

**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:**

9<sup>th</sup> February 2020

**Issue 2:**

4<sup>th</sup> June 2020

**WF Report No.**

416099



**Prepared for:**

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

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0249

**This report supersedes Issue 1  
of report 416099, dated 5<sup>th</sup> May  
2020.**

# Test Specimen

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## Summary of Tested Specimen

The timber floor assembly had overall nominal dimensions of 4490 mm long by 2960 mm wide by 269 mm deep. It comprised C16 timber joists 45 mm by 222 mm at 600 mm centres. The unexposed surface of the floor comprised nominally 22 mm thick tongue and grooved chipboard flooring screw fixed and glued to the top chord of the timber joist. The floor assembly was protected on its exposed face by a direct fixed ceiling, formed from two layers of 12.5 mm thick British Gypsum Wall Board 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 1.22kN/m<sup>2</sup>. This load was provided by the test sponsor as to represent the expected working load for the timber floor construction in practice.

*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

<b>Loadbearing Capacity</b>	The limiting deflection and the limiting rate of deflection for the specimen, as specified by the Standard, are calculated as:										
<table border="1"> <thead> <tr> <th>Criteria</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>(L) Length of clear span, <i>in mm</i></td> <td>4200</td> </tr> <tr> <td>(d)Depth of Structural Section, <i>in mm</i></td> <td>222</td> </tr> <tr> <td>Max Deflection (<math>L^2/400d</math>) - <i>in mm</i></td> <td>198.6</td> </tr> <tr> <td>Rate (<math>L^2 / 9000d</math>) - <i>in mm</i></td> <td>8.8</td> </tr> </tbody> </table>		Criteria	Value	(L) Length of clear span, <i>in mm</i>	4200	(d)Depth of Structural Section, <i>in mm</i>	222	Max Deflection ( $L^2/400d$ ) - <i>in mm</i>	198.6	Rate ( $L^2 / 9000d$ ) - <i>in mm</i>	8.8
Criteria	Value										
(L) Length of clear span, <i>in mm</i>	4200										
(d)Depth of Structural Section, <i>in mm</i>	222										
Max Deflection ( $L^2/400d$ ) - <i>in mm</i>	198.6										
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 68 minutes at which time the test was discontinued.											
<b>Integrity</b>	<p>It is required that the specimen retains its separating function, without:</p> <ul style="list-style-type: none"> <li>▪ causing ignition of a cotton pad when applied</li> <li>▪ permitting the penetration of a gap gauge as specified in BS EN 1363-1: 2012</li> <li>▪ sustained flaming on the unexposed surface</li> <li>▪ subsequent failure of loadbearing capacity</li> </ul> <p><b>These requirements were satisfied for the periods shown below:</b></p>										
<b>Sustained flaming</b>	68 minutes*										
<b>Gap gauge</b>	68 minutes*    No failure*										
<b>Cotton pad</b>	68 minutes*										
<b>Insulation</b>	<p>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.</p> <p><b>These requirements were satisfied for the period shown below:</b></p>										
68 minutes    No failure*											
*Test was discontinued after a period of 68 minutes.											
<b>Date of Test</b>	9 <sup>th</sup> February 2020										

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## Signatories

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Responsible Officer <b>C. Hoyle*</b> Technical Officer


Approved <b>D. Whittle*</b> Technical Officer


Head of Department <b>S. Hankey*</b> 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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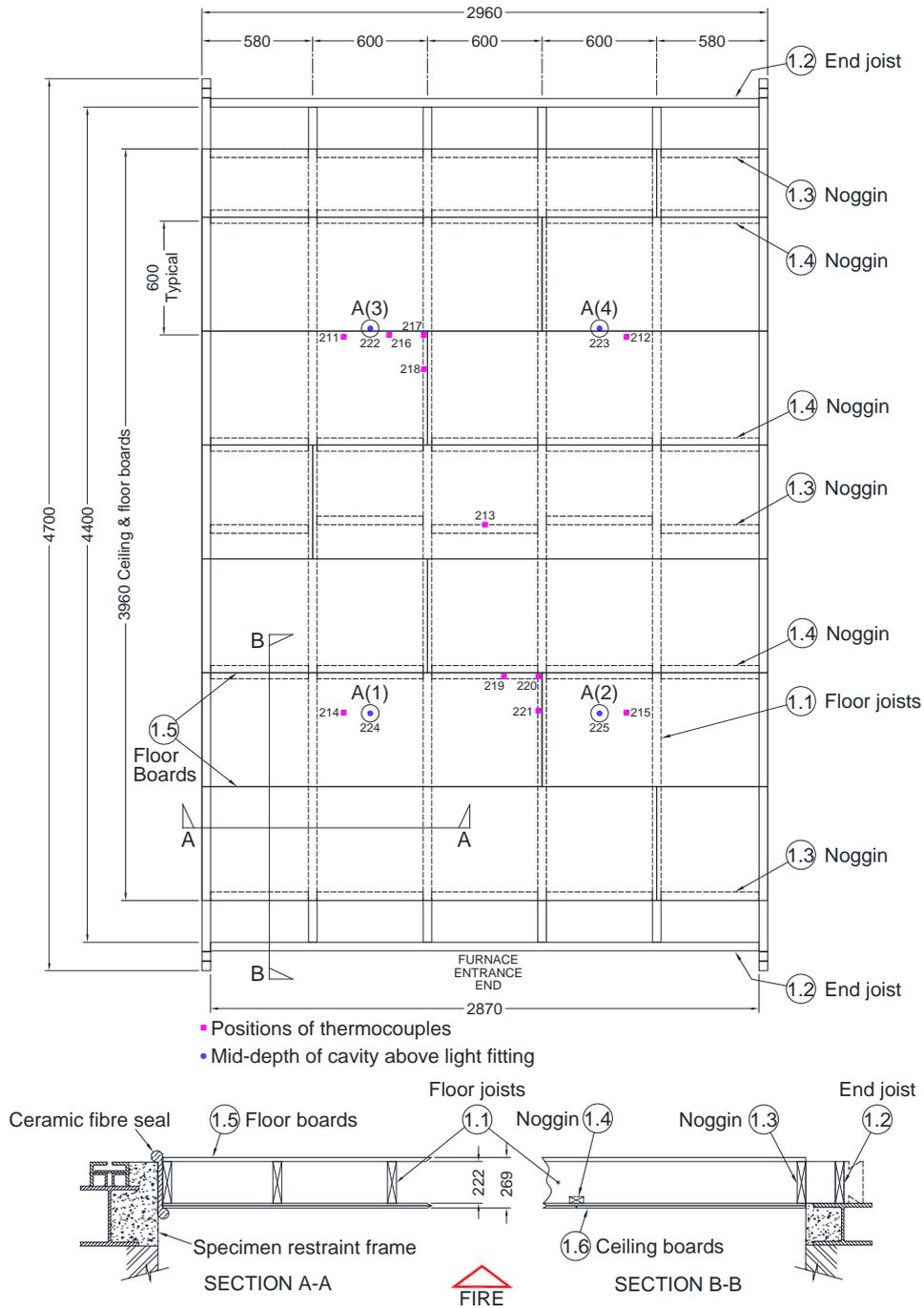
# Test Conditions

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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 28 January 2020 and 30 January 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 13 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 9°C to 24.5°C and 39% to 63% respectively.</p>
<b>Instruction to Test</b>	<p>The test was conducted on the 09 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 no variation 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 unexposed 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>

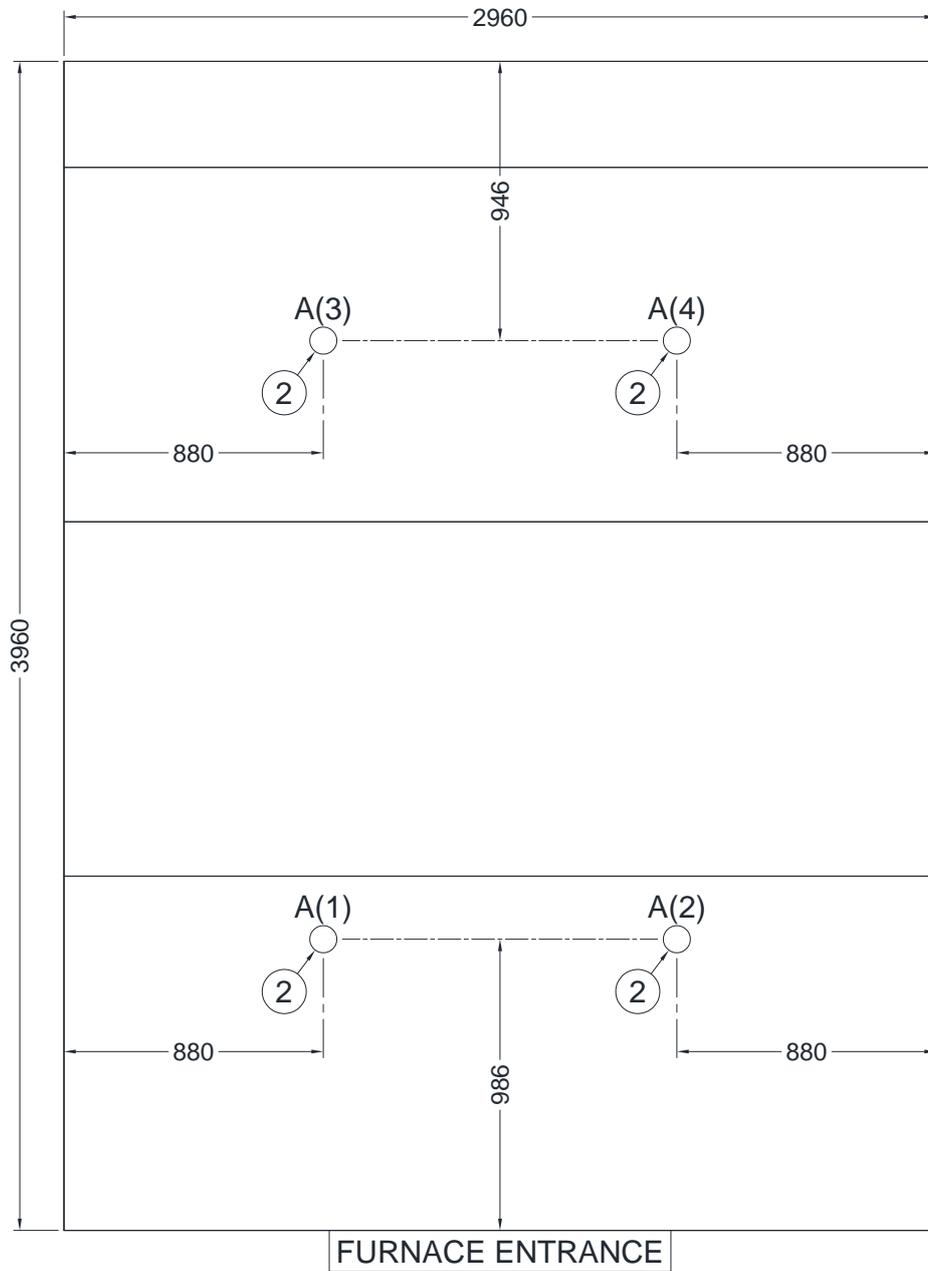
# Test Specimen

**Figure 1- Plan View of Test Specimen**



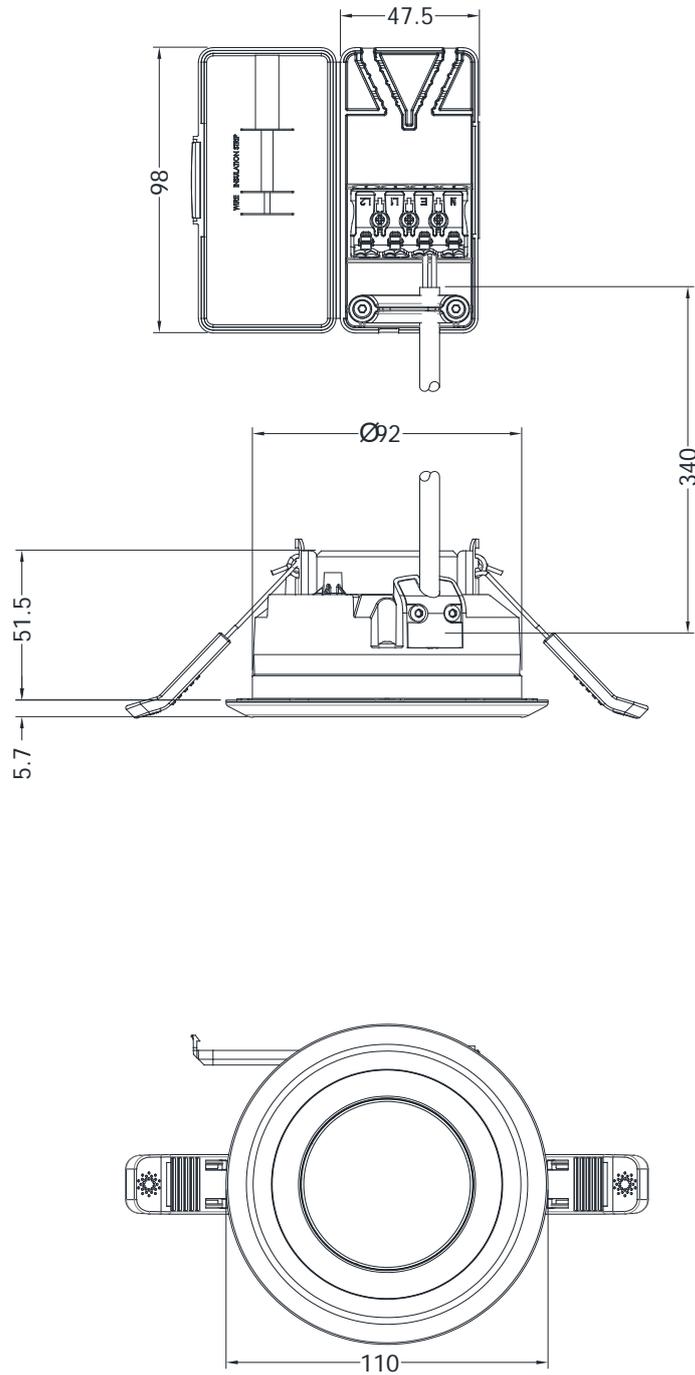
Do not scale. All dimensions are in mm

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



Do not scale. All dimensions are in mm

**Figure 3 – Details of Down lighters A(1, 2, 3 & 4)**



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>	
<b>1.1 Floor Joists</b>	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C16, to BS EN 519
Density	: 524.11 kg/m <sup>3</sup> , measured
Size	: 45.6 mm x 222 mm x 4400 mm long
Joist centres	: 600 mm
<b>1.2 End Joist</b>	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C16, to BS EN 519
Density	: 524.1 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
<b>1.3 Noggins (Section of Floor Joist)</b>	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 524.1 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
<b>1.4 Noggins</b>	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m <sup>3</sup> , measured
Size	: 65 mm x 45 mm
Joist centres	: 1200 mm
Fixing	: Fitted between floor joists and fixed with fired nails. Please see Figure 1 for positions
<b>1.5 Floor Boards</b>	
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

<u>Item</u>	<u>Description</u>
<b>1. Timber Floor (Continued)</b>	
1.6 Ceiling Boards	
Manufacturer	: British Gypsum
Reference	: Gyproc Wall Board
Material	: Type A gypsum
Density	: 842 kg/m <sup>3</sup> , measured
Thickness	: 25 mm, 2 off layers of 12.5 mm thick
Fixing method	: The boards were screw fixed in a two layers to the soffit of the joists. The joints in the second layer were staggered with respect to those of the first layer and were paper taped and skimmed with Gyproc Joint Compound
Fixings for the first layer	
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	
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
<b>2. Specimen A (1-4)</b>	
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

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Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	
-60	00	Test load applied
00	00	<b>The test commences.</b>
06	19	When viewed from the exposed face the paper lining on the surface of the board has blackened in colour.
11	24	Slight steam/smoke release observed from the perimeter edges of the specimen.
13	37	When viewed from the exposed face the paper has blackened in colour the plaster scrim along all joints has cracked and become loose. Light fitting in location below Thermocouple 222 and 224 have fallen away from the ceiling unable to observe light fittings in location below Thermocouple 223 light fitting in location below 225 has also detached and fallen away from the ceiling.
16	55	When viewed from the exposed face the plastic tape and trim has detached from along the joints.
22	00	When viewed from the exposed face the joints have blackened in colour and the gap between the boards has started to widen.
24	00	No significant visible change.
30	00	When viewed from the exposed face the joints continue to blacken in colour along all joints, flaming observed from the aperture below Thermocouple 224, 225 surface of the ceiling glowing orange in colour.
32	00	Specimen maintains load bearing integrity and insulation criteria.
35	00	No significant visible change.
40	00	When viewed from the exposed face no significant visible change.
43	00	When viewed from the exposed face the surface of the ceiling radiates a bright orange colour, all boards remain in place, no sagging observed along lateral a longitude edges.
50	00	No significant visible change.
55	00	No significant visible change.
60	00	Specimen maintains load bearing integrity and insulation.
68	00	<b>Test discontinued at client request.</b>

## Test Photographs

The unexposed face of the floor assembly prior to test



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 68 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	33
2	445	428
4	544	563
6	603	579
8	646	649
10	678	677
12	706	702
14	728	731
16	748	746
18	766	761
20	781	781
22	796	796
24	809	810
26	820	820
28	832	831
30	842	840
32	852	849
34	860	858
36	869	866
38	877	873
40	885	882
42	892	893
44	899	901
46	906	908
48	912	915
50	918	923
52	924	928
54	930	935
56	935	941
58	940	947
60	945	952
62	950	957
64	955	963
66	960	968
68	964	966

**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	16	14	16	17	19	16
2	16	14	16	17	19	16
4	16	14	16	17	19	16
6	16	14	16	17	19	16
8	16	14	16	17	19	16
10	16	14	16	17	19	16
12	16	*	16	18	20	18
14	18	*	16	19	21	19
16	19	*	17	20	22	20
18	20	*	17	22	24	21
20	22	*	18	24	25	22
22	24	*	18	25	27	24
24	26	*	19	27	28	25
26	28	*	20	28	30	27
28	29	*	20	29	31	27
30	31	*	21	30	33	29
32	32	*	22	32	34	30
34	34	*	23	33	35	31
36	35	*	24	34	37	33
38	37	*	25	35	38	34
40	38	*	26	36	39	35
42	39	*	28	37	40	36
44	40	*	29	38	41	37
46	41	*	31	39	42	38
48	42	*	32	40	43	39
50	43	*	32	41	44	40
52	44	*	34	42	45	41
54	45	*	35	43	46	42
56	46	*	35	44	47	43
58	48	*	36	45	49	45
60	51	*	37	47	51	47
62	54	*	38	50	55	49
64	59	*	39	53	59	53
66	63	*	39	57	64	56
68	68	*	40	62	69	60

\*Thermocouple malfunction

**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	19	19	16	20	20	19
2	19	19	16	20	20	19
4	19	19	16	20	20	19
6	19	19	16	20	20	19
8	19	19	16	20	20	19
10	19	19	16	20	20	19
12	19	19	16	20	20	19
14	20	19	16	21	20	19
16	21	19	*	21	20	19
18	23	20	*	22	21	19
20	24	21	*	23	21	19
22	26	21	*	25	22	19
24	28	22	*	26	23	20
26	30	23	*	27	24	20
28	32	24	*	29	25	20
30	34	26	*	30	26	22
32	37	27	*	32	27	22
34	40	29	*	34	28	21
36	43	31	*	36	29	22
38	45	33	*	38	30	21
40	47	34	*	41	31	22
42	48	36	*	43	32	24
44	49	38	*	45	33	22
46	50	39	*	47	34	22
48	51	41	*	48	35	24
50	52	42	*	50	36	25
52	52	43	*	51	37	23
54	53	45	*	52	38	25
56	54	46	*	53	38	25
58	55	47	*	54	39	25
60	57	49	*	56	40	26
62	58	49	*	58	41	25
64	60	51	*	60	42	25
66	62	53	*	63	43	26
68	64	55	*	65	44	26

\*Thermocouple malfunction

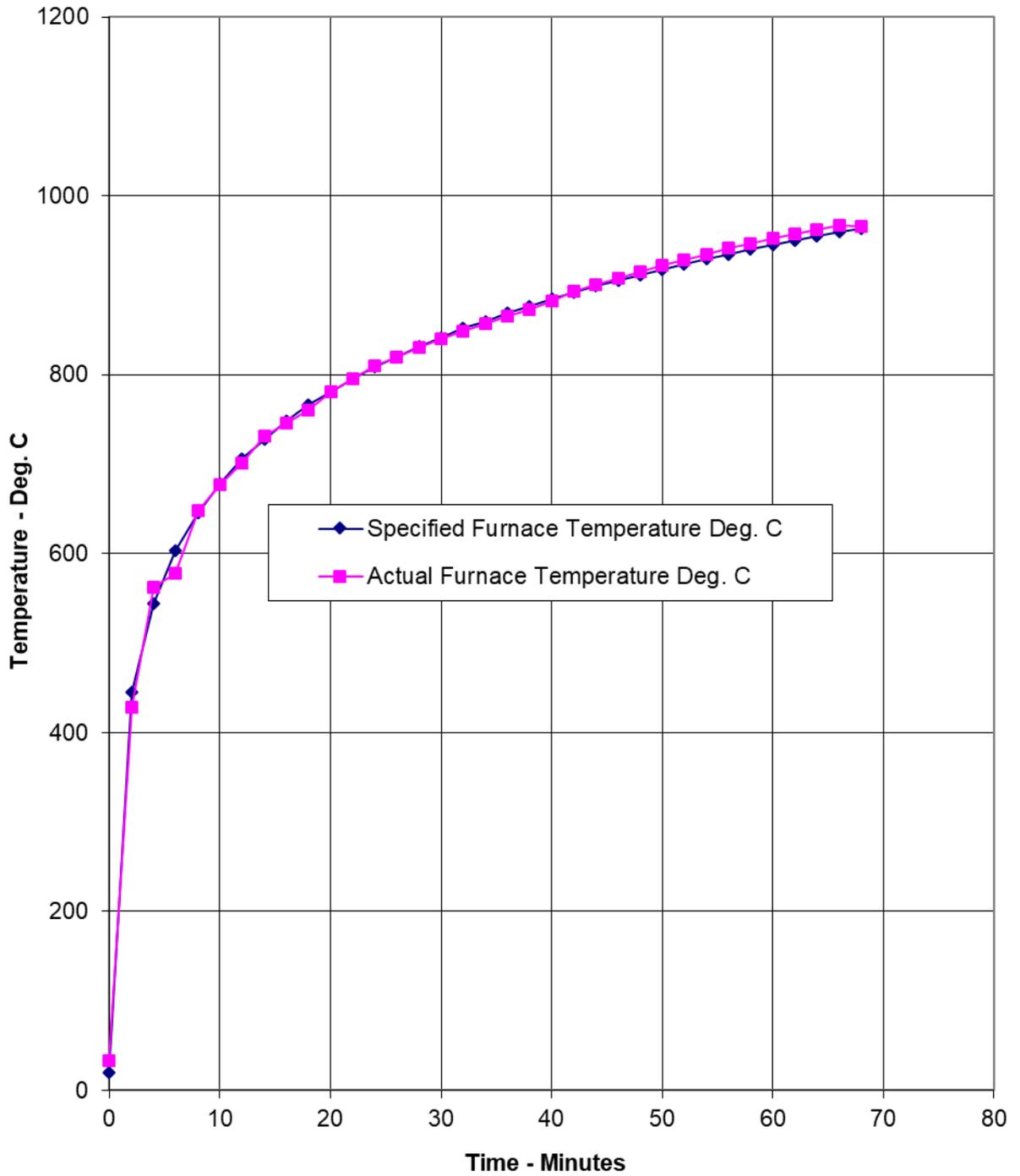
**Individual Temperatures Recorded At Mid-Height Of The Cavity Coincidental With The Light Fittings A(1) A(2) A(3) A(4)**

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	22	22	22	22
2	22	22	22	22
4	24	42	43	26
6	39	50	59	42
8	58	70	64	61
10	65	70	76	68
12	77	81	88	75
14	90	83	93	80
16	94	90	91	87
18	96	92	94	90
20	98	95	101	95
22	111	106	123	98
24	107	104	139	99
26	108	116	134	108
28	110	121	145	110
30	140	130	139	107
32	126	142	145	109
34	138	152	145	113
36	120	158	147	115
38	115	147	118	114
40	114	135	112	112
42	116	121	113	113
44	119	116	116	116
46	126	120	120	122
48	135	125	128	131
50	150	138	143	147
52	171	153	165	170
54	192	174	184	185
56	209	191	202	200
58	220	208	218	210
60	232	220	230	219
62	242	232	243	230
64	253	240	253	239
66	264	250	264	250
68	274	259	274	260

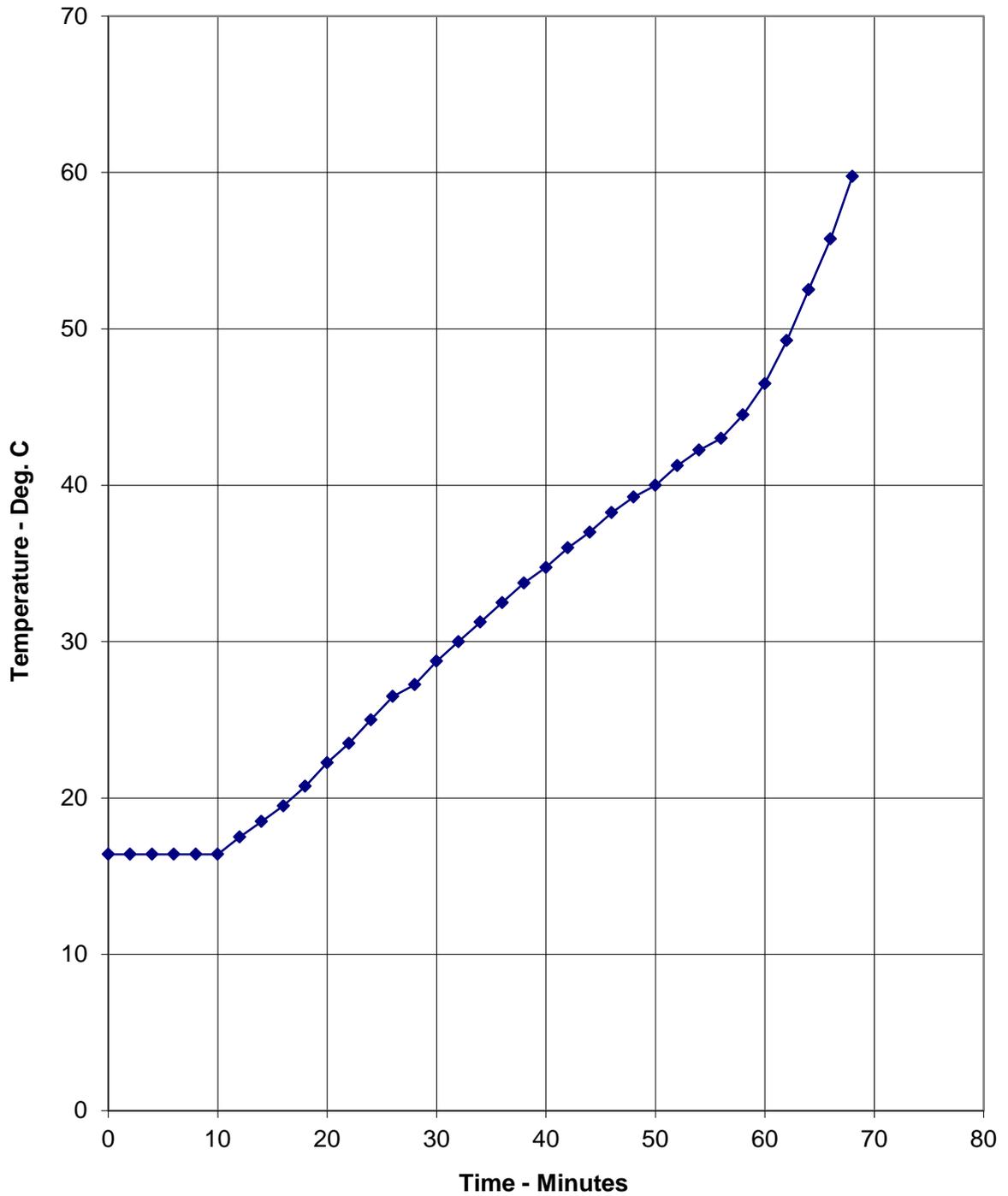
**Central Vertical Deflection Of The Specimen**

Time Mins	Central Vertical Deflection mm	Rate Of Deflection mm/min
0	0.000	0.000
2	2.216	0.336
4	2.820	0.453
6	3.089	0.118
8	3.357	0.101
10	3.307	0.000
12	3.307	0.000
14	3.357	-0.067
16	3.525	0.050
18	3.743	0.101
20	3.961	0.100
22	4.079	0.000
24	4.415	0.068
26	4.683	0.117
28	5.623	0.285
30	6.060	0.118
32	6.664	0.336
34	7.436	0.285
36	8.208	0.453
38	8.695	0.101
40	9.366	0.235
42	10.071	0.487
44	10.625	0.285
46	11.330	0.269
48	11.716	0.218
50	12.438	0.386
52	13.042	0.386
54	13.646	0.268
56	14.469	0.218
58	15.459	0.554
60	16.449	0.436
62	17.608	0.487
64	19.202	0.873
66	20.629	0.772
68	22.391	0.772

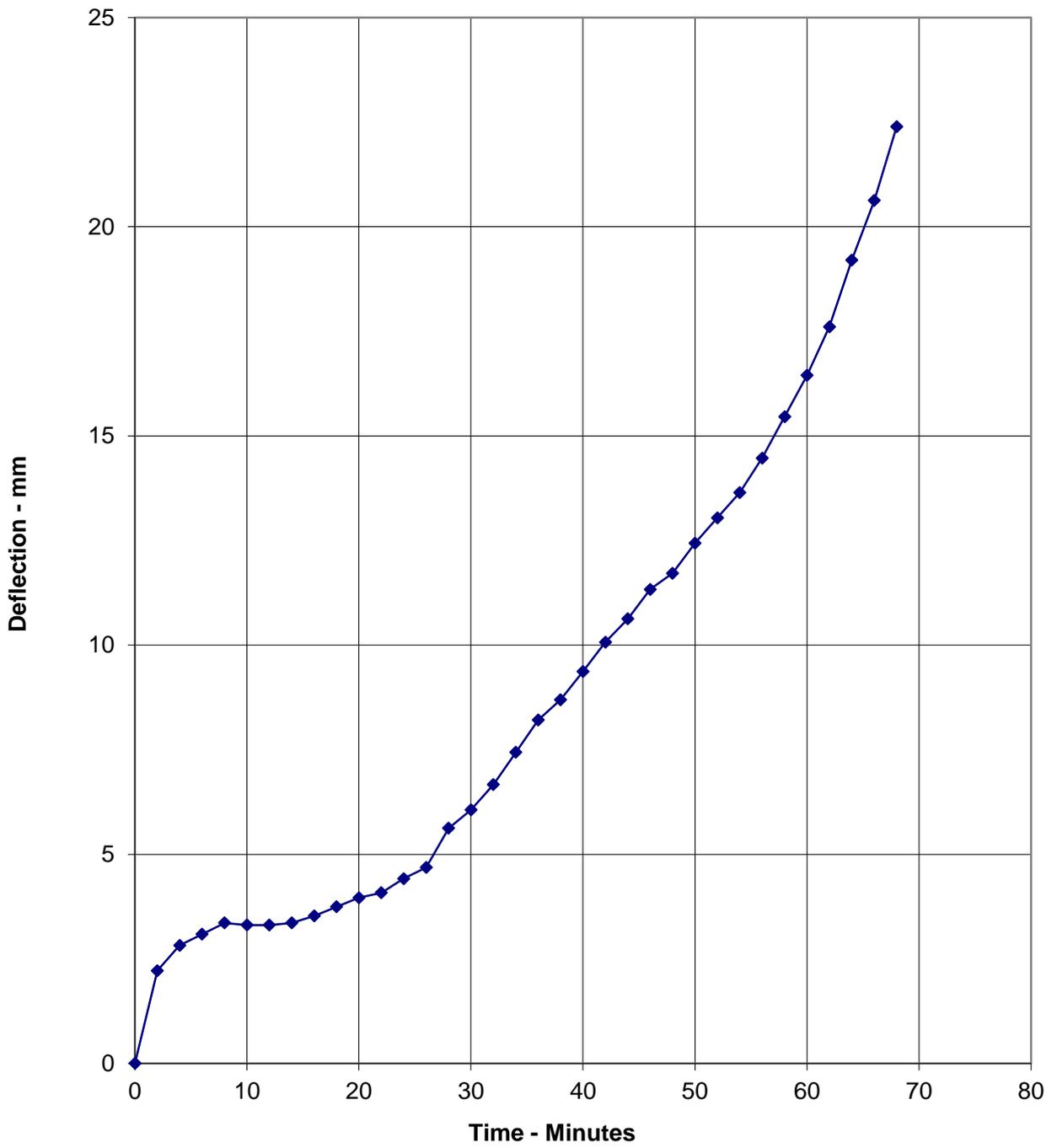
**Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard BS EN 1363-1: 2012**



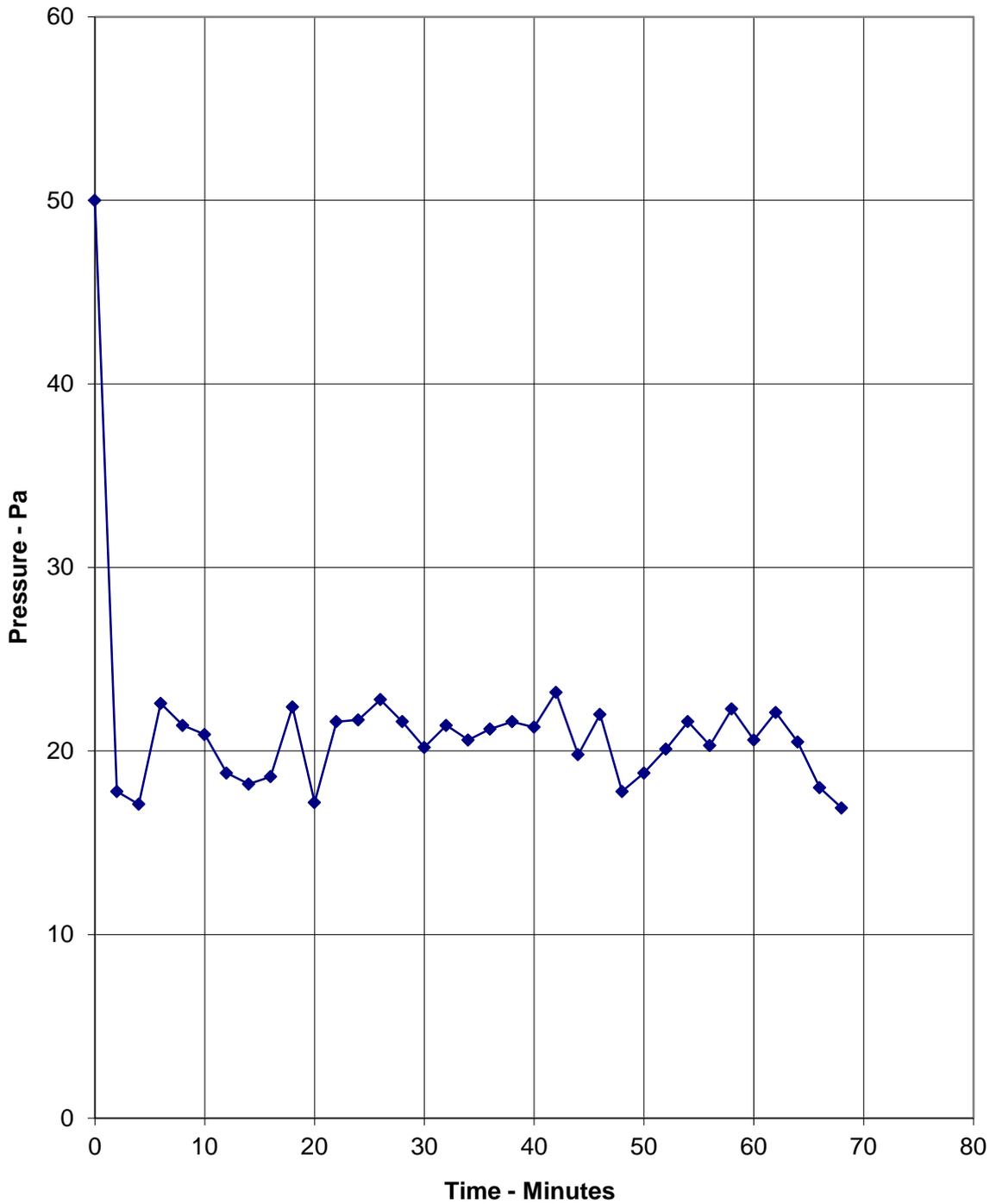
**Graph Showing Mean Temperature Recorded On The Unexposed Surface Of The Specimen**



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 416099, 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.

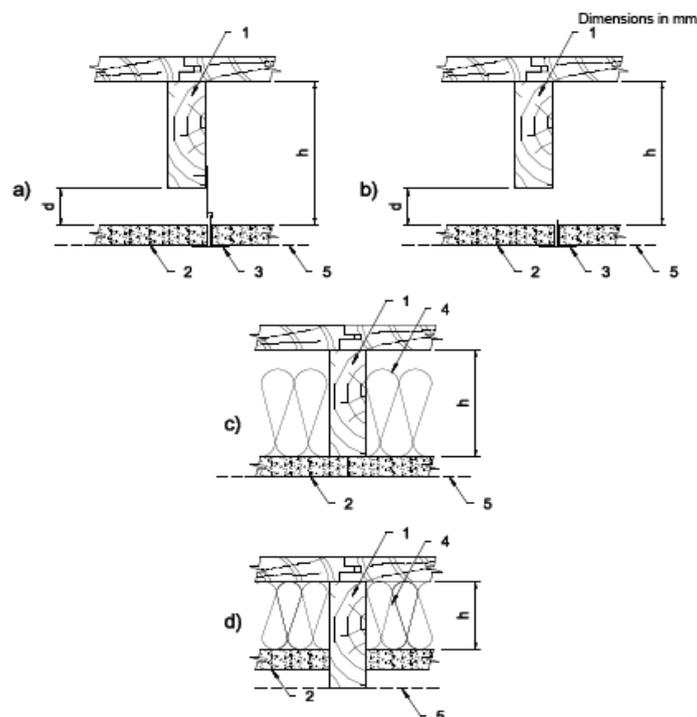
**b) With respect to the ceiling system:**

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

b) self-supported ceiling

c) and d) direct fixed ceiling with insulation in cavity

1 supporting construction (joist)

2 ceiling lining

3 supporting frame

4 insulation

5 pressure reference line

d distance between ceiling and structural members

h height of cavity