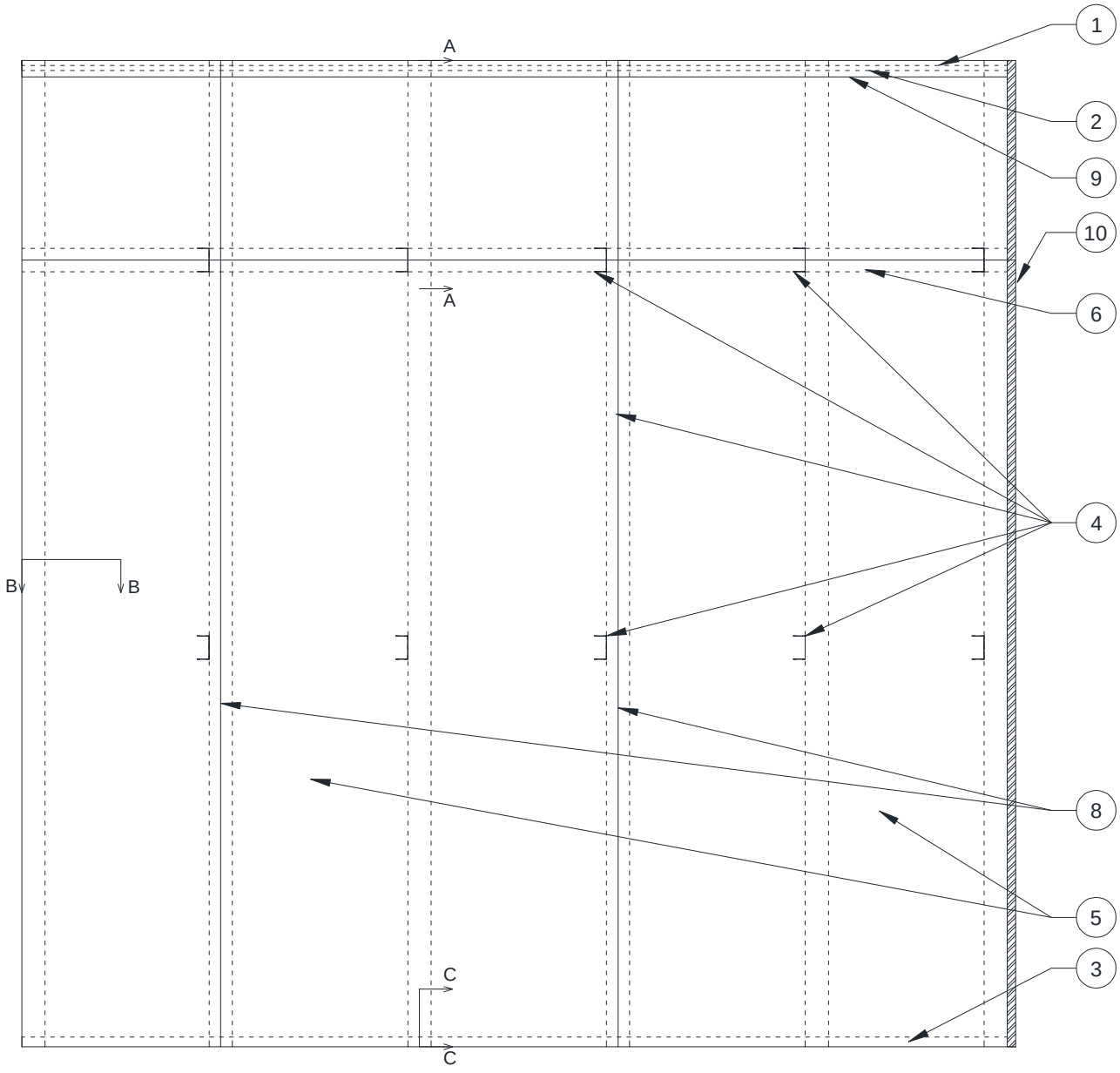
Item	Component	Information
1	**Deflection head boards** Manufacturer: Reference: Description: Overall size (h x d x w):	 British Gypsum. Gyproc Duraline board. A double layer of 15mm thick Gyproc Duraline board was affixed to the top faces of the head tracks using Everbuild Tecnic adhesive and Ø3.5 x 42 long steel screws at 600 * centres . 30 x 147 x 2975
2	**Head Track** Supplier: Reference: Description: Track size (l x d x h x t):	 Hadley Group. HRP 5426 52mm deep track. Two galvanised steel tracks set 43 apart were positioned on the soffit of the restraint frame, affixed through the deflection head boards with Ø5 x 65 long steel screws at 600 * centres. 2975 x 52 x 50 x 0.5
3	**Sole Track** Supplier: Reference: Description: Track size (l x d x h x t):	 Hadley Group. HRP 5305 52mm track. Two galvanised steel tracks set 43 apart were positioned on the floor of the restraint frame, affixed with Ø3.5 x 42 long steel screws at 600 * centres. 2975 x 52 x 26 x 0.5
4	**Vertical studs** Manufacturer: Reference: Description: Overall size (h x d x w x t):	 Hadley Group. HRP 5297 50mm stud. The galvanised steel studs were positioned within the head and sole tracks at 600 centres. The studs at the left hand side were affixed with Ø3.5 x 42 long steel screws at 600 * centres. The studs were cut 20mm short to allow for thermal expansion. Bracing 120mm sections of stud were affixed between the vertical studs at 1205* and 2265* vertical centres affixed using Ø3.5 x 13 wafer head screws. 2950 x 50 x 34 x 0.5

Item	Component	Information
5	**Plasterboard**	
	Manufacturer:	British Gypsum.
	Reference:	Gyproc Duraline board.
	Description:	A double layer of 15mm thick tapered edge Gyproc Duraline board was affixed to both faces of the stud and track assembly. The vertical joints were staggered between the layers as shown in Appendix 1 Figures 1 to 5 along with the horizontal joints.
	Weight (kg):	40 (per 2400 x 1200 board)**
	Fixings:	Inner Layer: Ø3.5 x 25 long steel countersunk drywall screws set at 300 centres. Outer Layer: Ø3.5 x 38 long steel countersunk drywall screws set at 300 centres.
	Overall size (h x w):	2975 x 2975
6	**Fixing Strap**	
	Manufacturer:	Hadley Group.
	Reference:	HRP 5179 Fixing strap
	Description:	Galvanised steel strap was positioned behind the horizontal joints on the outer plasterboards.
	Overall size (h x t):	70 x 0.5
7	**Insulation**	
	Supplier:	Saint-Gobain
	Reference:	Isover Acoustic Partition Roll
	Description:	Mineral fibre blanket fitted between the exposed side vertical studs.
	Density (kg/m^3):	24**
	Thickness (t):	50
8	**Joints**	
	Description:	The joints between plasterboards are scrim taped and skimmed with gypsum based jointing compound. Screw heads were dotted.
9	**Steel angle**	
	Supplier:	Hadley Group
	Reference:	HRP1900 25 x 25mm angle
	Description:	Galvanised steel unequal angle sections were affixed against the head of the boards and affixed to the restraint frame through the short edge using Ø3.5 x 42 long steel screws vertically at 600 * centres.
	Overall size (w x d x h x t):	2975 x 25 x 50 x 0.7
10	**Mineral fibre gasket**	
	Supplier:	Unifrax
	Reference:	Insulfrax LTX fibre blanket
	Description:	Mineral fibre blanket positioned between the right hand vertical edge of the frame and the partition such that it did not restrict the freedom of movement due to frictional forces, but did resist the penetration of hot gases.
	Density (kg/m^3):	128 *

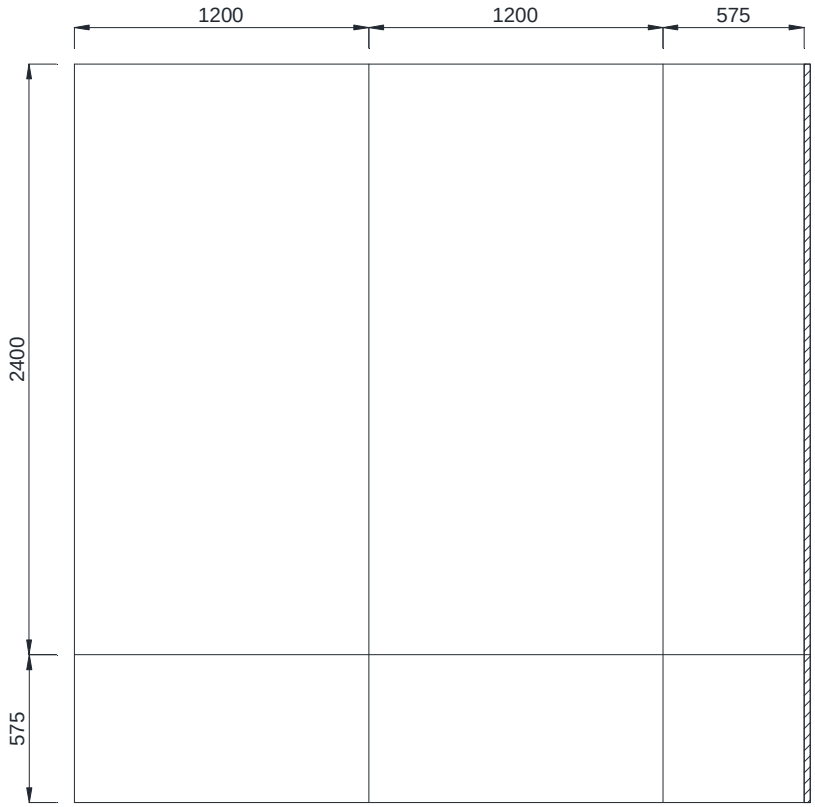
Item	Component	Information
11	**Fire stopping detail** Description:	The periphery of the partition was capped with Firewise Intumescent & Acoustic Acrylic Sealant on both faces.

Key:
* Nominal value
** Sponsor declared value or detail, not verified by laboratory

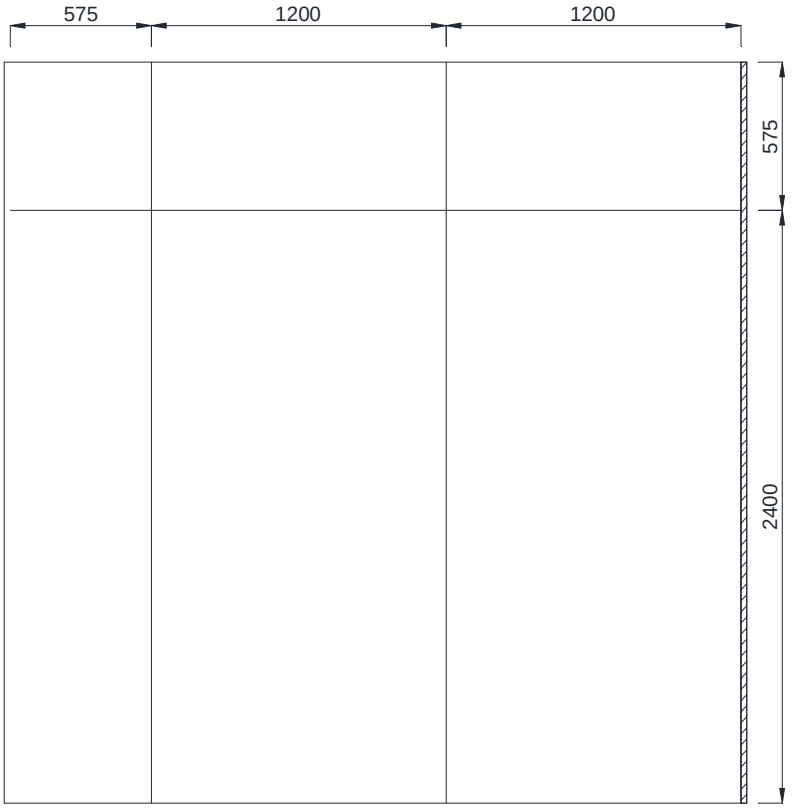
Appendix 1 Figure 1 – Elevation viewed from the unexposed side incl. hidden detail



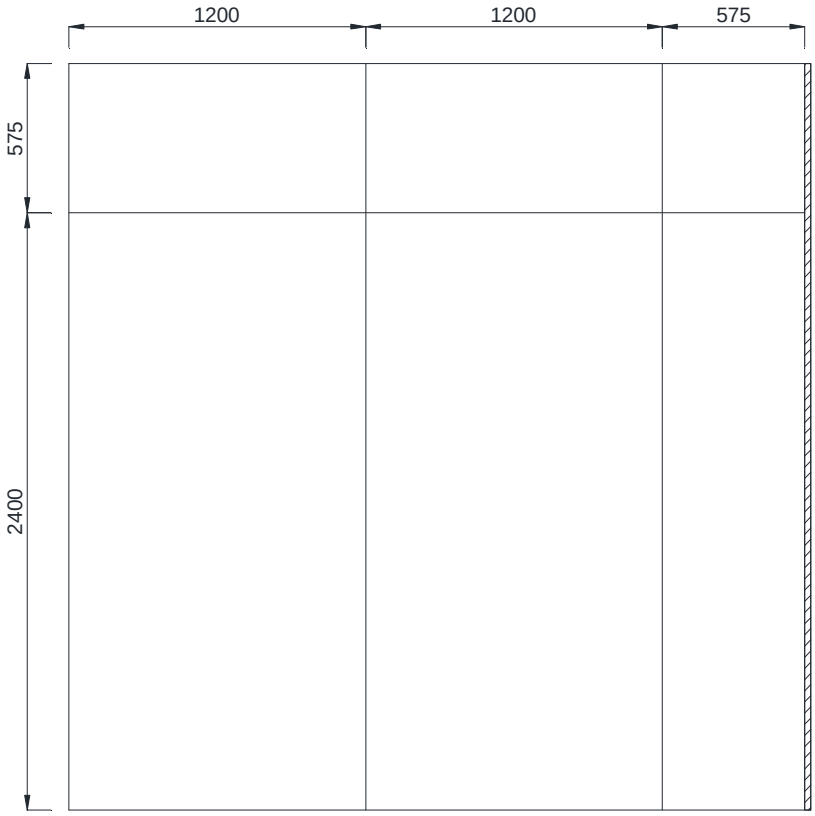
Appendix 1 Figure 2 – Unexposed inner layer plasterboard (unexposed face view)



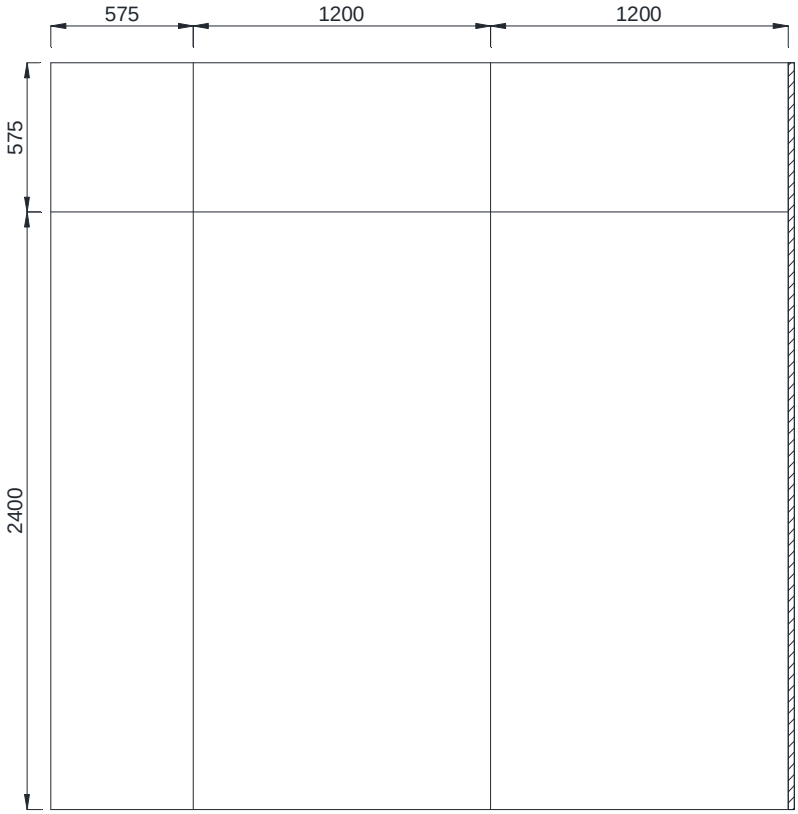
Appendix 1 Figure 3 – Unexposed outer layer plasterboard (unexposed face view)



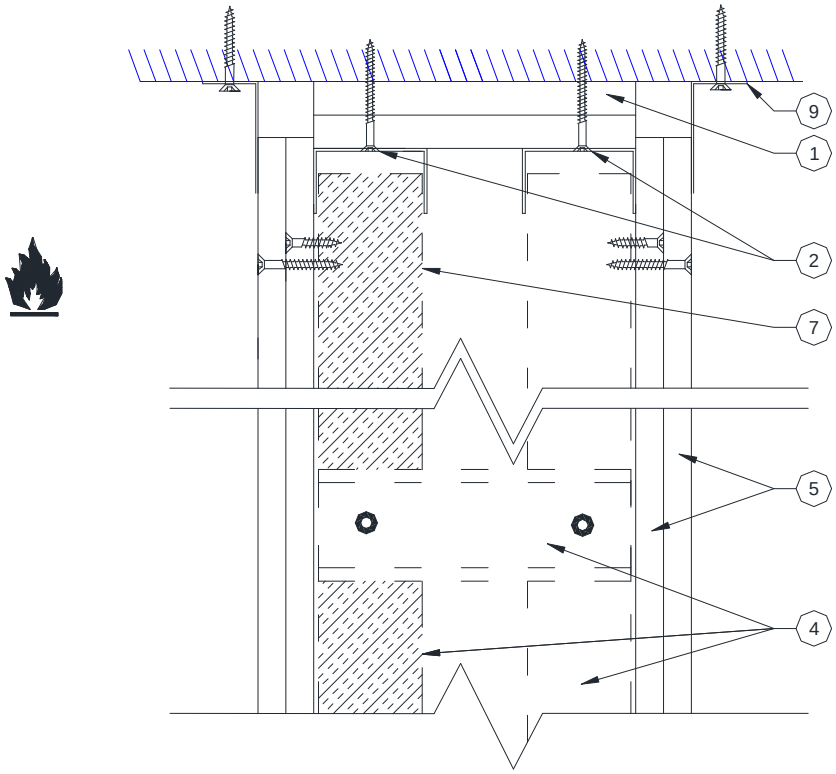
Appendix 1 Figure 4 – Exposed inner layer plasterboard (unexposed face view)



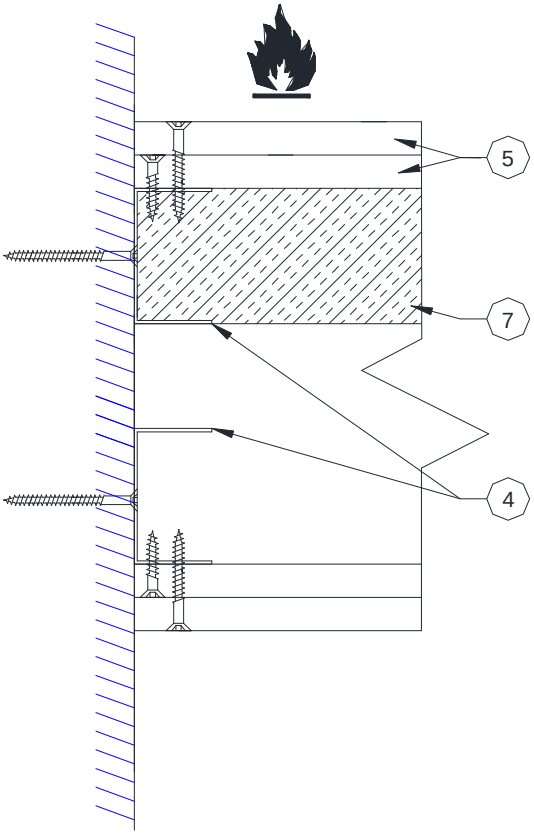
Appendix 1 Figure 5 – Exposed outer layer plasterboard (unexposed face view)



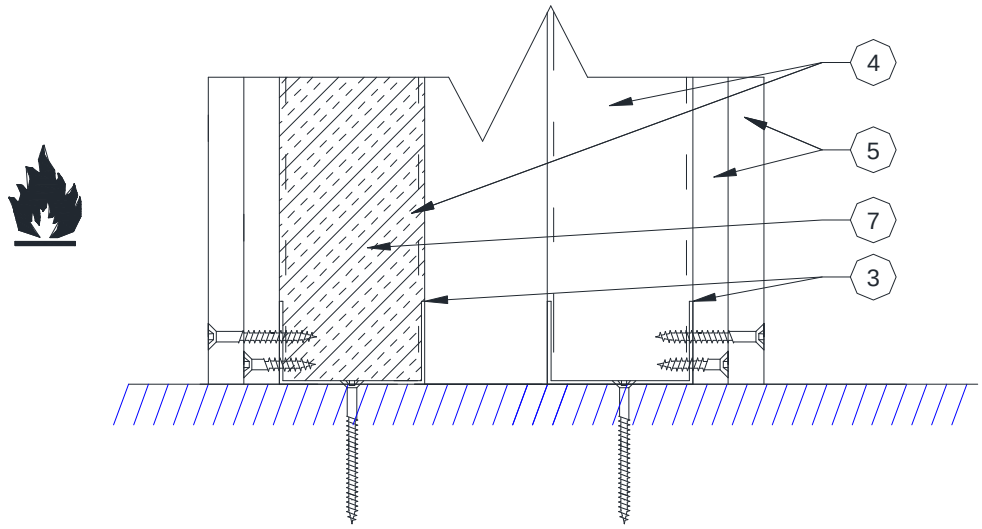
Appendix 1 Figure 6 – Section A – A



Appendix 1 Figure 7 – Section B – B



Appendix 1 Figure 8 – Section C – C



APPENDIX 2 PHOTOGRAPHS

Appendix 2.1 Pre-test photos

Photo 2.1.1

Photo 2.1.2

Photo 2.1.3

Photo 2.1.4

Photo 2.1.5

Photo 2.1.6

Photo 2.1.7

Appendix 2.2 During test photos

Photo 2.2.1

Photo 2.2.2

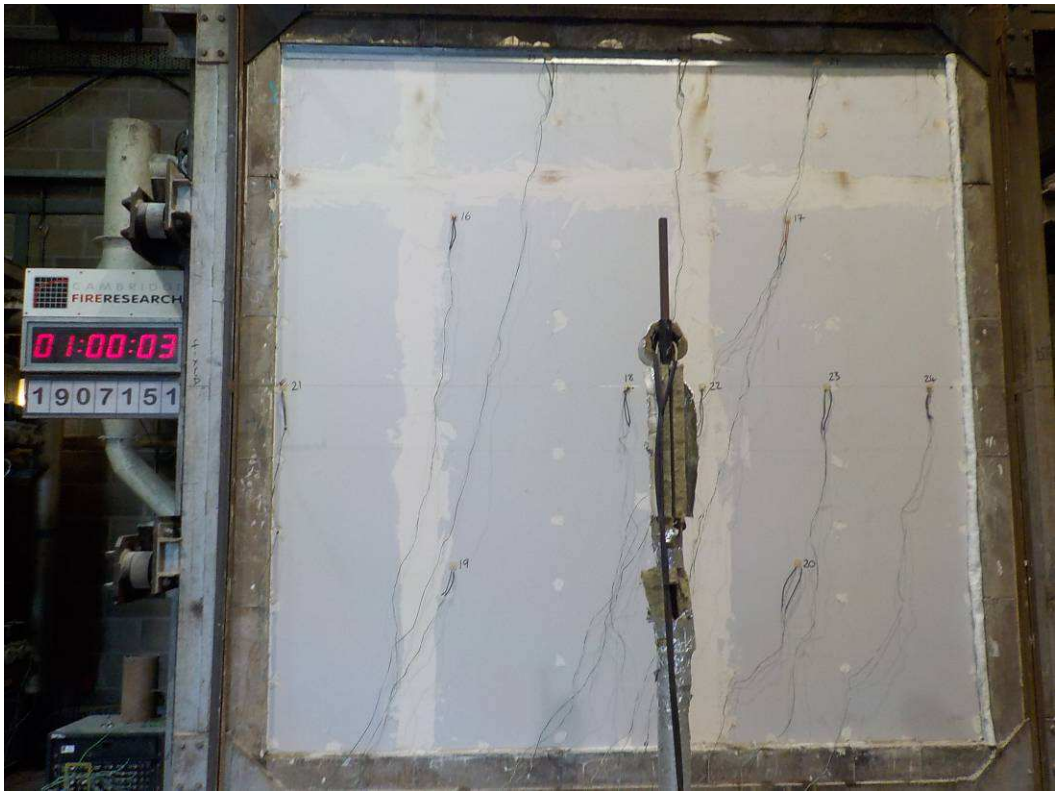


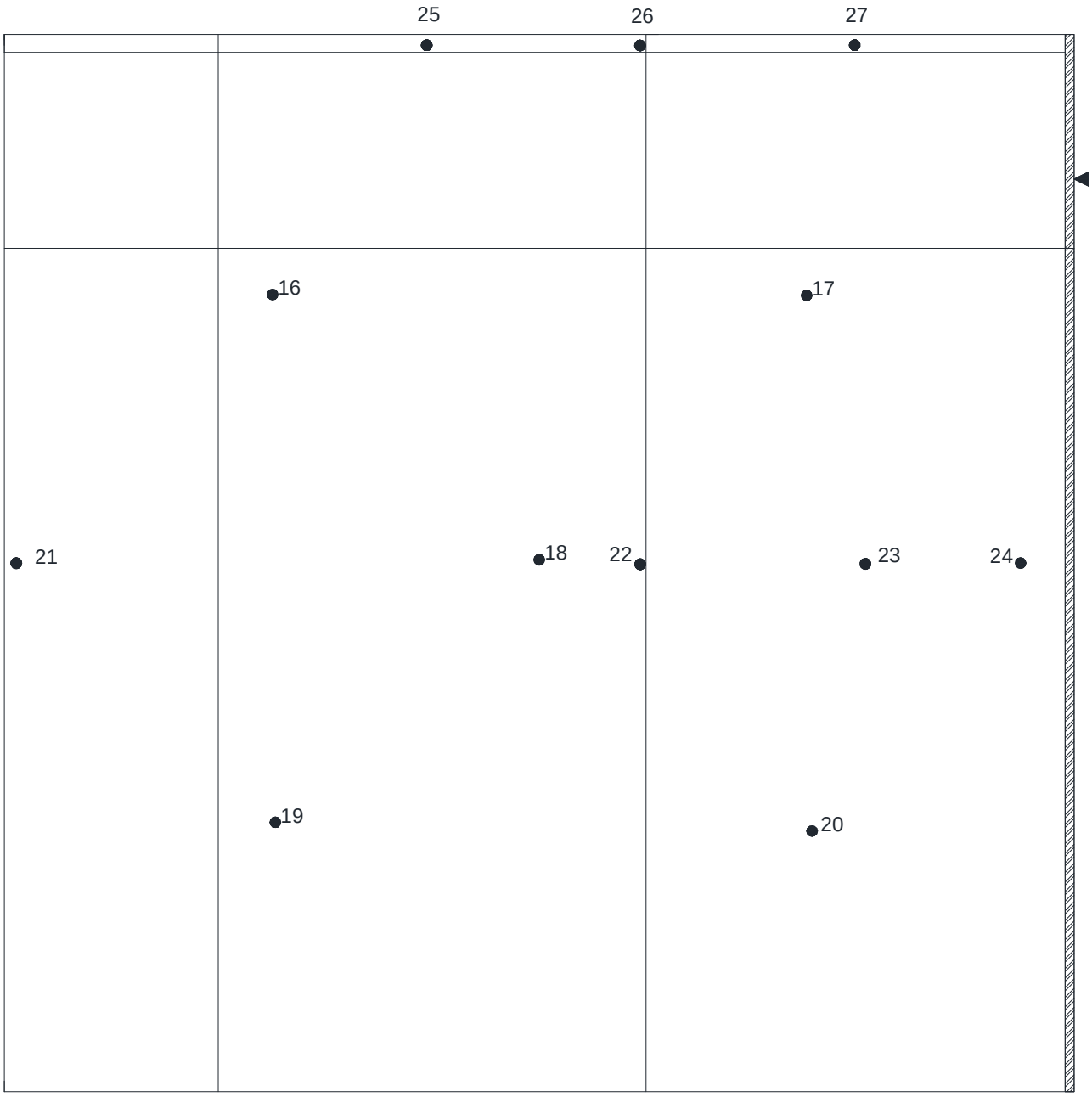
Photo 2.2.3

Photo 2.2.4

Photo 2.2.5

Appendix 2.3 Post-test photos

APPENDIX 3 POSITIONING OF INSTRUMENTATION



● Unexposed face specimen thermocouple
◀ Furnace pressure measurement position

APPENDIX 4 RECORDED THERMOCOUPLE DATA

Time	T/C 16	T/C 17	T/C 18	T/C 19	T/C 20	T/C 21	T/C 22	T/C 23	T/C 24	T/C 25	T/C 26	T/C 27
min	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C	˚C
0	21	21	21	21	20	21	21	21	21	21	21	21
1	21	21	21	21	21	21	21	20	21	21	21	21
2	21	21	21	21	21	21	21	21	21	21	21	21
3	21	21	21	21	21	21	21	20	21	21	21	21
4	21	21	21	21	21	21	21	21	21	21	21	21
5	21	21	21	21	21	21	21	21	21	21	21	21
6	21	21	21	21	21	21	21	21	21	21	21	21
7	21	21	21	21	21	21	21	21	21	21	21	21
8	21	21	21	21	21	21	21	21	21	21	22	22
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11	21	21	21	21	21	21	21	21	21	22	22	25
12	21	21	21	21	21	21	21	21	21	22	22	26
13	21	21	21	21	21	21	21	21	21	22	22	29
14	21	21	21	21	21	21	21	21	21	23	23	32
15	21	21	21	21	21	21	21	21	21	24	24	36
16	21	21	21	21	21	21	21	21	21	26	26	40
17	21	21	21	21	21	21	21	21	21	28	27	45
18	21	22	21	21	21	21	22	22	22	30	30	48
19	22	22	21	21	21	22	22	22	22	32	33	50
20	22	22	21	22	22	22	23	23	22	34	37	52
21	23	23	22	22	22	23	23	24	23	36	42	55
22	23	24	22	23	22	23	24	24	24	37	46	56
23	24	24	23	23	23	24	25	26	25	38	49	57
24	24	25	24	24	23	25	26	26	26	39	54	59
25	25	26	24	24	24	26	27	28	27	40	58	60
26	26	27	25	25	25	27	28	29	28	41	64	62
27	27	28	26	26	26	28	29	30	29	43	70	64
28	28	29	27	26	26	28	30	31	30	45	73	65
29	29	30	28	27	27	29	31	32	31	48	75	68
30	31	32	29	28	28	30	32	33	33	50	77	69
31	32	33	30	29	29	31	33	34	34	53	78	70
32	33	34	31	30	29	32	35	35	35	55	79	72
33	34	35	32	30	30	32	36	37	36	57	81	73
34	35	37	33	31	31	34	37	38	37	58	81	75
35	36	38	34	32	32	35	38	39	39	59	82	76
36	38	39	35	33	33	35	39	40	40	60	83	77
37	39	40	36	34	34	36	40	41	41	61	84	79
38	40	42	37	35	35	37	41	42	42	62	85	80
39	41	43	38	36	36	38	42	43	43	63	85	81
40	43	44	39	37	37	39	43	44	45	64	86	82
41	44	45	40	38	38	40	44	45	46	64	87	83
42	45	46	41	39	39	41	45	46	47	66	87	84
43	46	47	42	40	40	42	46	46	48	66	88	85
44	47	49	43	41	41	43	47	47	49	67	88	86
45	48	50	44	42	42	44	48	48	50	67	88	87
46	49	51	45	43	43	44	49	49	51	68	88	87
47	50	52	46	44	44	45	50	50	52	69	89	87
48	51	53	47	45	45	45	50	51	53	70	89	88
49	52	53	48	45	45	46	51	52	54	70	89	88
50	53	54	49	46	46	47	52	52	55	70	89	88

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Time	T/C 16	T/C 17	T/C 18	T/C 19	T/C 20	T/C 21	T/C 22	T/C 23	T/C 24	T/C 25	T/C 26	T/C 27
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
51	54	55	50	47	47	48	53	53	56	71	89	88
52	54	56	51	48	48	49	53	54	56	71	89	88
53	55	56	51	49	49	49	54	55	57	72	89	88
54	56	57	52	50	50	50	55	55	57	72	88	87
55	57	58	53	50	51	51	56	56	58	73	88	87
56	57	58	54	51	51	51	56	56	59	72	87	86
57	58	59	54	52	52	51	56	57	59	72	86	86
58	58	59	54	52	52	52	57	57	60	71	85	85
59	58	59	55	53	53	52	57	57	60	71	85	85
60	59	59	55	54	54	53	58	58	61	70	85	84
61	58	60	56	54	54	53	58	58	61	71	83	83
62	59	60	56	55	54	53	58	58	61	70	82	82
63	58	60	56	55	55	54	58	58	61	69	81	81
64	59	60	56	55	55	54	58	59	61	68	80	80
65	59	59	56	56	55	54	58	59	61	68	79	79
66	58	59	56	56	56	54	58	59	61	68	78	78
67	58	59	56	56	56	54	58	59	61	68	77	77
68	58	59	56	56	56	54	58	58	61	68	76	76
69	58	58	56	56	56	54	58	58	60	68	76	76
70	57	58	56	56	56	54	58	58	60	68	76	76
71	57	58	56	56	56	54	58	58	60	68	77	76
72	57	57	55	56	56	54	58	58	60	67	77	76
73	57	57	56	56	55	53	58	58	60	67	76	77
74	57	57	56	56	56	53	58	58	60	67	76	77
75	57	57	56	56	55	53	58	58	60	67	76	77
76	57	57	55	56	56	53	58	58	60	68	76	78
77	56	57	55	56	56	53	58	58	60	69	76	78
78	56	57	55	56	56	53	58	59	60	70	77	78
79	57	58	55	56	56	53	58	59	60	70	76	78
80	57	58	56	57	56	53	58	60	61	70	77	78
81	58	59	56	56	56	53	59	60	61	71	76	78
82	58	59	56	57	56	53	59	60	61	71	76	78
83	59	60	56	57	56	54	59	61	62	71	76	78
84	59	60	56	57	56	53	59	61	62	71	76	78
85	60	60	56	57	56	54	60	62	62	72	76	78
86	60	61	57	57	57	54	60	62	63	73	76	79
87	60	61	57	57	57	54	60	63	63	73	76	79
88	61	62	57	57	57	54	61	63	63	73	76	79
89	61	62	58	57	57	54	62	64	64	74	76	79
90	61	62	58	58	57	54	62	64	64	74	76	79
91	62	63	59	58	57	55	62	65	64	75	76	79
92	62	63	59	58	58	55	63	65	65	75	76	80
93	62	63	59	58	57	55	63	66	65	75	76	80
94	62	64	59	58	58	55	63	66	65	76	76	80
95	62	64	60	59	58	56	64	67	66	75	77	80
96	63	64	61	59	59	56	65	67	66	76	77	80
97	63	64	61	59	59	56	65	68	67	76	77	80
98	63	65	61	60	59	57	65	68	67	76	78	80
99	63	65	61	60	59	57	66	68	67	75	78	80
100	64	65	61	60	60	57	66	69	68	74	78	80

CAMBRIDGE FIRERESEARCH

Time	T/C 16	T/C 17	T/C 18	T/C 19	T/C 20	T/C 21	T/C 22	T/C 23	T/C 24	T/C 25	T/C 26	T/C 27
min	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
101	64	65	61	61	60	58	67	69	68	76	79	81
102	64	66	62	61	61	58	67	69	68	77	78	80
103	64	66	62	61	61	58	68	70	68	79	78	79
104	64	66	63	61	61	58	68	70	68	81	79	79
105	65	66	63	62	61	59	69	70	69	80	81	79
106	65	66	63	62	62	59	69	70	69	83	82	79
107	65	66	63	62	62	59	69	70	69	86	83	80
108	65	67	64	62	62	60	69	70	69	87	85	80
109	66	67	64	62	62	60	70	71	69	87	88	80
110	66	67	65	63	62	61	70	71	69	88	89	80
111	66	68	66	63	62	61	70	71	69	87	91	81
112	67	68	66	63	62	62	70	71	69	87	93	81
113	67	68	67	63	62	62	71	72	69	84	96	81
114	68	69	67	64	63	63	71	72	69	85	100	82
115	69	69	68	65	63	63	71	73	70	84	102	83
116	70	70	68	65	63	64	72	73	70	86	104	84
117	71	70	69	66	63	65	72	73	70	86	106	85
118	72	71	69	67	64	65	73	74	70	88	110	86
119	72	71	69	67	65	66	73	74	71	88	112	87
120	72	72	70	68	66	67	74	74	71	91	117	88
121	73	72	70	68	67	68	74	74	72	93	121	90
122	73	73	71	69	68	68	75	74	72	97	124	92
123	74	74	71	69	68	69	76	76	73	101	127	92
124	75	75	73	70	69	70	78	78	74	105	123	93
125	75	76	74	70	70	71	79	79	74	107	120	94
126	75	76	75	72	70	72	80	80	75	110	118	94
127	76	76	75	73	72	74	81	80	76	114	125	95
128	76	77	76	76	74	75	83	81	76	119	144	97
129	77	77	77	78	76	77	84	82	77	123	155	109
130	78	78	77	79	77	78	85	82	78	127	156	139
131	81	79	78	79	78	79	85	82	79	134	158	159
132	84	81	78	80	79	81	86	83	79	143	163	171