

Title:

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

Date of Test:

19th February 2020

Issue 2:

4th June 2020

WF Report No.

423749



Prepared for:

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

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**This report supersedes Issue 1
of report 423749, dated 1st May
2020.**

Test Assembly

Summary of Tested Specimen

The timber floor assembly had overall nominal dimensions of 4500 mm long by 2960 mm wide by 262 mm deep. It comprised 'MITEK 72 mm by 225 mm Posi-joists at 600 mm centres. The upper 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 a single layer of 15 mm thick British Gypsum Wall Board plasterboard to EN 520 standard.

The ceiling incorporated four downlighter fittings with a model reference of Lumi Plugin LP110.

The floor supported a uniformly distributed load of 1.5 kN/m². 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

Loadbearing Capacity	The limiting deflection and the limiting rate of deflection for the specimen, as specified by the Standard, are calculated as:								
<table border="1"> <tr> <td>(d) Depth of structural section, mm</td> <td>225</td> </tr> <tr> <td>(L) Length of clear span, mm</td> <td>4200</td> </tr> <tr> <td>Limiting deflection, mm</td> <td>196</td> </tr> <tr> <td>Limiting rate of deflection, mm/sec</td> <td>8.7</td> </tr> </table>		(d) Depth of structural section, mm	225	(L) Length of clear span, mm	4200	Limiting deflection, mm	196	Limiting rate of deflection, mm/sec	8.7
(d) Depth of structural section, mm	225								
(L) Length of clear span, mm	4200								
Limiting deflection, mm	196								
Limiting rate of deflection, mm/sec	8.7								
The allowable rate of deflection criteria is not applicable for the first 10 minutes of the test. This criterion was satisfied for 34 minutes.									
Integrity	<p>It is required that the specimen retains its separating function, without:</p> <ul style="list-style-type: none"> ▪ 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 <p>These requirements were satisfied for the periods shown below:</p>								
Sustained flaming	34 minutes*								
Gap gauge	34 minutes*								
Cotton pad	34 minutes*								
Insulation	<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>These requirements were satisfied for the period shown below:</p> <p>34 minutes No failure*</p> <p>*Test was discontinued after a period of 34 minutes.</p>								

Date of Test 19th February 2020

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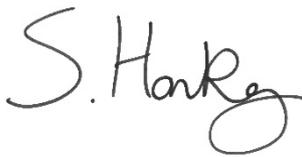
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* For and on behalf of **Warringtonfire**.

Report Issued: 1st May 2020

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Revision History

Issue No: 2	Re-issue Date: 4 th June 2020
Revised By: W. Drazkiewicz	Approved By: D. Fitzsimmons
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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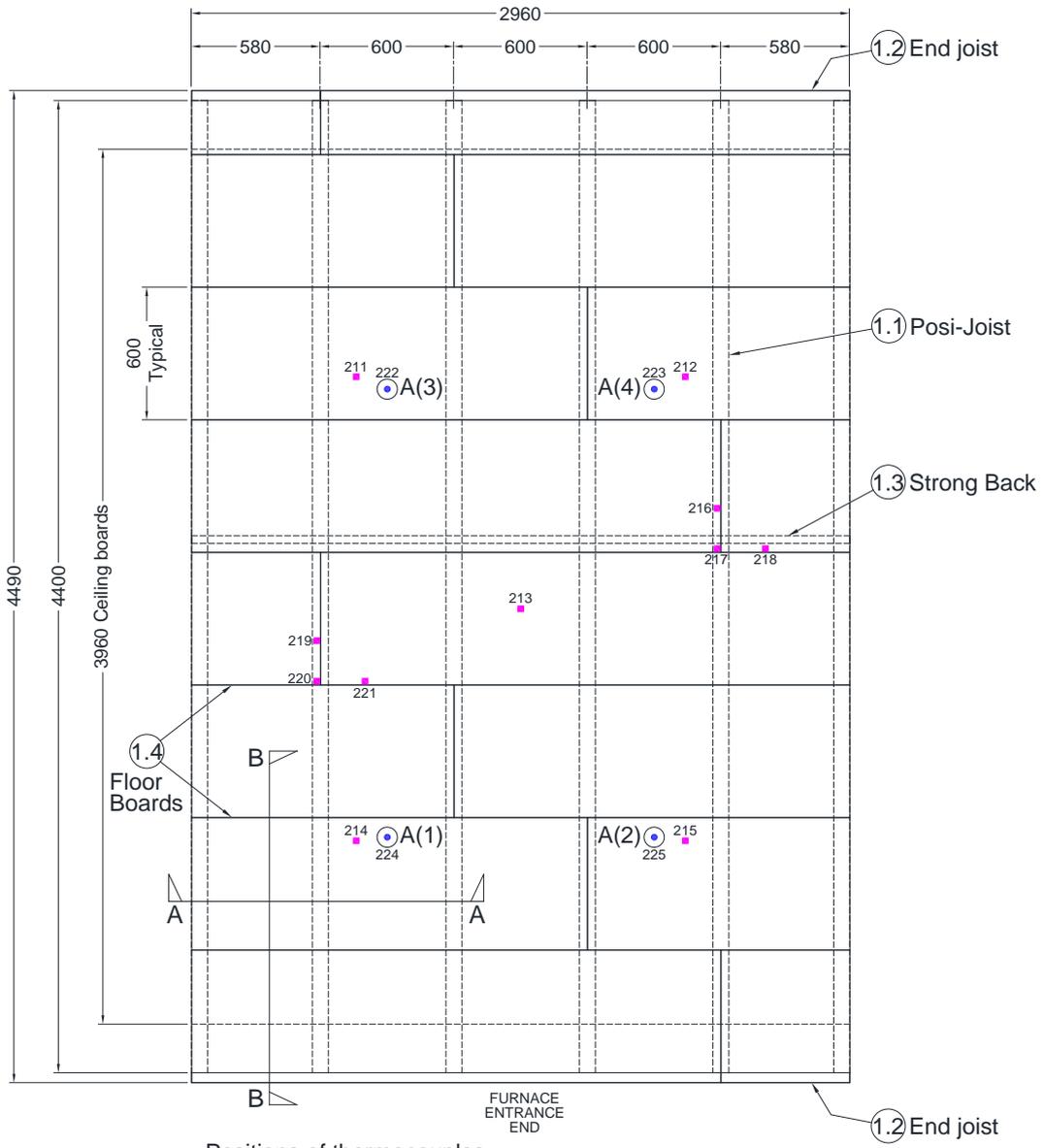
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Test Conditions

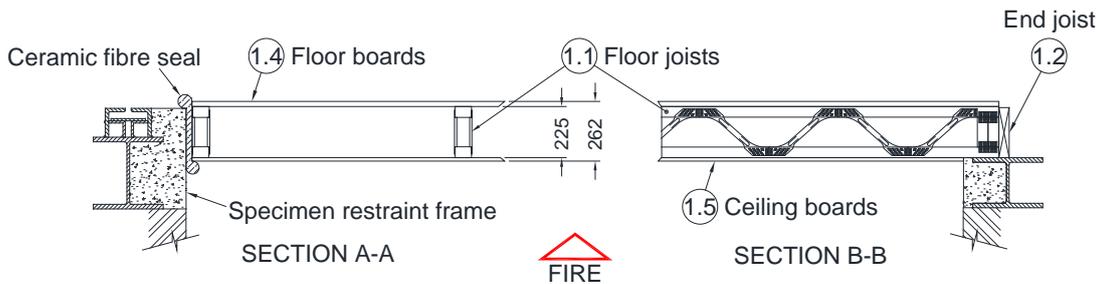
Standard	<p>BS EN 1365-2: 2014, 'Fire resistance tests for loadbearing elements – Part 2: Floors and Roofs'.</p> <p>The purpose of the test was to evaluate the performance of a timber floor construction protected by a ceiling of known fire resistance, when incorporating downlighter fitting assemblies.</p>
Sampling	<p>Warringtonfire 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>
Installation	<p>Representatives of Warringtonfire assembled the floor construction and installed the downlighters between the 12th February 2020 and the 14th February 2020.</p>
Conditioning	<p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of eight 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 39.5% to 74.5% respectively.</p>
Instruction to Test	<p>The test was conducted on the 19 February 2020 at the request of Sleep Safe System Ltd T/A Lumi-Plugin, the test sponsor.</p> <p>Mr. B. Ward a representative of the test sponsor witnessed the test.</p>
Ambient Temperature	<p>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 +1°C during the test.</p>
Furnace	<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>
Thermocouples	<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>
Application of the load	<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>
Loadbearing Capacity Criteria	<p>A linear deflection transducer was provided at the approximate centre on the unexposed surface of the specimen to record its vertical deflection.</p>
Furnace Pressure	<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

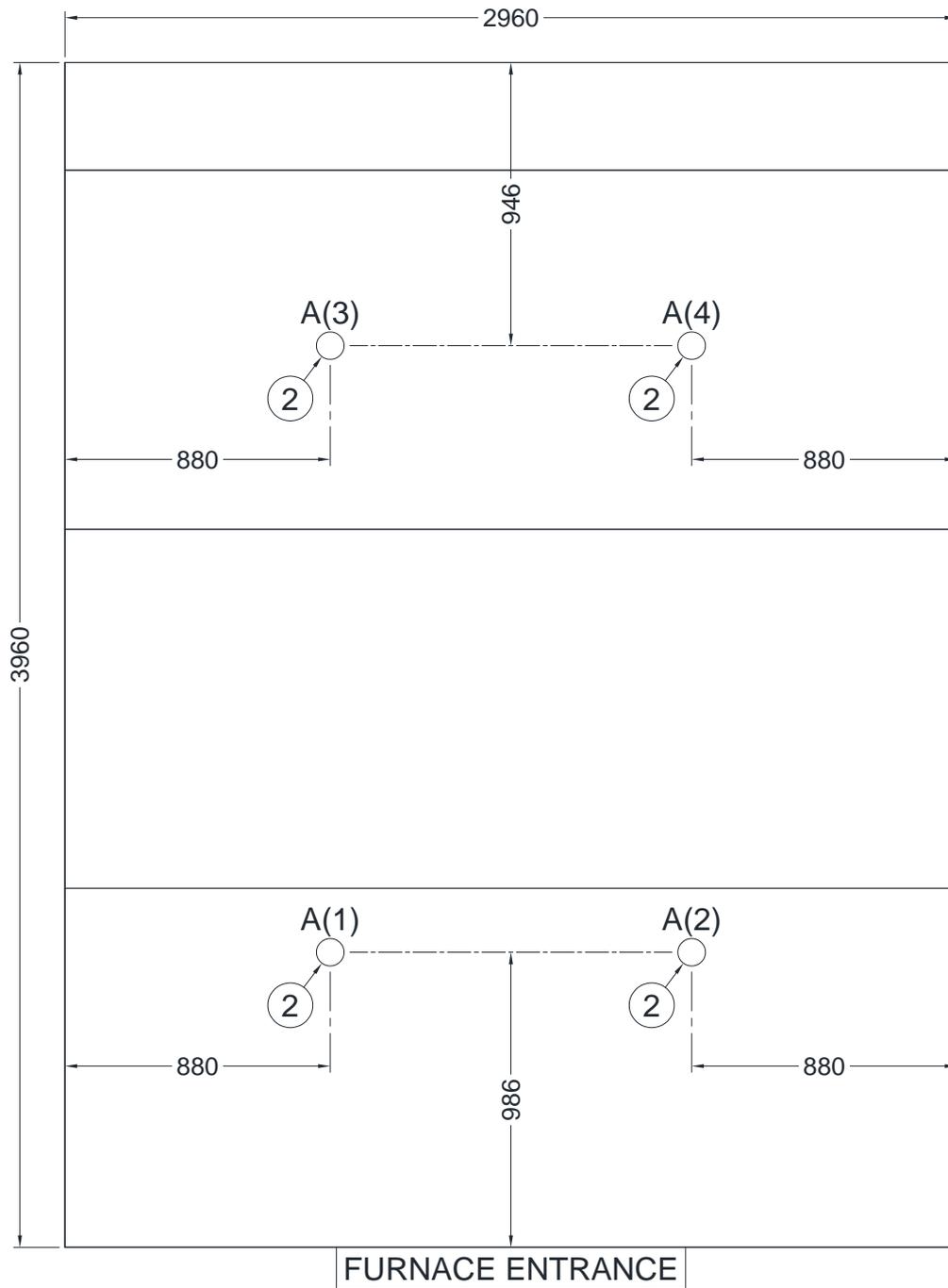


- Positions of thermocouples
- Mid-depth of cavity above light fitting



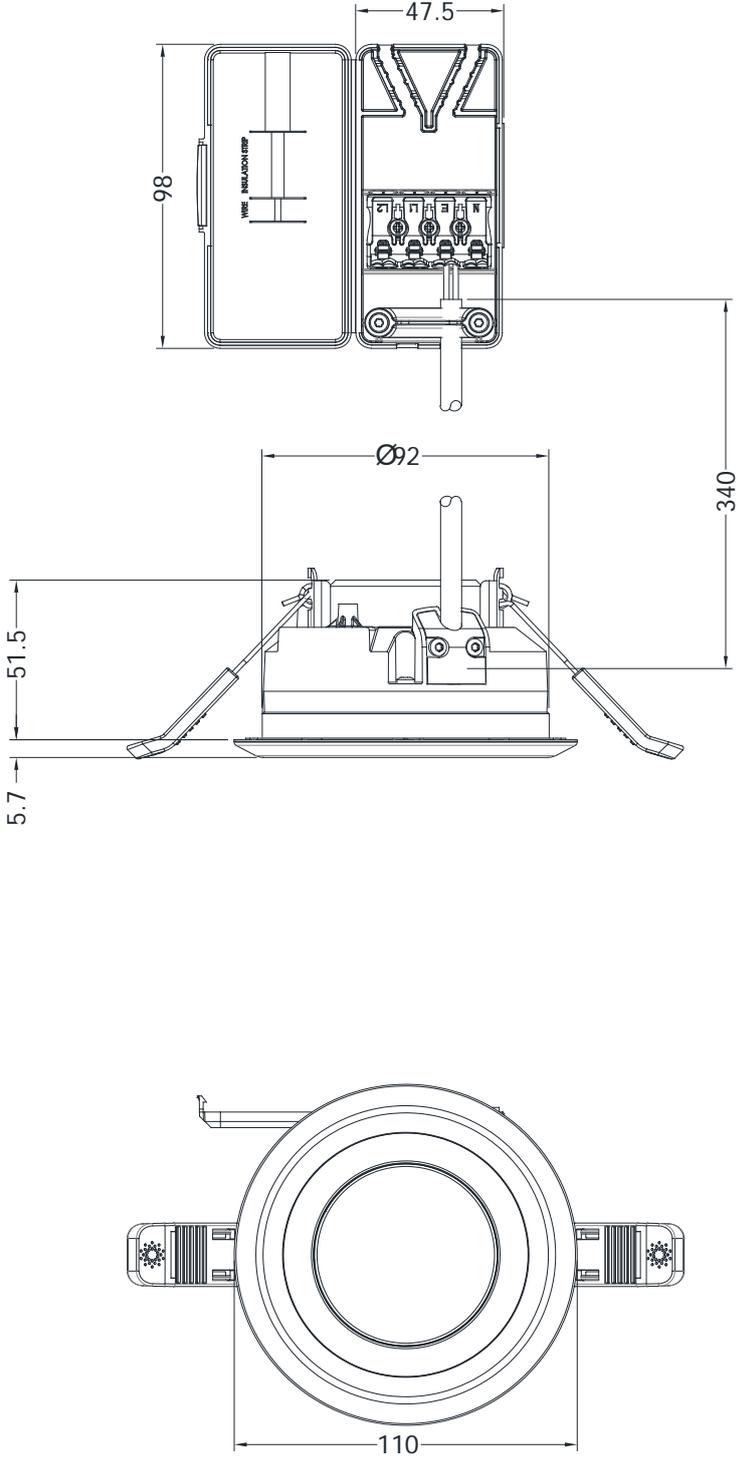
Do not scale. All dimensions are in mm

Figure 2 – Details of Downlighter Positions



Do not scale. All dimensions are in mm

Figure 3 – Details of Downlighters



Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 3)

(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Timber Floor	
1.1. Posi-Joists	
Assembled joist size	: 72 mm wide x 225 mm deep x 4400 mm long
Top and bottom chords	
i. material	: TR26 grade European whitewood
ii. density	: 450 kg/m ³ , stated
iii. cross section	: 72 mm horizontal x 48 mm vertical x 4400 mm long
End and Internal Blocks	
i. material	: TR26 grade European whitewood
ii. density	: 450 kg/m ³ , stated
iii. cross section	: 72 mm x 48 mm x 129 mm
Metal Webs	
i. reference	: Mitek PS9 webs
ii. material	: Galvanised mild steel
iii. section size	: 206 mm high x 302.5 mm long x 1 mm thick, 12 off each side of joist
iv. fixing method	: Fitted between top and bottom chords and fixed via integral nailplate
1.2. End Joists	
Material	: British home-grown, rough sawn softwood, kiln dried
Grade	: C16, to BS EN 519
Density	: 375 kg/m ³
Size	: 45 mm wide x 220 mm deep x 2960 long
Fixing method	: Fitted across the ends of the posi-joists and through screwed to the top and bottom chords of each joist
1.3. Strong Back	
i. material	: TR26 grade European whitewood
ii. density	: 450 kg/m ³ , stated
iii. cross section	: 35 mm wide x 94.4 mm high x 2960 mm long
iv. fixing method	: Fitted at 90° to joists and screwed to an internal block near mid-span using 2 off 90mm long 5mm diameter screws per joist
1.4. Floor Boards	
Material	: Flooring grade tongue and groove chipboards
Reference	: FSC E1 P5
Density	: 685 kg/m ³
Thickness	: 22 mm
Size	: 600 mm wide
Fixing	: Fitted in a single layer and bonded to the top chords of each joist and the top of the end joists as well as in the tongue and groove of adjoining boards. Also, fixed with 64.3 mm long x 4.4 mm diameter countersunk steel screws to floor joists at 300 mm centres

<u>Item</u>	<u>Description</u>
1. Timber Floor (Continued)	
1.5. Ceiling Boards	
Manufacturer	: British Gypsum
Reference	: Gyproc Wallboard SE
Density	: 706 kg/m ³
Material	: Type A gypsum complete with strong paper liners
Thickness	: 15 mm thick
Fixing method	: The boards were screw fixed in a single layer to the soffit of the joists. The joints were paper taped and skimmed with Gyproc Joint Compound
Fixing	
i. method	: The boards were screw fixed to the soffit of the joists with all joints staggered
ii. fixings	: 45 mm long x 3.5 mm diameter drywall screws
iii. centres	: 150 mm centres along joints and 150 mm to the perimeter of the ceiling
2. Specimen A (1-4)	
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	: 92mm 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	
-60	00	Load applied.
00	00	The test commences.
05	04	When viewed from the exposed face the paper lining has blackened in colour.
07	00	Steam/smoke release observed being released around the perimeter edge.
08	10	When viewed from the exposed face the plasterboard is radiating a dull orange colour. Flaming is observed from the location of the light fittings.
12	13	When viewed from the exposed face flaming continues from the light fittings aperture. Joints between the boards beginning to widen and slight sagging.
20	00	When viewed from the exposed face flaming now observed only from location below Thermocouple 225. Plasterboard radiates a bright orange colour.
22	56	When viewed from the exposed face the joints between the boards continue to widen and sagging along the edges of the boards continues.
26	46	Steam/smoke release observed from the perimeter edge increasing.
30	00	Specimen continues to maintain loadbearing, integrity and insulation.
34	00	Test discontinued.

Test Photographs

The unexposed face of the floor assembly prior to test



The unexposed face of the floor assembly prior to test



The unexposed face of the floor assembly after 15 minutes of testing



The unexposed face of the floor assembly after 34 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	29
1	349	302
2	445	437
3	502	515
4	544	538
5	576	548
6	603	614
7	626	618
8	646	646
9	663	666
10	678	678
11	693	686
12	706	701
13	717	716
14	728	725
15	739	734
16	748	743
17	757	753
18	766	769
19	774	781
20	781	782
21	789	787
22	796	793
23	802	798
24	809	804
25	815	811
26	820	815
27	826	831
28	832	840
29	837	840
30	842	844
31	847	847
32	852	852
33	856	857
34	860	908

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	17	16	17	18	17	17
1	17	16	17	17	17	17
2	17	16	17	18	17	17
3	17	16	17	18	17	17
4	17	16	17	18	17	17
5	17	16	*	18	17	17
6	17	16	*	18	17	17
7	17	16	*	18	17	17
8	18	16	*	18	17	17
9	18	16	*	18	18	17
10	19	17	*	19	18	17
11	19	18	*	19	19	18
12	20	18	*	20	19	18
13	21	19	*	20	20	18
14	22	20	*	21	20	19
15	23	20	*	22	21	19
16	24	21	*	23	22	20
17	25	22	*	23	23	20
18	25	23	*	24	24	20
19	26	23	*	25	24	21
20	27	24	*	26	25	21
21	28	25	*	27	26	22
22	29	26	*	27	27	22
23	30	27	*	28	28	28
24	31	28	*	29	29	29
25	32	29	*	30	29	30
26	34	30	*	31	30	31
27	36	33	*	32	31	33
28	38	36	*	33	32	35
29	41	40	*	34	34	37
30	45	46	*	35	36	41
31	49	52	*	37	38	44
32	54	58	*	39	42	48
33	58	64	*	41	45	52
34	63	68	*	44	49	56

*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	16	15	16	17	17	17
1	16	15	16	17	17	17
2	16	15	16	17	17	17
3	16	15	15	17	17	17
4	16	15	15	17	17	17
5	16	15	15	17	17	17
6	16	15	15	17	17	17
7	16	15	15	17	17	17
8	16	15	15	17	17	18
9	16	15	15	17	17	18
10	16	15	15	17	17	19
11	16	15	15	18	17	19
12	16	15	15	18	18	20
13	17	15	15	18	18	21
14	17	15	15	18	18	21
15	17	16	15	19	18	22
16	17	16	15	19	19	23
17	18	16	15	20	19	24
18	18	16	16	20	19	25
19	19	16	16	21	20	26
20	19	17	15	21	20	27
21	19	17	16	22	21	28
22	20	17	16	22	21	29
23	20	17	16	22	21	30
24	21	18	16	23	22	30
25	21	18	16	23	22	31
26	21	18	17	24	23	32
27	22	19	17	24	23	33
28	*	19	15	25	24	35
29	24	19	15	26	24	36
30	24	20	15	26	25	39
31	25	22	16	27	25	42
32	25	24	17	27	26	45
33	26	25	18	28	27	48
34	27	27	17	29	27	52

*Thermocouple malfunction

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

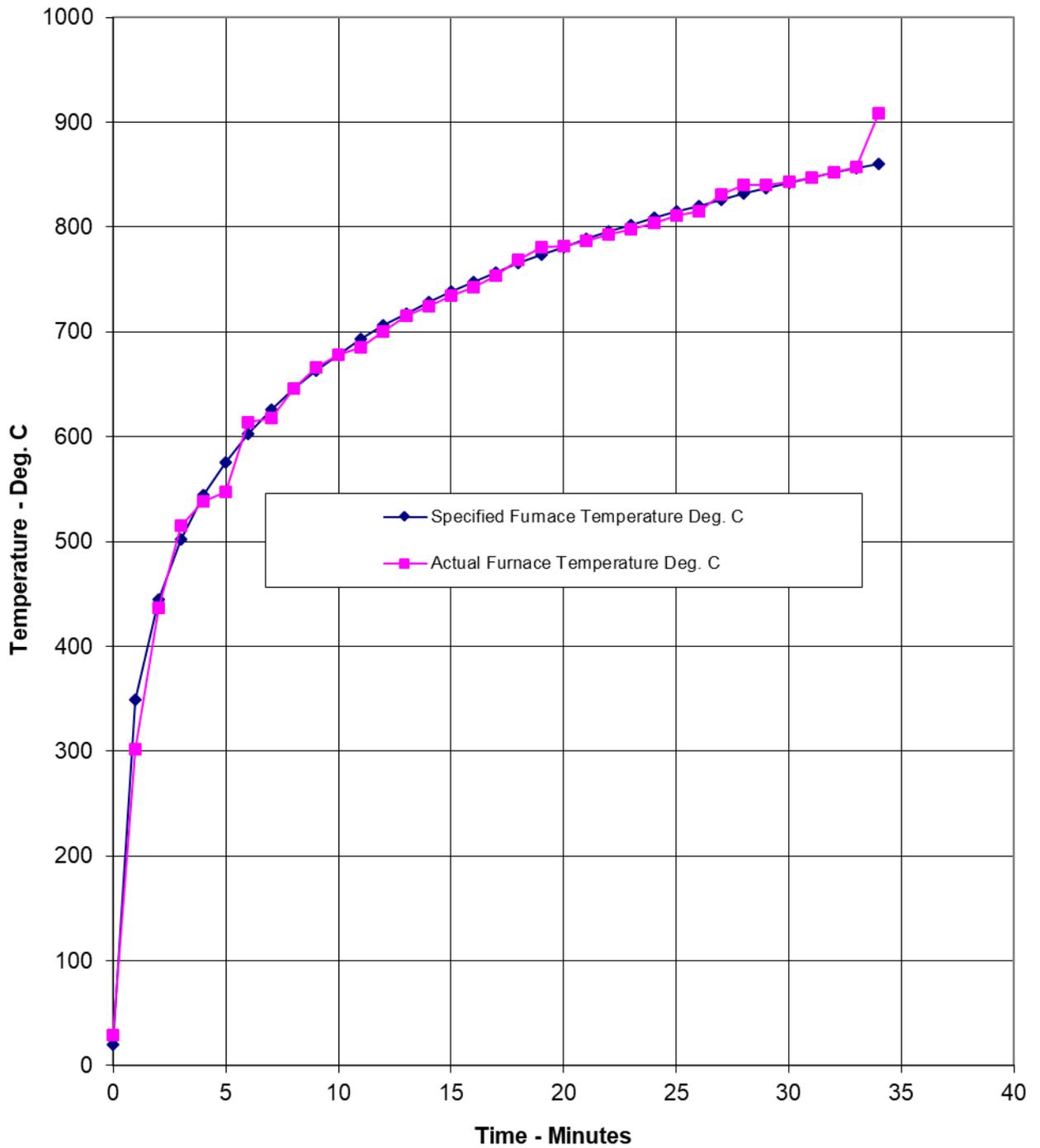
Time Mins	T/C Number 222 Deg. C	T/C Number 223 Deg. C	T/C Number 224 Deg. C	T/C Number 225 Deg. C
0	19	18	19	19
1	22	19	20	19
2	34	30	24	24
3	48	47	41	42
4	61	53	50	51
5	68	59	55	55
6	74	65	61	61
7	77	69	64	66
8	98	71	67	69
9	98	74	69	72
10	105	79	71	73
11	109	90	77	80
12	108	100	85	86
13	124	108	92	90
14	125	115	97	98
15	128	117	96	100
16	126	115	98	106
17	132	118	102	118
18	142	127	104	115
19	163	145	109	122
20	193	169	116	118
21	219	191	125	126
22	236	211	138	139
23	254	229	155	156
24	287	282	165	174
25	280	316	182	196
26	298	349	196	208
27	288	378	210	220
28	297	390	222	231
29	305	418	229	254
30	314	416	241	271
31	321	425	252	285
32	331	443	260	297
33	351	456	271	313
34	*	487	281	318

*Thermocouple malfunction

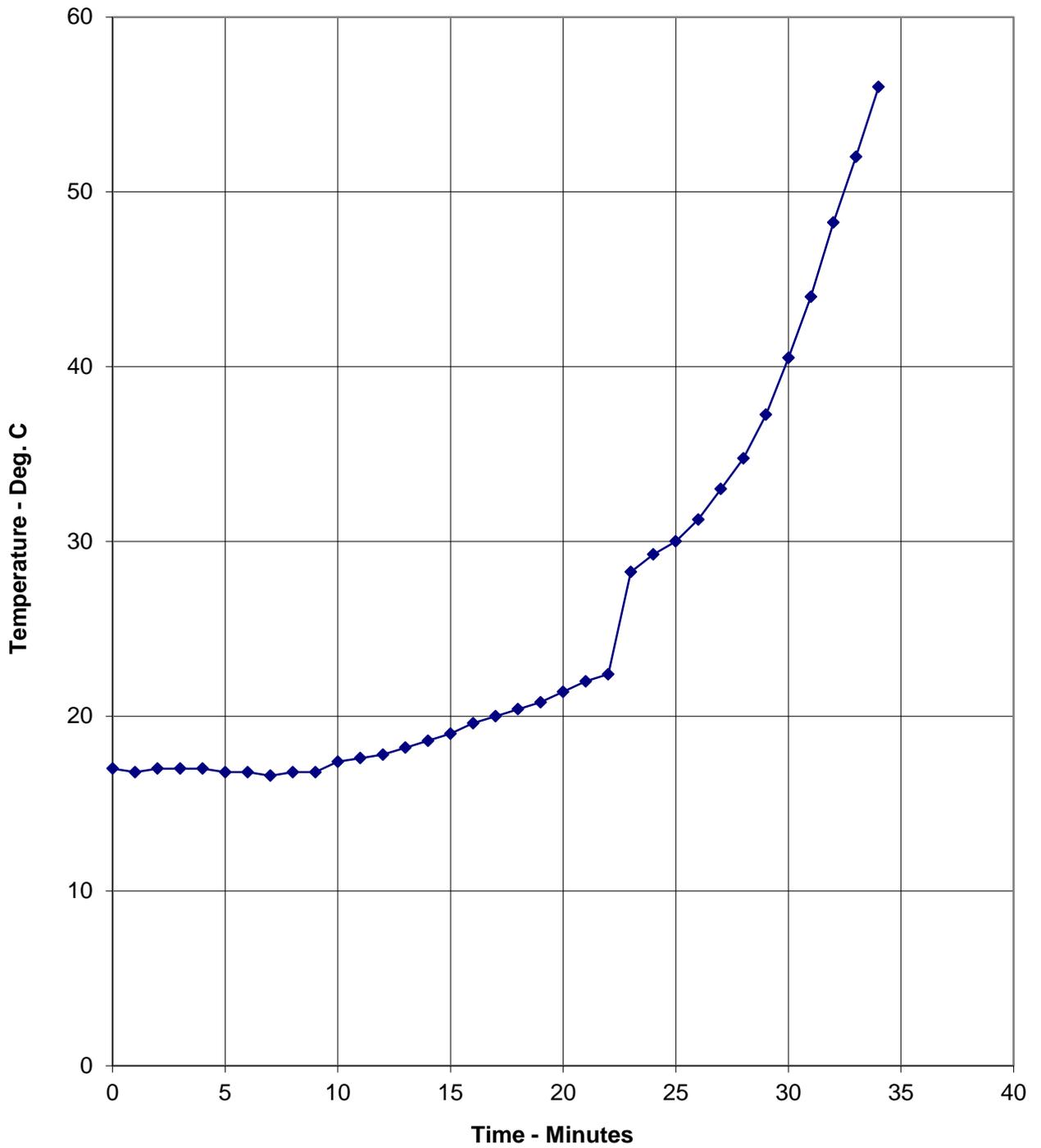
Central Vertical Deflection Of The Specimen

Time Mins	Central Vertical Deflection mm	Rate Of Deflection mm/min
0	0.000	0.000
1	0.067	0.000
2	0.386	0.067
3	0.386	0.319
4	0.453	0.000
5	0.453	0.067
6	1.326	0.000
7	1.326	0.873
8	1.326	0.000
9	1.326	0.000
10	1.377	0.000
11	1.444	0.050
12	1.662	0.067
13	1.880	0.218
14	2.149	0.218
15	2.266	0.269
16	2.434	0.117
17	2.652	0.168
18	2.803	0.218
19	2.971	0.151
20	3.257	0.168
21	3.475	0.285
22	3.794	0.218
23	4.129	0.319
24	4.515	0.336
25	5.120	0.386
26	5.724	0.604
27	6.546	0.604
28	7.268	0.822
29	8.091	0.722
30	8.863	0.823
31	10.189	0.772
32	10.843	1.326
33	12.052	0.655
34	15.073	1.209

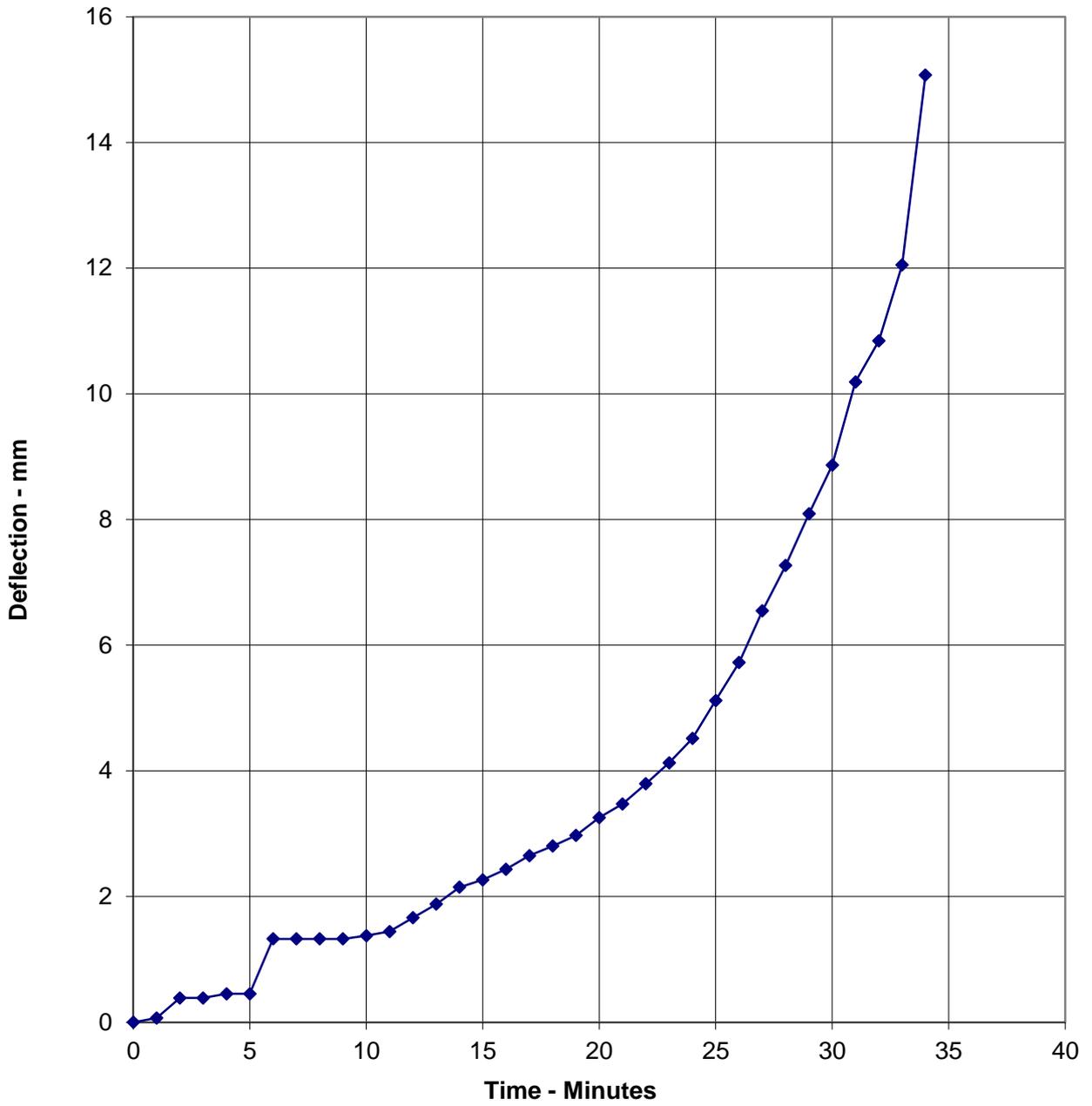
Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard BS EN 1363-1: 2012



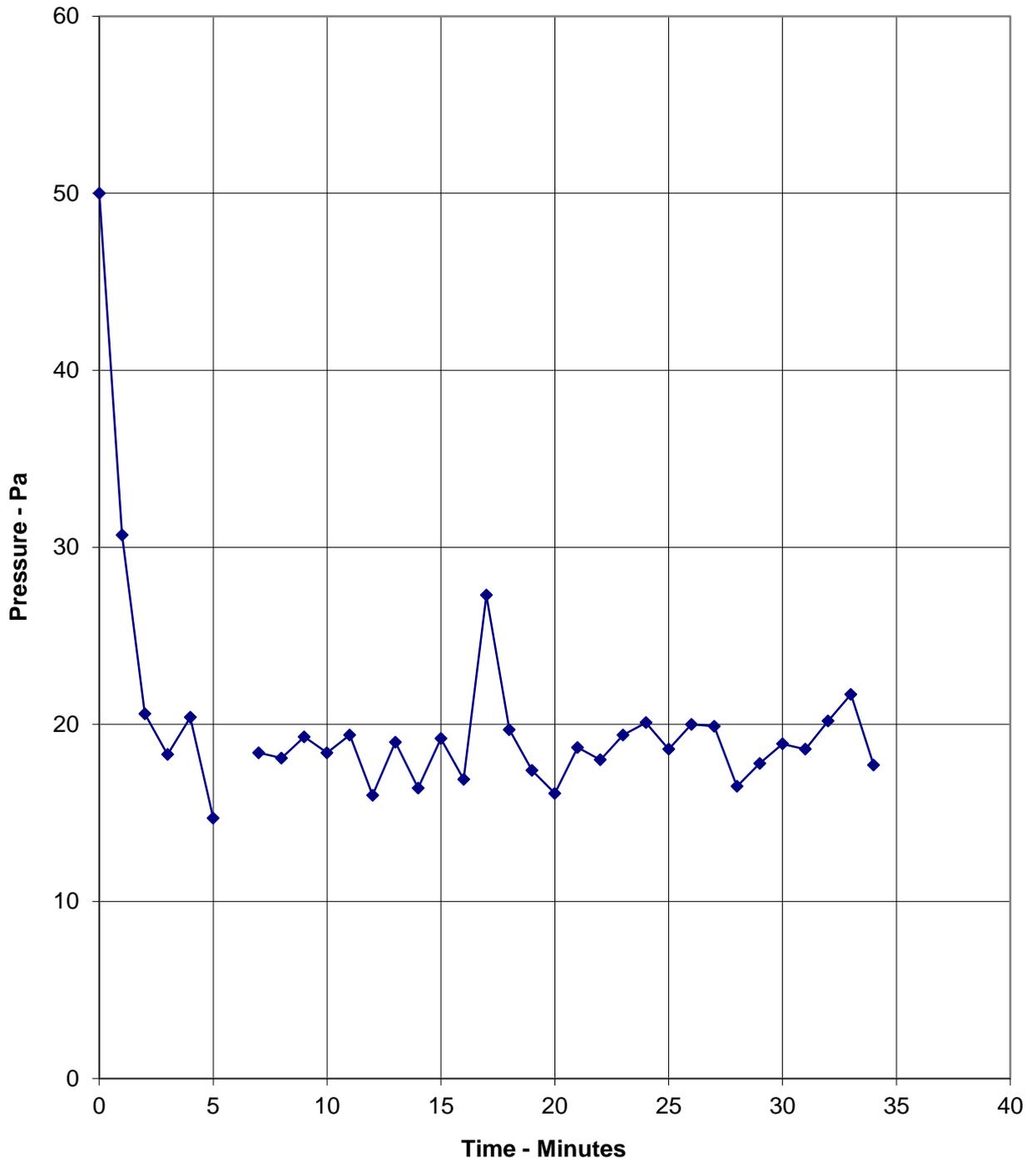
Graph Showing Mean Temperature Recorded On The Unexposed Surface Of The Specimen



Graph Showing The Recorded Vertical Deflection Of The Specimen



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



On-going Implications

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 all previous issues of reports referenced 423749.

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.

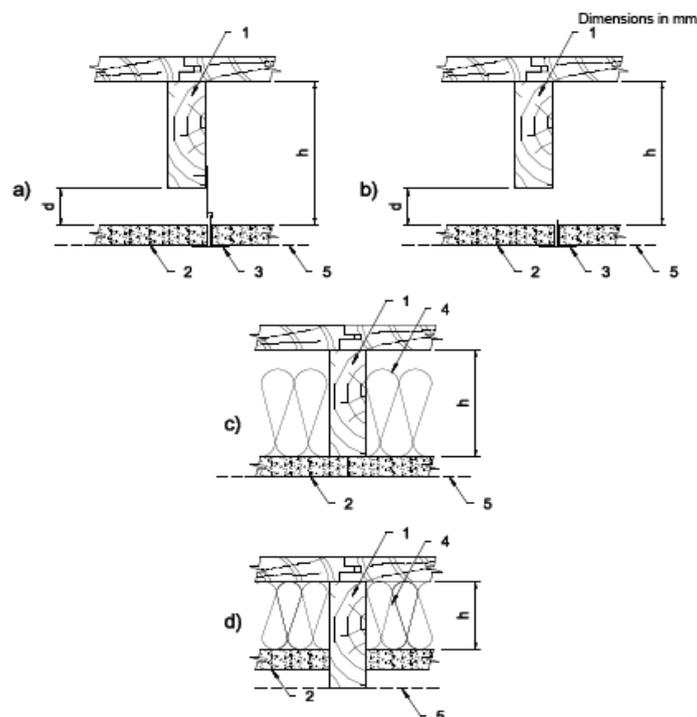
b) With respect to the ceiling system:

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