

**Title:**

Fire Resistance Test In Accordance  
With BS EN 1365-2: 2014, On A  
Loadbearing Timber Floor  
Construction Protected By A  
Plasterboard Ceiling Incorporating  
Four Lumi-Plugin Downlights

**Date of Test:**

14<sup>th</sup> February 2020

**Issue 2:**

4<sup>th</sup> June 2020

**WF Report No.**

423750



**Prepared for:**

**Sleep Safe System Ltd T/A Lumi-Plugin**

Lindenmuth House  
37 Lindenmuth Way  
Greenham Business Park  
Newbury  
Berkshire  
RG19 6HW



0249

**This report supersedes Issue 1  
of report 423750, dated 5<sup>th</sup> May  
2020.**

# Test Assembly

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## Summary of Tested Specimen

The timber floor assembly had overall nominal dimensions of 4500 mm long by 2960 mm wide by 280 mm deep. It comprised C24 timber joists 45 mm by 222 mm at 450 mm centres. The unexposed surface of the floor comprised nominally 22 mm thick tongue and grooved chipboard flooring. The floor assembly was protected on its exposed face by a direct fixed ceiling, formed from three layers of 12.5 mm thick British Gypsum Wall Board plasterboard to EN 520 standards.

The ceiling incorporated four Lumi Plugin down lighter light fittings, consisting of one model type referenced as LP110.

The floor supported a uniformly distributed load of 2.63 kN/m<sup>2</sup>. This load was calculated to represent the maximum design load for the timber floor construction.

*Detailed drawings of the test specimen(s) and a comprehensive description of the test construction based on a detailed survey of the specimen(s) and information supplied by the sponsor of the test are included in the Test Specimen and Schedule of Components sections of this report.*

## Performance Criteria and Test Results

### Loadbearing Capacity

The limiting deflection and the limiting rate of deflection for the specimen, as specified by the Standard, are calculated as:

Criteria	Value
(L) Length of clear span, <i>in mm</i>	4205
(d) Depth of Structural Section, <i>in mm</i>	222
Max Deflection ( $L^2/400d$ ) - <i>in mm</i>	199.1
Rate ( $L^2 / 9000d$ ) - <i>in mm</i>	8.8

The allowable rate of deflection criteria is not applicable for the first 10 minutes of the test. This criterion was satisfied for 100 minutes at which time the test was discontinued.

### Integrity

It is required that the specimen retains its separating function, without:

- causing ignition of a cotton pad when applied
- permitting the penetration of a gap gauge as specified in BS EN 1363-1: 2012
- sustained flaming on the unexposed surface
- subsequent failure of loadbearing capacity

**These requirements were satisfied for the periods shown below:**

### Sustained flaming

100 minutes\*

### Gap gauge

100 minutes\*    No failure\*

### Cotton pad

100 minutes\*

### Insulation

It is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure.

**These requirements were satisfied for the period shown below:**

100 minutes    No failure\*

\*Test was discontinued after a period of 100 minutes.

### Date of Test

14<sup>th</sup> February 2020

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## Signatories

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Responsible Officer

**C. Hoyle\***

Technical Officer



Approved

**D. Whittle\***

Technical Officer



Head of Department

**S. Hankey\***

Business Unit Head – Fire Resistance

\* For and on behalf of **Warringtonfire**.Report Issued: 5<sup>th</sup> May 2020

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## Revision History

Issue No: 2	Re-issue Date: 4 <sup>th</sup> June 2020
Revised By: <b>W. Drazkiewicz</b>	Approved By: <b>D. Fitzsimmons</b>
Reason for Revision: Changes to downlighters descriptions to match product labels. Cut out sizes indicated wrong in first issue, revision required.	

Issue No:	Re-issue Date:
Revised By:	Approved By:
Reason for Revision:	

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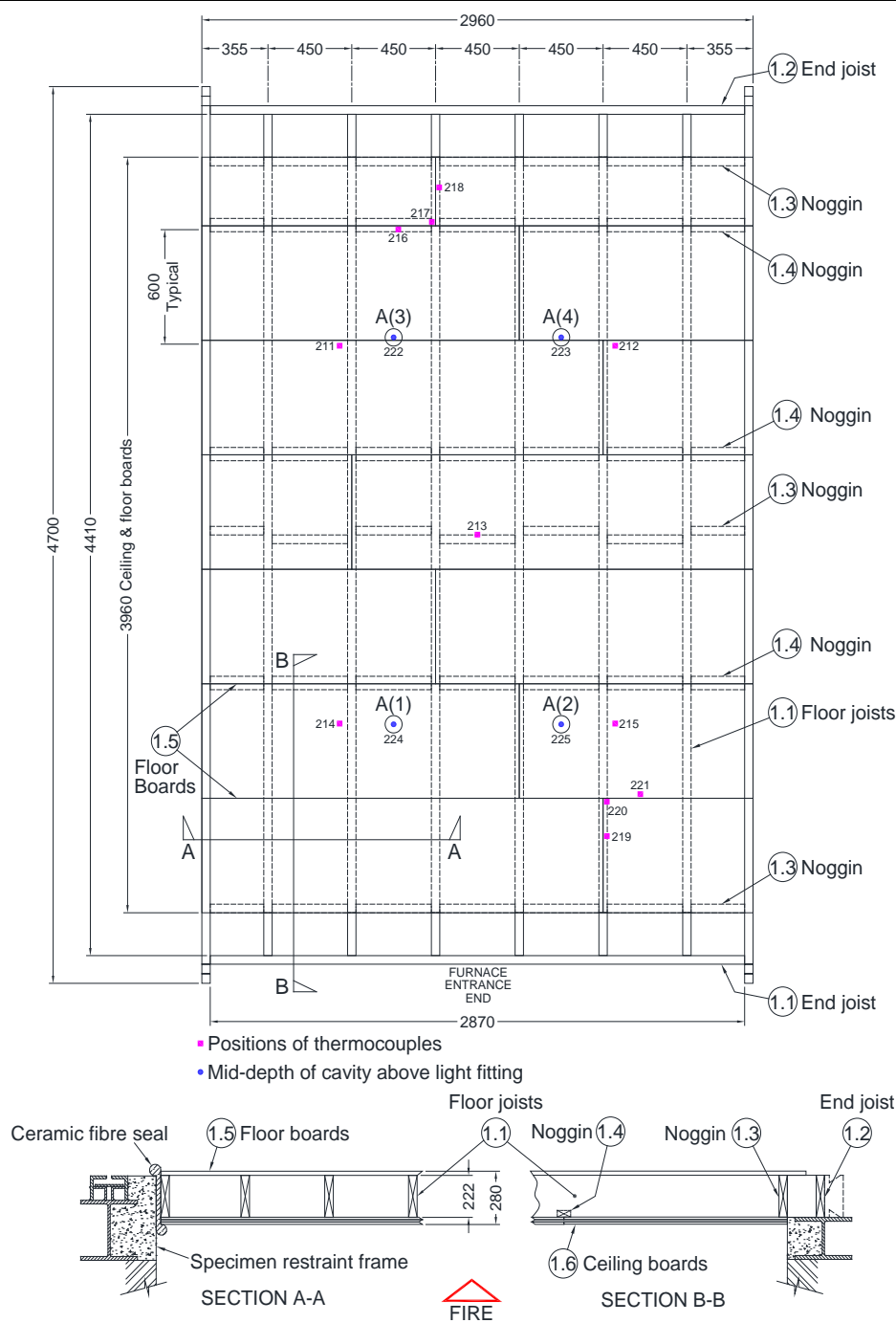
# Test Conditions

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<b>Standard</b>	<p>BS EN 1365-2: 2014, 'Fire resistance tests for loadbearing elements – Part 2: Floors and Roofs'</p> <p>The purpose of the test was to evaluate the performance of a timber floor construction protected by a ceiling of known fire resistance, when incorporating down lighter light fitting assemblies.</p>
<b>Sampling</b>	<p><b>Warringtonfire</b> was not involved in the sampling or selection of the tested specimen or any of the components.</p> <p>The results obtained during the test only apply to the test samples as provided by the test sponsor</p>
<b>Installation</b>	<p>Representatives of <b>Warringtonfire</b> assembled the floor construction and installed the downlighters between the 06 February 2020 and 10 February 2020.</p>
<b>Conditioning</b>	<p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of nine 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 8.5°C to 22.5°C and 41.5% to 69% respectively.</p>
<b>Instruction to Test</b>	<p>The test was conducted on the 14 February 2020 at the request of <b>Sleep Safe System Ltd T/A Lumi-Plugin</b>, the test sponsor.</p> <p>Mr. B. Ward a representative of the test sponsor witnessed the test.</p>
<b>Ambient Temperature</b>	<p>The ambient air temperature in the vicinity of the test construction was 18°C at the start of the test with a maximum variation of +/-2°C during the test.</p>
<b>Furnace</b>	<p>The furnace was controlled so that its mean temperature complied with the requirements of BS EN 1363-1: 2012 Clause 5.1 using eight plate thermometers, distributed over a plane 100 mm from the underside of test assembly.</p>
<b>Thermocouples</b>	<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. The locations and reference numbers of the various mineral insulated and unexposed surface thermocouples are shown in Figure 1.</p>
<b>Application of the load</b>	<p>The full test load was applied via dead loads uniformly distributed over the upper surface of the test specimen timber floor, 60 minutes before the commencement of the test.</p>
<b>Loadbearing Capacity Criteria</b>	<p>A linear deflection transducer was provided at the approximate centre on the unexposed surface of the specimen to record its vertical deflection.</p>
<b>Furnace Pressure</b>	<p>After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 2012, clause 5.2.1 The calculated pressure differential relative to the laboratory atmosphere 100 mm below the soffit of the specimen was 18 (± 5) Pa between 5 and 10 minutes and 18 (± 3) Pa thereafter.</p>

# Test Construction

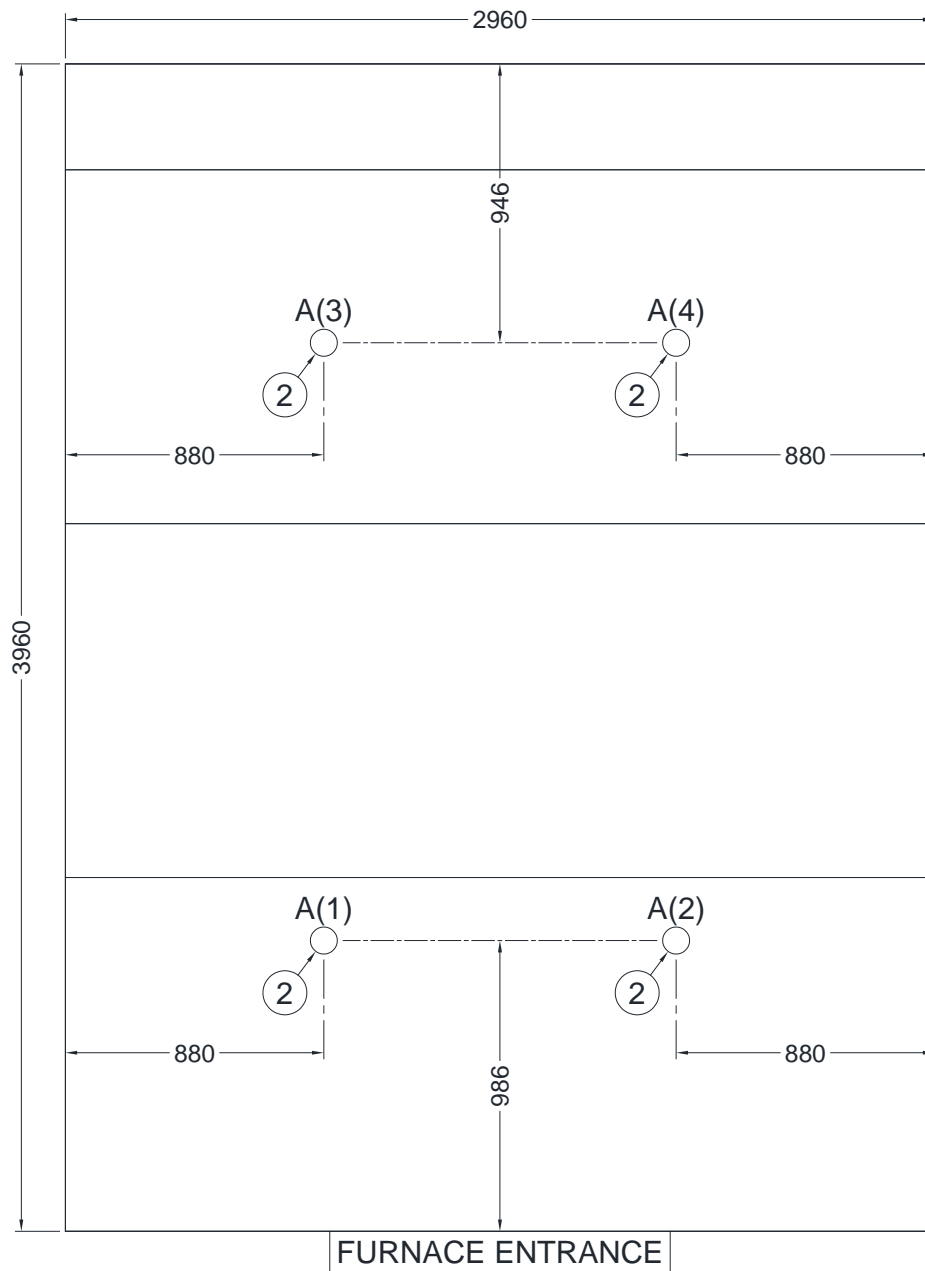
Figure 1- General Elevation of the Unexposed Face of the Test Construction



Do not scale. All dimensions are in mm

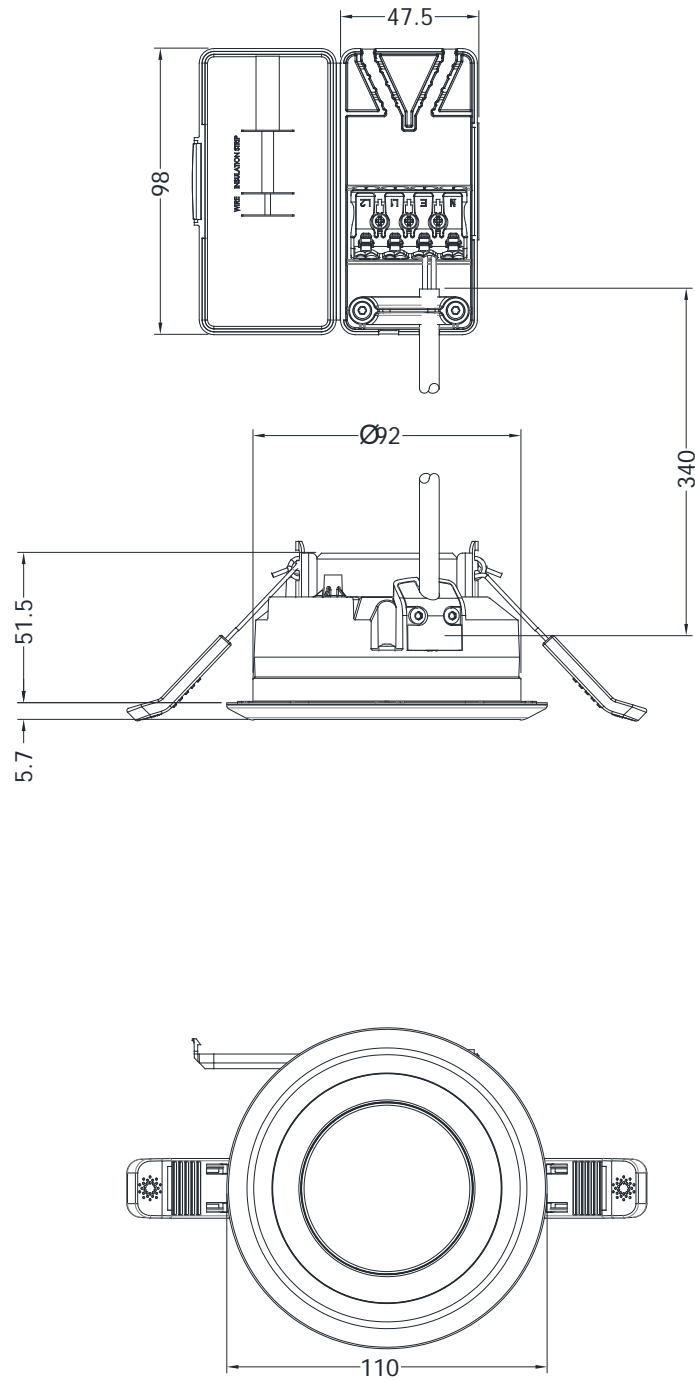


**Figure 2 – Details of Down lighter Positions**



Do not scale. All dimensions are in mm

**Figure 3 – Details of Downlighter Specimen**



Do not scale. All dimensions are in mm

# Schedule of Components

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(Refer to Figures 1 to 6)

(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
<b>1. Timber Floor</b>	
1.1 Floor Joists	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m <sup>3</sup> , measured
Size	: 45.6 mm x 222 mm x 4410 mm long
Joist centres	: 450 mm
1.2 End Joist	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m <sup>3</sup> , measured
Size	: 45.6 mm x 222 mm x 2870 long
Fixing	: Fitted at each end of the floor joists and fixed with fired nails. Please see Figure 1 for positions
1.3 Noggins (Section of Floor Joist)	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m <sup>3</sup> , measured
Size	: 45.6 mm x 222 mm
Fixing	: Fitted between floor joists and fixed with fired nails. Please see Figure 1 for positions
1.4 Noggins	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m <sup>3</sup> , measured
Size	: 67.6 mm x 43.2 mm
Joist centres	: 1200 mm
Fixing	: Fitted between floor joists and fixed with fired nails. Please see Figure 1 for positions
1.5 Floor Boards	
Material	: Flooring grade tongue and groove chipboards
Reference	: FSC E1 P5
Thickness	: 22 mm
Size	: 600 mm wide
Fixing	: Fixed in a single layer with 4 mm diameter x 65 mm long countersunk steel screws to floor joists at 300 mm centres

**Item****Description****1. Timber Floor (Continued)****1.6 Ceiling Boards**

Manufacturer	:	British Gypsum
Reference	:	Gyproc Wall Board
Material	:	Type A gypsum
Density	:	842 kg/m <sup>3</sup> , measured
Thickness	:	37.5 mm, 3 off layers of 12.5 mm thick
Fixing method	:	The boards were screw fixed to the soffit of the joists. All joints of the second layer were staggered with respect to those of the first and third layers. All joints in the third layer were paper taped and skimmed with British Gypsum jointing compound

## Fixings for the first layer of boards

i. type	:	Bugle head, sharp point, drywall screws
ii. material	:	Black phosphate coated steel
iii. overall size	:	38 mm long x 3.5 mm diameter
iv. centres	:	150 mm centres around the perimeter and 150 mm in the centre of the board

## Fixings for the second layer of boards

i. type	:	Bugle head, sharp point, drywall screws
ii. material	:	Black phosphate coated steel
iii. overall size	:	50 mm long x 3.5 mm diameter
iv. centres	:	150 mm centres around the perimeter and 150 mm in the centre of the board

## Fixings for the third layer of boards

i. type	:	Bugle head, sharp point, drywall screws
ii. material	:	Black phosphate coated steel
iii. overall size	:	75 mm long x 4.2 mm diameter
iv. centres	:	150 mm centres around the perimeter and 150 mm in the centre of the board

**2. Specimen A**

Manufacturer	:	Lumi-Plugin
Reference	:	LP110
Overall dimensions and construction	:	See Figure 3 for details
Luminaire Details		
i. driver	:	Internal Driver
ii. power consumption	:	8.5W 220V-240VAC~50Hz 0.05A PF>0.8
iii. current	:	0.05A
iv. colour temperature	:	3000K & 4000K
v. light output	:	600lm
vi. beam angle	:	100°
vii. chip life TM-21	:	CRI80 – 50,000hrs
viii. cut out	:	93mm diameter
ix. tilt	:	Fixed
x. rotation	:	Fixed
xi. IP rating	:	IP65
xii. finish	:	White Alu Finish

## Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	
00	00	<b>The test commences.</b>
05	32	When viewed from the exposed face, the surface of the board has blackened in colour and the paper lining has burnt away.
08	34	When viewed from the exposed face, the tap and scrim over the joints has started to crack and small sections have detached from the ceiling.
10	00	When viewed from the exposed face, the centre of the downlights have detached and flaming observed from thermocouple 225, the surface of the board is beginning to glow orange in colour.
14	00	When viewed from the exposed face, the joints between the boards has darkened in colour and beginning to widen, approximately 4mm-6mm flaming continues to be observed from location of thermocouple 225.
17	10	When viewed from the exposed face, slight undulating ripple along the lateral edges of the plasterboard observed.
19	00	When viewed from the exposed face, flaming observed from light fitting location below thermocouple 224 and thermocouple 225.
22	00	Steam/smoke release observed to be increasing from around the perimeter edge of the ceiling.
28	25	When viewed from the exposed face, no flaming observed from light fitting locations below thermocouple 224 and thermocouple 225. The surface of the plasterboard radiates orange in colour, the joints between the boards have widen approximately 6mm - 10mm. screw head fixings have darkened in colour.
26	00	No significant visible changes.
28	00	When viewed from the exposed face, no significant visible changes.
33	00	No significant visible changes.
42	11	When viewed from the exposed face undulations observed along joint edges.
49	44	When viewed from the exposed face, all plasterboard remains in place. No significant visible changes.
50	00	No significant visible changes.
60	00	Specimen maintains loadbearing integrity and insulation criteria.
65	10	When viewed from the exposed face, no significant visible changes.

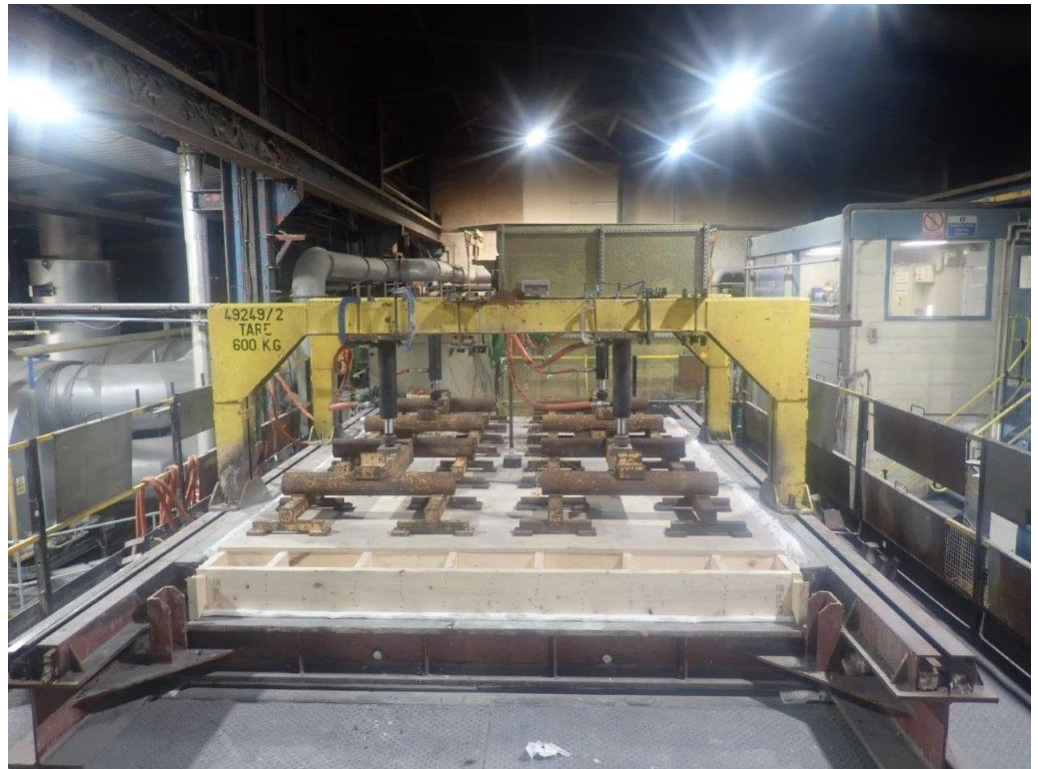
## Time

mins secs

78	18	When viewed from the exposed face the lateral edges of the plasterboard begins to detach from the screw fixings located in the centre of the specimen ceiling.
80	00	When viewed from the exposed face, the board at the centre of the ceiling has detached approximately 1m <sup>2</sup> area.
84	00	When viewed from the exposed face, additional sections of plasterboard to the exposed face begin to detach.
86	00	When viewed from the exposed face cracks have appeared in the second layer of board flaming observed from the cracks.
88	00	No significant visible changes.
88	40	When viewed from the exposed face, additional sections of board to the exposed layer have detached.
90	00	Specimen maintains load bearing integrity and insulation criteria.
100	00	<b>Test discontinued at client's request.</b>

## Test Photographs

The unexposed face of the floor assembly prior to test



The unexposed face of the floor assembly after 20 minutes of testing

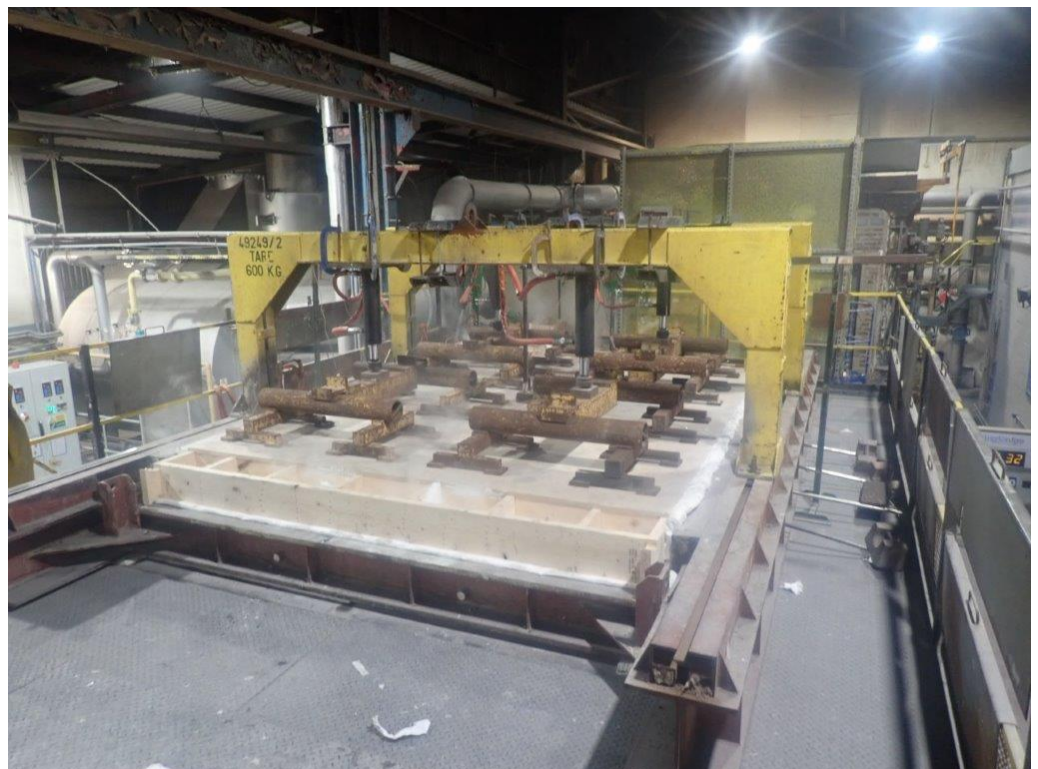




The unexposed face of the floor assembly after 26 minutes of testing



The unexposed face of the floor assembly after 30 minutes of testing





The unexposed face of the floor assembly after 60 minutes of testing



The unexposed face of the floor assembly after 100 minutes of testing



## Temperature, Pressure and Deflection Data

Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard BS EN 1363-1: 2012

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	42
3	502	542
6	603	586
9	663	648
12	706	712
15	739	742
18	766	763
21	789	780
24	809	806
27	826	826
30	842	839
33	856	853
36	869	864
39	881	875
42	892	894
45	902	908
48	912	920
51	921	931
54	930	939
57	938	946
60	945	956
63	953	963
66	960	970
69	966	975
72	973	981
75	979	987
78	985	991
81	990	997
84	996	1003
87	1001	1010
90	1006	1014
93	1011	1018
96	1016	1021
99	1020	1026
100	1022	1027

**Individual Temperatures And Mean Recorded On The Unexposed Surface Of The Specimen**

Time Mins	T/C Number 211 Deg. C	T/C Number 212 Deg. C	T/C Number 213 Deg. C	T/C Number 214 Deg. C	T/C Number 215 Deg. C	Mean Temp Deg. C
0	14	15	15	17	17	16
3	15	15	15	16	17	16
6	15	15	15	16	17	16
9	15	15	15	16	17	16
12	14	15	15	16	17	15
15	14	15	15	16	17	15
18	15	15	15	17	17	16
21	15	16	15	17	17	16
24	16	16	16	18	18	17
27	17	17	16	19	18	17
30	18	18	17	20	19	18
33	19	19	18	21	20	19
36	20	21	19	23	22	21
39	22	22	19	24	23	22
42	23	24	21	25	24	23
45	24	25	22	23	26	24
48	26	26	23	24	27	25
51	27	27	24	25	28	26
54	28	29	25	25	30	27
57	29	30	26	26	31	28
60	30	31	27	26	32	29
63	32	33	28	27	33	31
66	33	34	30	28	35	32
69	34	35	31	28	36	33
72	35	36	32	29	37	34
75	37	38	33	30	39	35
78	38	39	35	30	40	36
81	39	40	36	30	41	37
84	40	41	37	29	42	38
87	41	42	38	29	43	39
90	42	43	39	30	44	40
93	42	44	39	29	45	40
96	43	44	40	30	45	40
99	44	45	40	31	46	41
100	44	45	41	31	46	41

**Individual Temperatures Recorded On The Unexposed Surface Of The Specimen Adjacent to Joints**

Time Mins	T/C Number 216 Deg. C	T/C Number 217 Deg. C	T/C Number 218 Deg. C	T/C Number 219 Deg. C	T/C Number 220 Deg. C	T/C Number 221 Deg. C
0	17	17	18	16	19	19
3	17	17	19	17	19	19
6	17	17	19	17	19	19
9	17	17	18	16	19	19
12	17	17	18	16	19	20
15	17	17	18	16	19	20
18	17	17	18	16	19	21
21	17	17	19	17	20	22
24	17	18	19	17	20	23
27	18	18	20	18	21	24
30	19	19	21	19	22	26
33	19	20	22	20	23	27
36	20	21	23	21	24	29
39	21	22	25	22	25	31
42	23	23	26	23	27	33
45	24	24	27	25	28	35
48	25	25	29	26	30	36
51	26	26	30	28	31	38
54	28	28	32	29	32	41
57	29	29	33	30	34	43
60	30	30	34	31	35	46
63	31	31	35	32	36	48
66	33	32	37	33	37	50
69	34	33	38	34	38	52
72	35	34	39	35	39	53
75	36	35	40	36	40	54
78	37	36	42	37	41	55
81	39	37	43	38	42	55
84	40	38	44	39	43	56
87	42	40	45	40	44	56
90	44	41	46	41	45	57
93	45	42	46	41	46	58
96	46	43	47	42	47	58
99	46	43	48	42	48	59
100	46	43	48	43	49	59

**Individual Temperatures Recorded At Mid-Height Of The Cavity Coincidental With The Light Fittings A(1, 2, 3, and 4)**

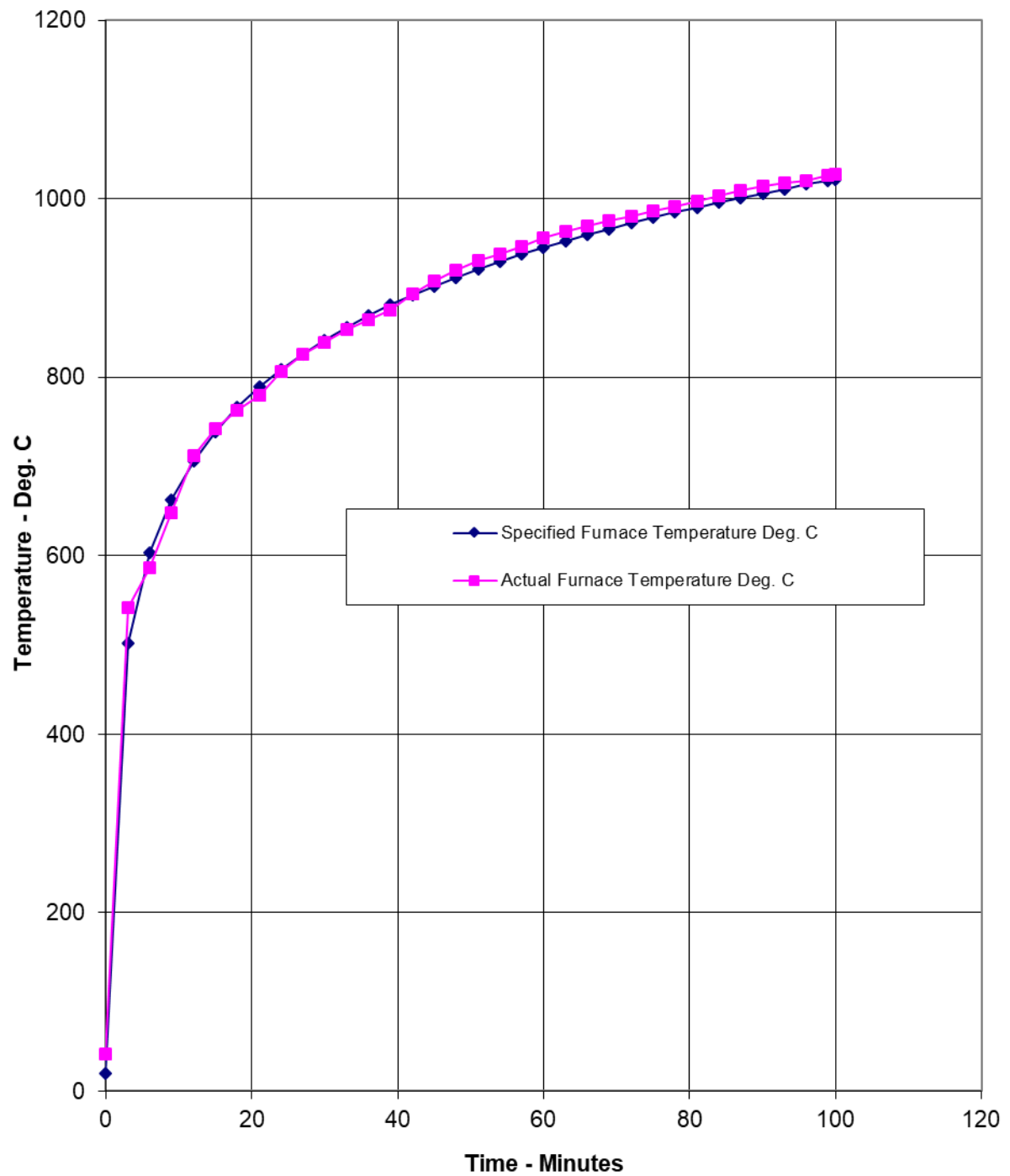
Time Mins	T/C Number 222 Deg. C	T/C Number 223 Deg. C	T/C Number 224 Deg. C	T/C Number 225 Deg. C
0	21	23	21	18
3	27	31	23	*
6	56	54	46	*
9	57	63	46	*
12	55	56	59	*
15	72	68	71	*
18	85	78	100	*
21	97	103	135	*
24	120	103	134	*
27	138	116	156	*
30	130	116	162	*
33	163	123	187	*
36	166	112	187	*
39	167	113	193	*
42	174	115	183	*
45	185	171	199	*
48	178	159	202	*
51	172	156	210	*
54	163	144	210	*
57	155	140	208	*
60	178	131	211	*
63	167	132	199	*
66	179	139	189	*
69	173	140	183	*
72	160	138	178	*
75	160	139	172	*
78	143	139	157	*
81	144	136	154	*
84	137	135	153	*
87	136	137	142	*
90	147	149	143	*
93	162	165	150	*
96	194	182	165	*
99	222	199	181	*
100	228	203	184	*

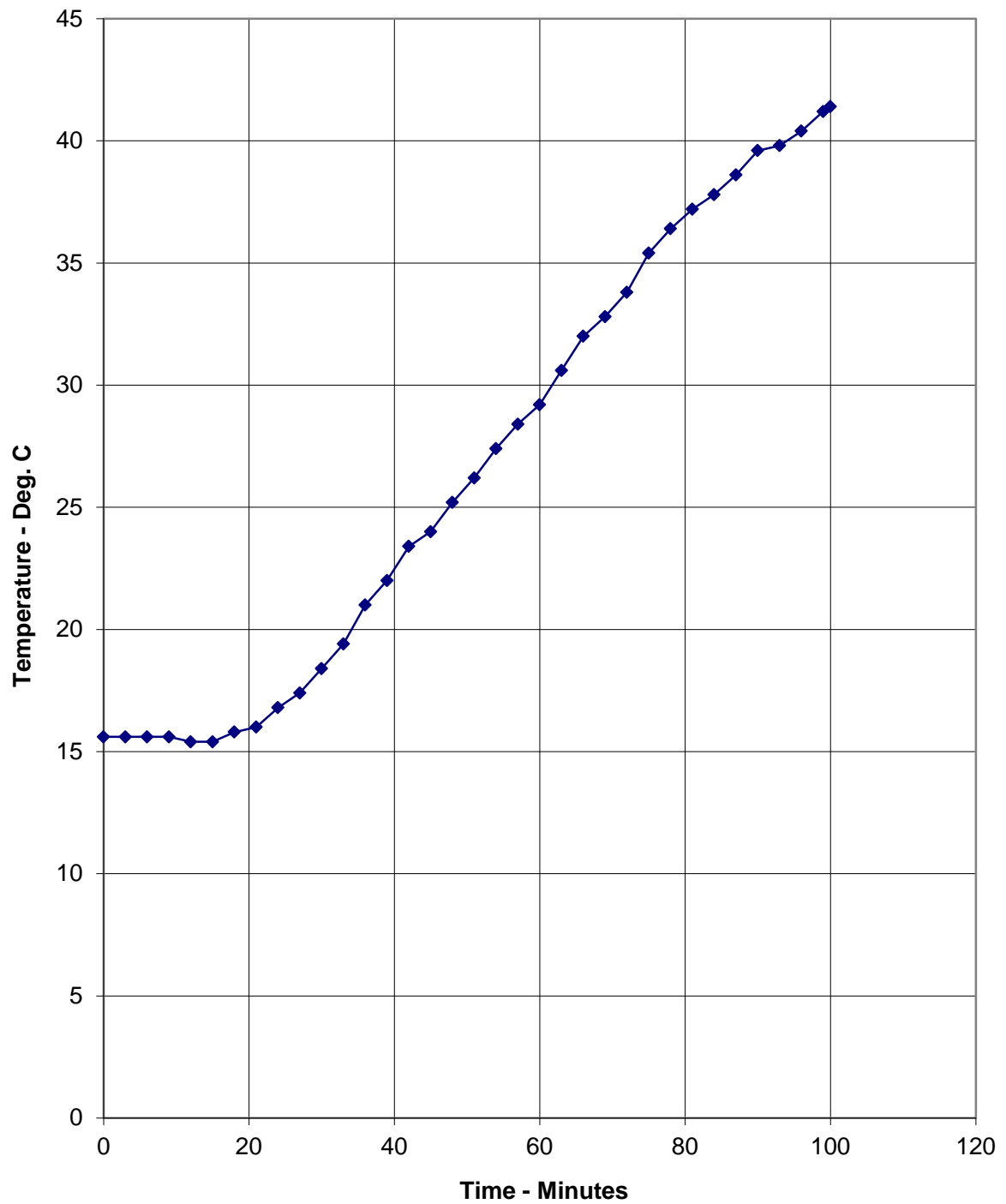
\*Thermocouple malfunction

**Central Vertical Deflection Of The Specimen**

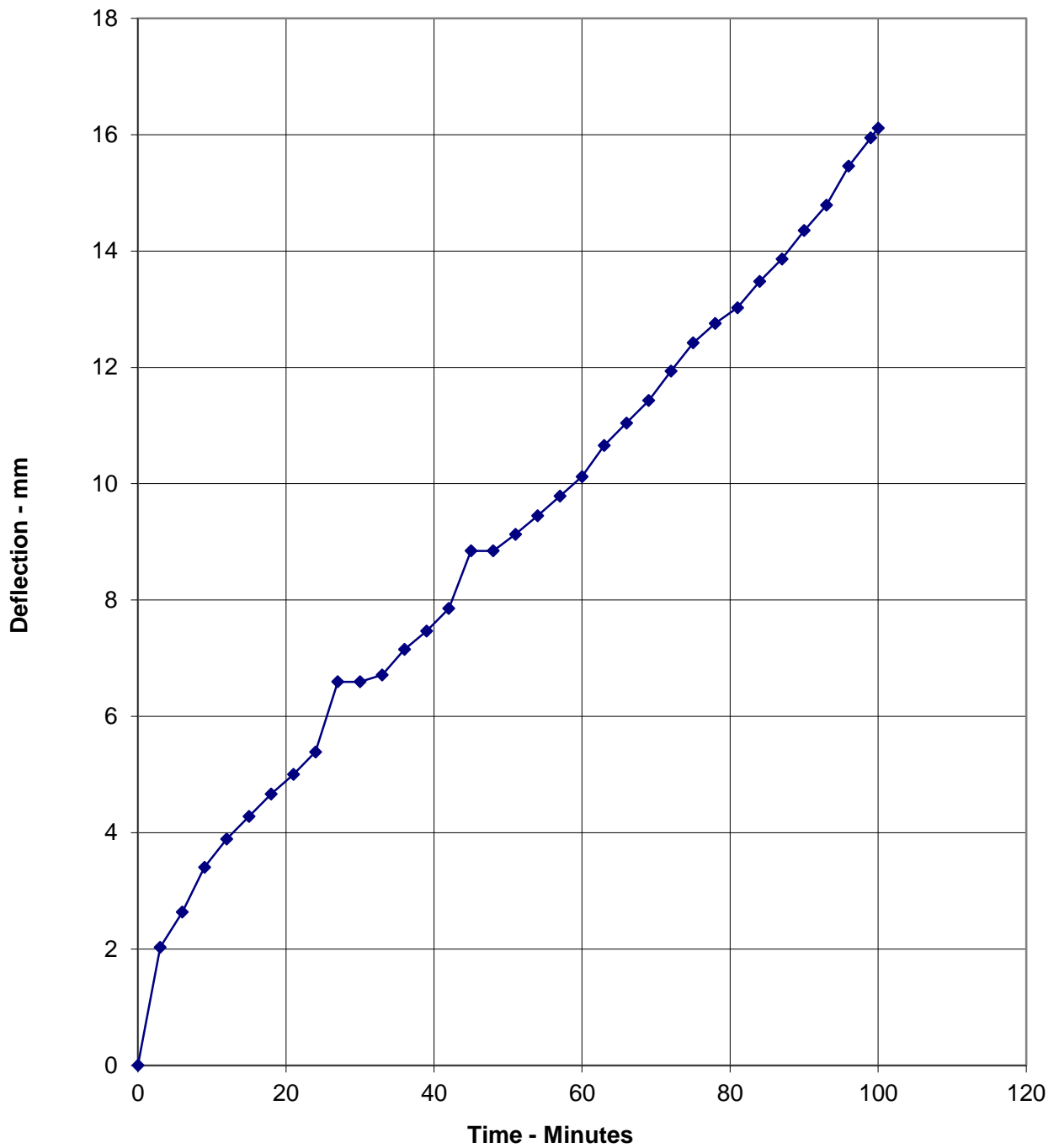
Time Mins	Central Vertical Deflection mm	Rate Of Deflection mm/min
0	0.000	0.000
3	2.031	0.336
6	2.635	0.336
9	3.407	0.117
12	3.894	0.269
15	4.280	0.151
18	4.666	0.101
21	5.002	0.051
24	5.388	0.168
27	6.596	0.050
30	6.596	0.000
33	6.714	0.067
36	7.150	0.168
39	7.469	0.050
42	7.855	0.151
45	8.845	0.000
48	8.845	-0.068
51	9.131	0.067
54	9.450	0.051
57	9.785	0.167
60	10.121	0.218
63	10.658	0.151
66	11.044	0.151
69	11.430	0.151
72	11.934	0.118
75	12.421	0.101
78	12.756	0.117
81	13.025	0.101
84	13.478	0.235
87	13.864	0.168
90	14.351	0.118
93	14.787	0.168
96	15.459	0.286
99	15.945	0.050
100	16.113	0.168

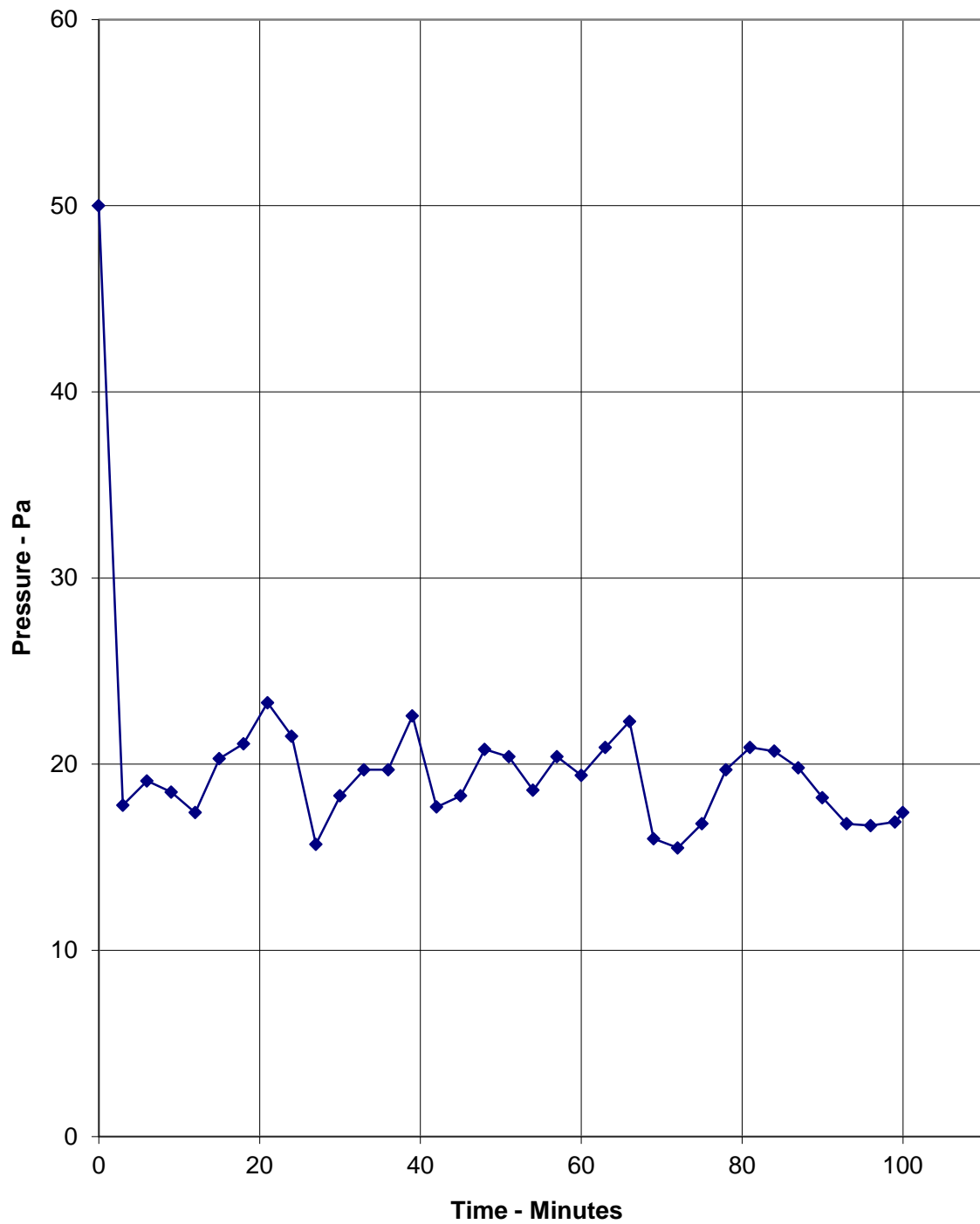
**Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard BS EN 1363-1: 2012**



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



**Graph Showing The Recorded Vertical Deflection and Rate Of Deflection Of The Specimen**

**Graph Showing Recorded Furnace Pressure 100 mm Below The Underside Of The Specimen**

## On-going Implications

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### Limitations

This report details the method of construction, the test conditions and the results obtained when the specific elements of construction described herein were tested following the procedure outlined in BS EN 1363-1: 2012, and where appropriate BS EN 1363-2: 1999. Any significant deviation with respect to size, constructional details, loads, stresses, edge or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report. Annex A of BS EN 1363-1: 2012, provides guidance information on the application of fire resistance tests and the interpretation of test data.

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.

**This report supersedes Issue 1 of report 423750, dated 5<sup>th</sup> May 2020.**

### EGOLF

Certain aspects of some fire test specifications are open to different interpretations. 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

## Field of Direct Application

The results are directly applicable to a similar untested floor construction provided the following is true:

**a) With respect to the structural building member:**

The maximum moments and shear forces, which when calculated on the same basis as the test load, shall not be greater than those tested.

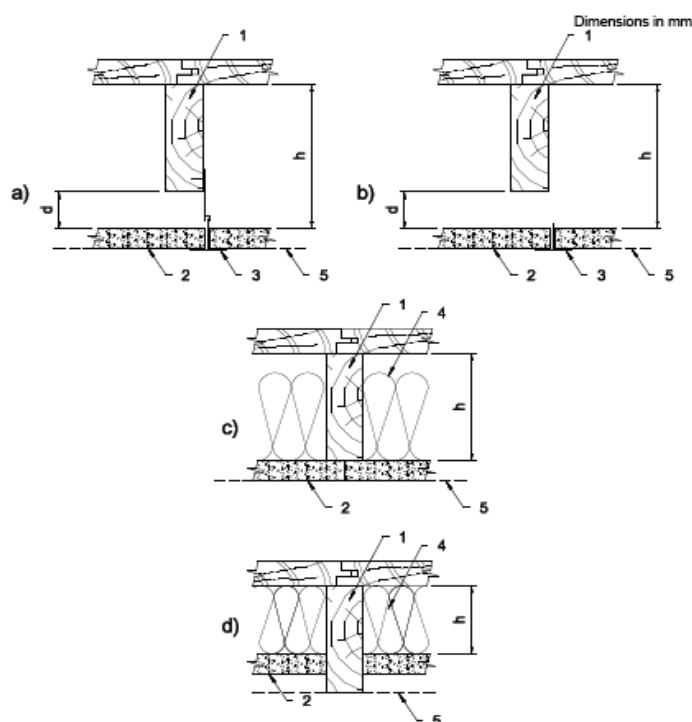
**b) With respect to the ceiling system:**

The size of panels of the ceiling lining may be increased by a maximum of 5 % but limited to a maximum of 50 mm. The length of the grid members can be increased accordingly.

The total area occupied by fixtures and fittings relative to the area of the ceiling lining is not increased and the maximum tested opening in the lining is not exceeded.

**c) With respect to the cavity:**

The height of the cavity 'h' and the minimum distance 'd' between the ceiling and the structural members (see Figure below) are equal to or greater than those tested.



### KEY

- |  |   |
|--|---|
| a) suspended ceiling                                     | 4 insulation                                      |
| b) self-supported ceiling                                | 5 pressure reference line                         |
| c) and d) direct fixed ceiling with insulation in cavity | d distance between ceiling and structural members |
| 1 supporting construction (joist)                        | h height of cavity                                |
| 2 ceiling lining   |   |
| 3 supporting frame                                       |   |