

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:

1st February 2020

Issue 2:

4th June 2020

WF Report No.

416098



Prepared for:

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

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**This report supersedes
Issue 1 of report 416098,
dated 1st May 2020.**

Test Assembly

Summary of Tested Specimen

The timber floor assembly had overall nominal dimensions of 4400 mm long by 2960 mm wide by 222 mm deep. It comprised C16 timber joists 45 mm by 222 mm at 600 mm centres. The upper 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 a single layer of 15 mm thick British Gypsum Gyproc Type A wallboard to EN 520 standards.

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

The floor supported a uniformly distributed load of 1.23kN/m^2 . 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:

| | |
|-------------------------------------|-------|
| (d) Depth of structural section, mm | 222 |
| (L) Length of clear span, mm | 4200 |
| Limiting deflection, mm | 207.1 |
| Limiting rate of deflection, mm/sec | 9.2 |

The allowable rate of deflection criteria is not applicable for the first 10 minutes of the test. This criterion was satisfied for 33 minutes.

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

33 minutes*

Gap gauge

33 minutes* No failure*

Cotton pad

33 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:

33 minutes No failure*

*Test was discontinued after a period of 33 minutes.

Date of Test

1st February 2020

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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: | |

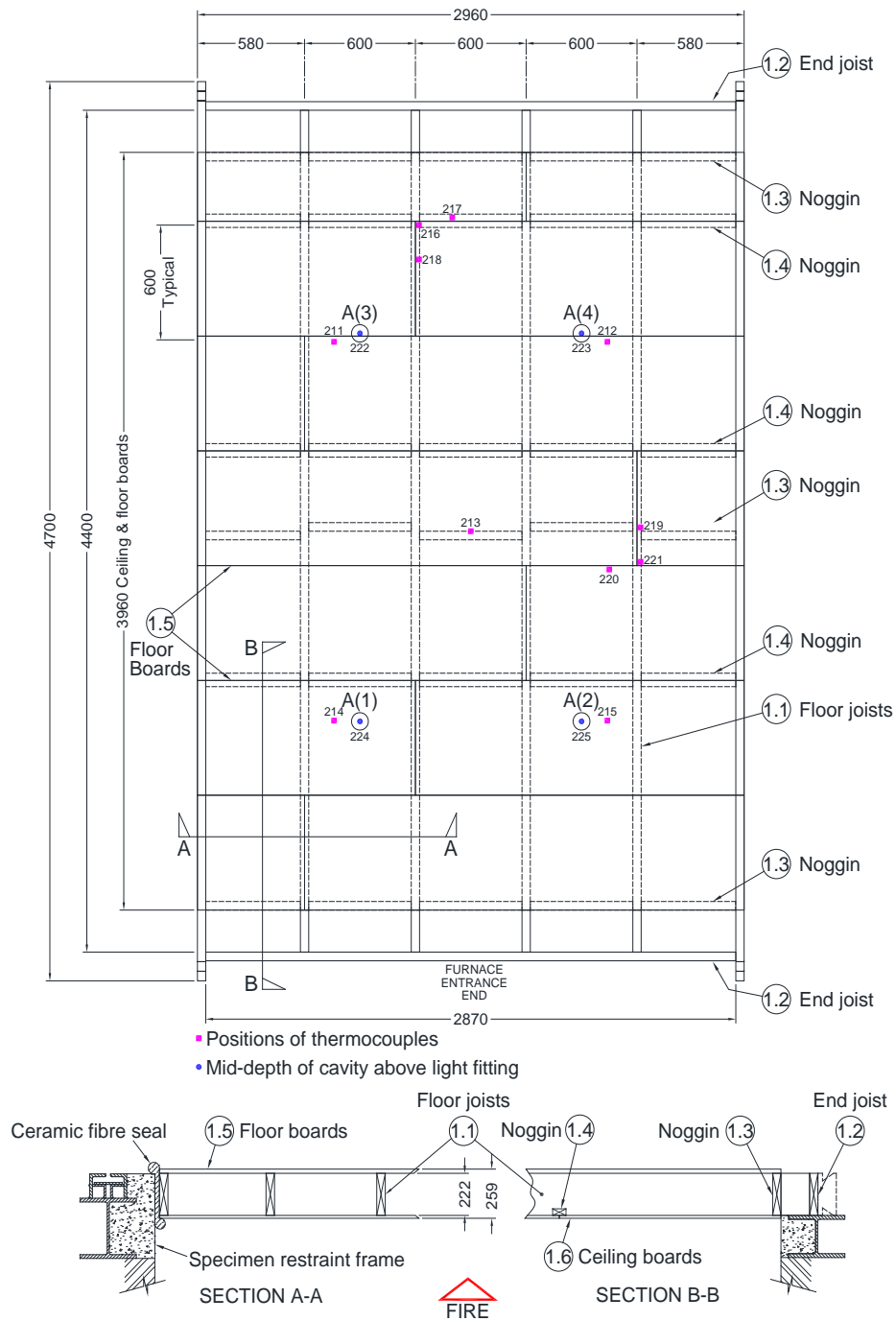
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Test Conditions

| | |
|--------------------------------------|---|
| 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 a known fire resistance, when incorporating down lighter light 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 28 January 2020 and 30 January 2020.</p> |
| Conditioning | <p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 3 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 15.5°C to 21.5°C and 42.5% to 70% respectively.</p> |
| Instruction to Test | <p>The test was conducted on the 01 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 20°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 (internal thermocouples) 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, 45 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> |

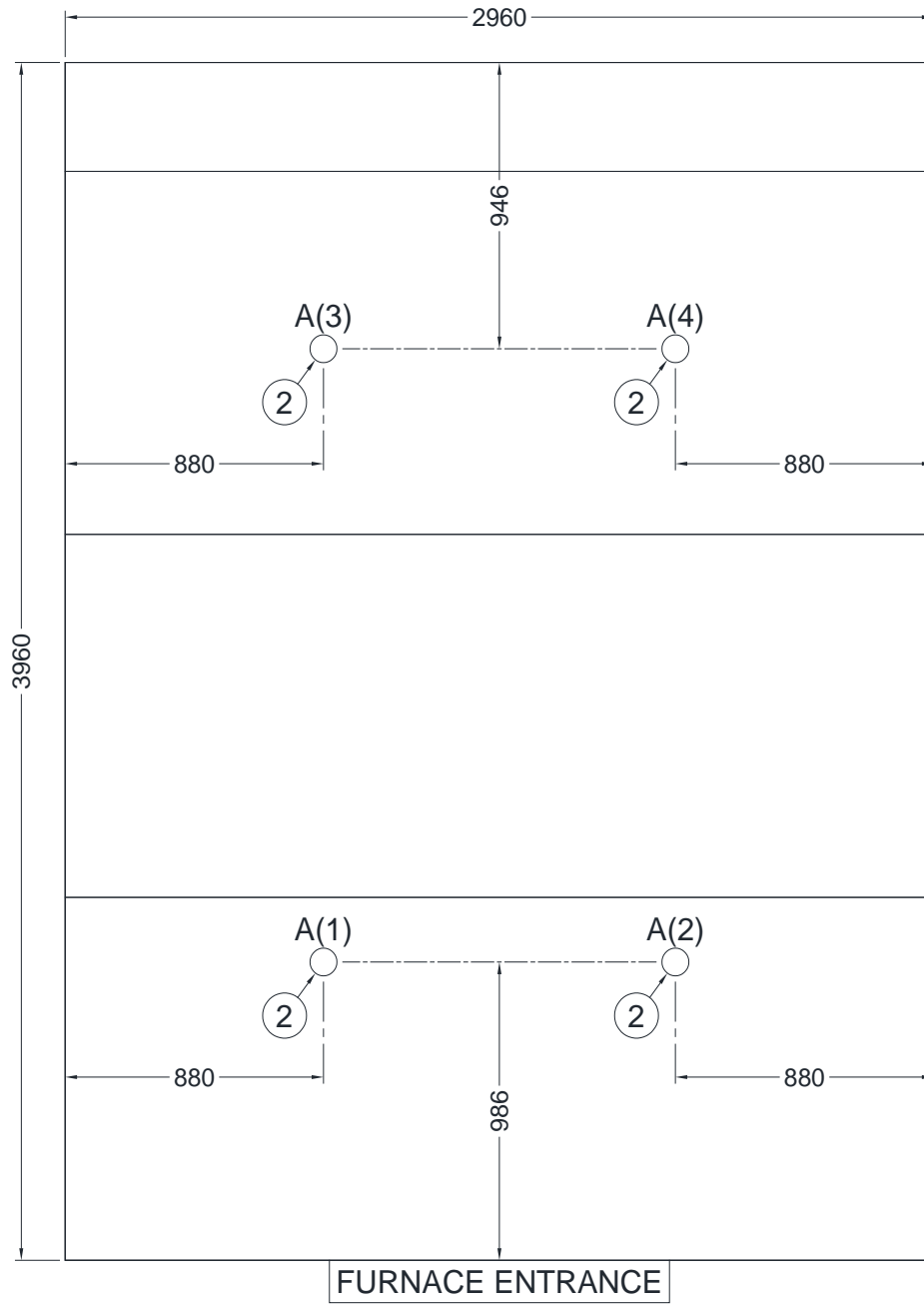
Test Construction

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

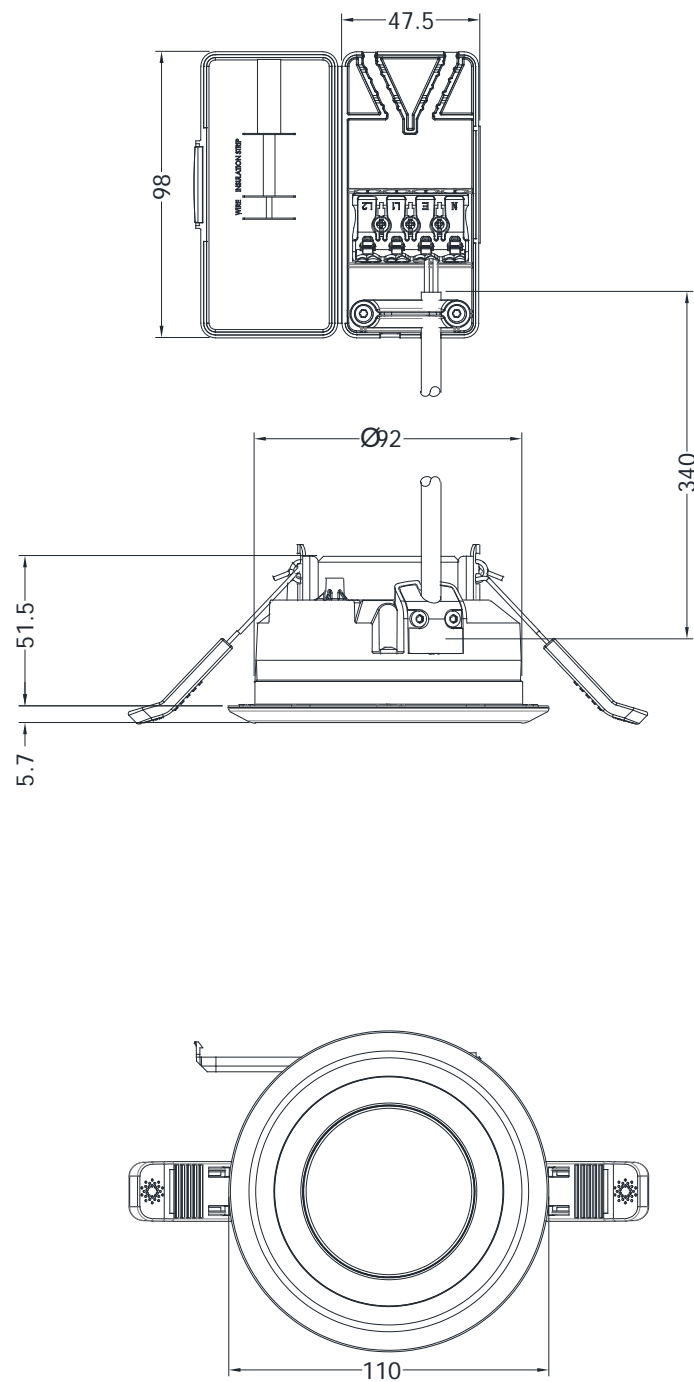


Do not scale. All dimensions are in mm

Figure 2 – Details of Downlighter Positions



Do not scale. All dimensions are in mm

Figure 3 – Details of Downlighters Specimen A

Do not scale. All dimensions are in mm

Schedule of Components

(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> |
|--------------------------------------|--|
| 1. Timber Floor | |
| 1.1 Floor Joists | |
| Material | : British Home-grown, rough sawn softwood, kiln dried |
| Grade | : C16, to BS EN 519 |
| Density | : 524.11 kg/m ³ , measured |
| Size | : 45.6 mm x 222 mm x 4400 mm long |
| Joist centres | : 600 mm |
| 1.2 End Joist | |
| Material | : British Home-grown, rough sawn softwood, kiln dried |
| Grade | : C16, to BS EN 519 |
| Density | : 524.1 kg/m ³ , 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 | : 524.1 kg/m ³ |
| 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 ³ , 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 |
| 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 Wallboard |
| Material | : | Type A gypsum complete with strong paper liners |
| Density | : | 773 kg/m ³ , measured |
| 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 |
| Fixings | | |
| i. type | : | Bugle head, sharp point, drywall screws |
| ii. material | : | Black phosphate coated steel |
| iii. overall size | : | 35 mm long x 3.9 mm diameter |
| iv. centres | : | 150 mm centres around the perimeter and 150 mm in the centre of the board |

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 | : | 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 | |
| -45 | 00 | Test load applied |
| 00 | 00 | The test commences. |
| 04 | 18 | When viewed from the exposed face the paper lining has burnt away the tape and scrim has cracked. |
| 08 | 12 | When viewed from the exposed face the surface of the boards radiate a full orange colour. |
| 15 | 15 | When viewed from the exposed face all light fittings detached location of 224 and 225. |
| 18 | 08 | Steam/smoke release observed from the end joists of the timber frame. |
| 21 | 22 | When viewed from the exposed face joints opening up between the boards approximately 10mm. All light fittings have now detached from the plasterboard. |
| 27 | 12 | When viewed from exposed face the joints have discoloured in colour and the gap continues to widen. |
| 30 | 00 | Specimen continues to maintain load bearing, integrity and insulation criteria. |
| 33 | 00 | Test discontinued at client request. |

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



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 | 41 |
| 1 | 349 | 413 |
| 2 | 445 | 507 |
| 3 | 502 | 569 |
| 4 | 544 | 599 |
| 5 | 576 | 611 |
| 6 | 603 | 616 |
| 7 | 626 | 619 |
| 8 | 646 | 626 |
| 9 | 663 | 663 |
| 10 | 678 | 684 |
| 11 | 693 | 694 |
| 12 | 706 | 701 |
| 13 | 717 | 708 |
| 14 | 728 | 733 |
| 15 | 739 | 746 |
| 16 | 748 | 755 |
| 17 | 757 | 763 |
| 18 | 766 | 769 |
| 19 | 774 | 775 |
| 20 | 781 | 780 |
| 21 | 789 | 787 |
| 22 | 796 | 791 |
| 23 | 802 | 799 |
| 24 | 809 | 820 |
| 25 | 815 | 827 |
| 26 | 820 | 828 |
| 27 | 826 | 832 |
| 28 | 832 | 838 |
| 29 | 837 | 844 |
| 30 | 842 | 848 |
| 31 | 847 | 850 |
| 32 | 852 | 848 |
| 33 | 856 | 851 |

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 | 14 | 14 | 14 | 16 | 14 |
| 1 | 14 | 14 | 14 | 14 | 16 | 14 |
| 2 | 14 | 14 | 14 | 14 | 16 | 14 |
| 3 | 14 | 14 | 14 | 14 | 16 | 14 |
| 4 | 14 | 14 | 14 | 14 | 16 | 14 |
| 5 | 14 | 14 | 14 | 14 | 16 | 14 |
| 6 | 14 | 14 | 14 | 14 | 17 | 15 |
| 7 | 14 | 14 | 14 | 14 | 17 | 15 |
| 8 | 14 | 15 | 14 | 15 | 17 | 15 |
| 9 | 15 | 15 | 14 | 15 | 17 | 15 |
| 10 | 15 | 16 | 15 | 15 | 18 | 16 |
| 11 | 16 | 16 | 15 | 16 | 19 | 16 |
| 12 | 17 | 17 | 16 | 16 | 19 | 17 |
| 13 | 18 | 18 | 16 | 17 | 20 | 18 |
| 14 | 19 | 19 | 17 | 18 | 21 | 19 |
| 15 | 19 | 20 | 17 | 19 | 22 | 19 |
| 16 | 20 | 21 | 18 | 19 | 22 | 20 |
| 17 | 21 | 21 | 18 | 20 | 23 | 21 |
| 18 | 22 | 22 | 19 | 21 | 24 | 22 |
| 19 | 23 | 23 | 20 | 22 | 25 | 23 |
| 20 | 24 | 24 | 20 | 23 | 26 | 23 |
| 21 | 25 | 25 | 21 | 23 | 27 | 24 |
| 22 | 25 | 26 | 21 | 24 | 27 | 25 |
| 23 | 26 | 27 | 22 | 25 | 28 | 26 |
| 24 | 27 | 28 | 23 | 26 | 29 | 27 |
| 25 | 28 | 28 | 23 | 26 | 30 | 27 |
| 26 | 29 | 29 | 24 | 27 | 30 | 28 |
| 27 | 29 | 30 | 24 | 28 | 31 | 28 |
| 28 | 30 | 32 | 25 | 29 | 32 | 30 |
| 29 | 31 | 33 | 26 | 29 | 32 | 30 |
| 30 | 33 | 35 | 27 | 30 | 33 | 32 |
| 31 | 35 | 38 | 27 | 31 | 34 | 33 |
| 32 | 37 | 41 | 28 | 32 | 35 | 35 |
| 33 | 40 | 45 | 29 | 33 | 37 | 37 |

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 | 15 | 17 | 17 |
| 1 | * | 17 | 17 | 15 | 17 | 17 |
| 2 | * | 17 | 17 | 15 | 17 | 17 |
| 3 | * | 17 | 17 | 15 | 17 | 17 |
| 4 | * | 17 | 17 | 15 | 17 | 17 |
| 5 | * | 17 | 17 | 15 | 17 | 17 |
| 6 | * | 17 | 17 | 15 | 17 | 17 |
| 7 | * | 17 | 17 | 15 | 18 | 17 |
| 8 | * | 17 | 17 | 15 | 18 | 18 |
| 9 | * | 18 | 17 | 15 | 18 | 18 |
| 10 | * | 18 | 17 | 14 | 19 | 18 |
| 11 | * | 19 | 18 | 14 | 19 | 18 |
| 12 | * | 19 | 18 | 13 | 20 | 19 |
| 13 | * | 20 | 19 | 13 | 21 | 19 |
| 14 | * | 21 | 19 | 13 | 21 | 20 |
| 15 | * | 22 | 19 | 12 | 22 | 20 |
| 16 | * | 23 | 20 | 12 | 23 | 21 |
| 17 | * | 23 | 20 | 11 | 24 | 21 |
| 18 | * | 24 | 21 | 11 | 25 | 22 |
| 19 | * | 25 | 21 | 11 | 26 | 23 |
| 20 | * | 26 | 22 | 11 | 27 | 23 |
| 21 | * | 27 | 23 | 23 | 27 | 24 |
| 22 | * | 29 | 23 | 23 | 28 | 25 |
| 23 | * | 30 | 24 | 23 | 29 | 26 |
| 24 | * | 31 | 24 | 23 | 30 | 27 |
| 25 | * | 33 | 25 | 24 | 31 | 28 |
| 26 | * | 34 | 25 | 24 | 32 | 29 |
| 27 | * | 36 | 26 | 24 | 33 | 30 |
| 28 | * | 38 | 27 | 24 | 34 | 31 |
| 29 | * | 39 | 27 | 24 | 35 | 32 |
| 30 | * | 41 | 28 | 25 | 36 | 34 |
| 31 | * | 43 | 28 | 25 | 37 | 35 |
| 32 | * | 44 | 29 | 25 | 38 | 36 |
| 33 | * | 45 | 30 | 26 | 39 | 37 |

*Thermocouple malfunction

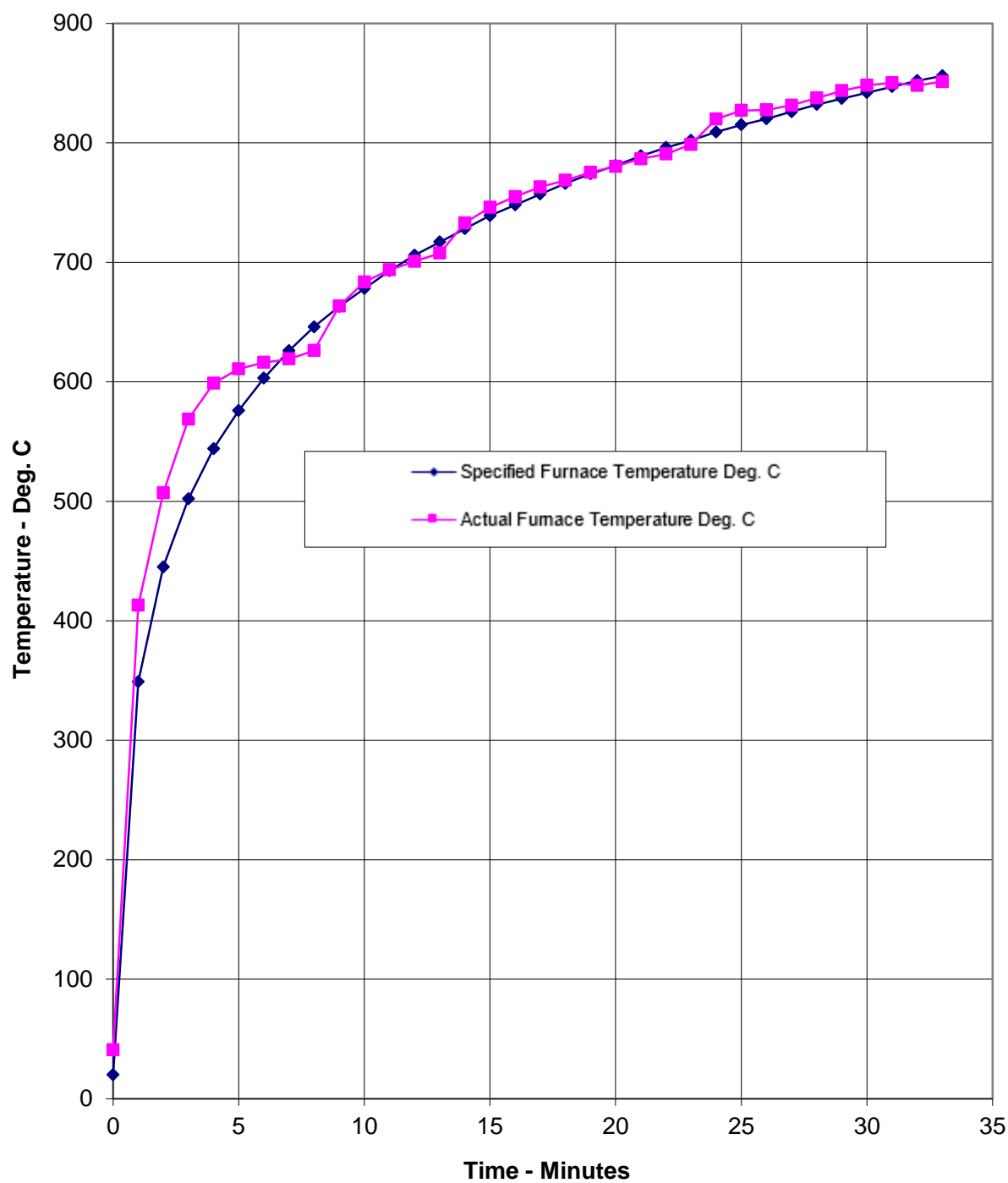
Individual Temperatures Recorded At Mid-Height Of The Cavity Coincidental With The Light Fittings A(1-4)

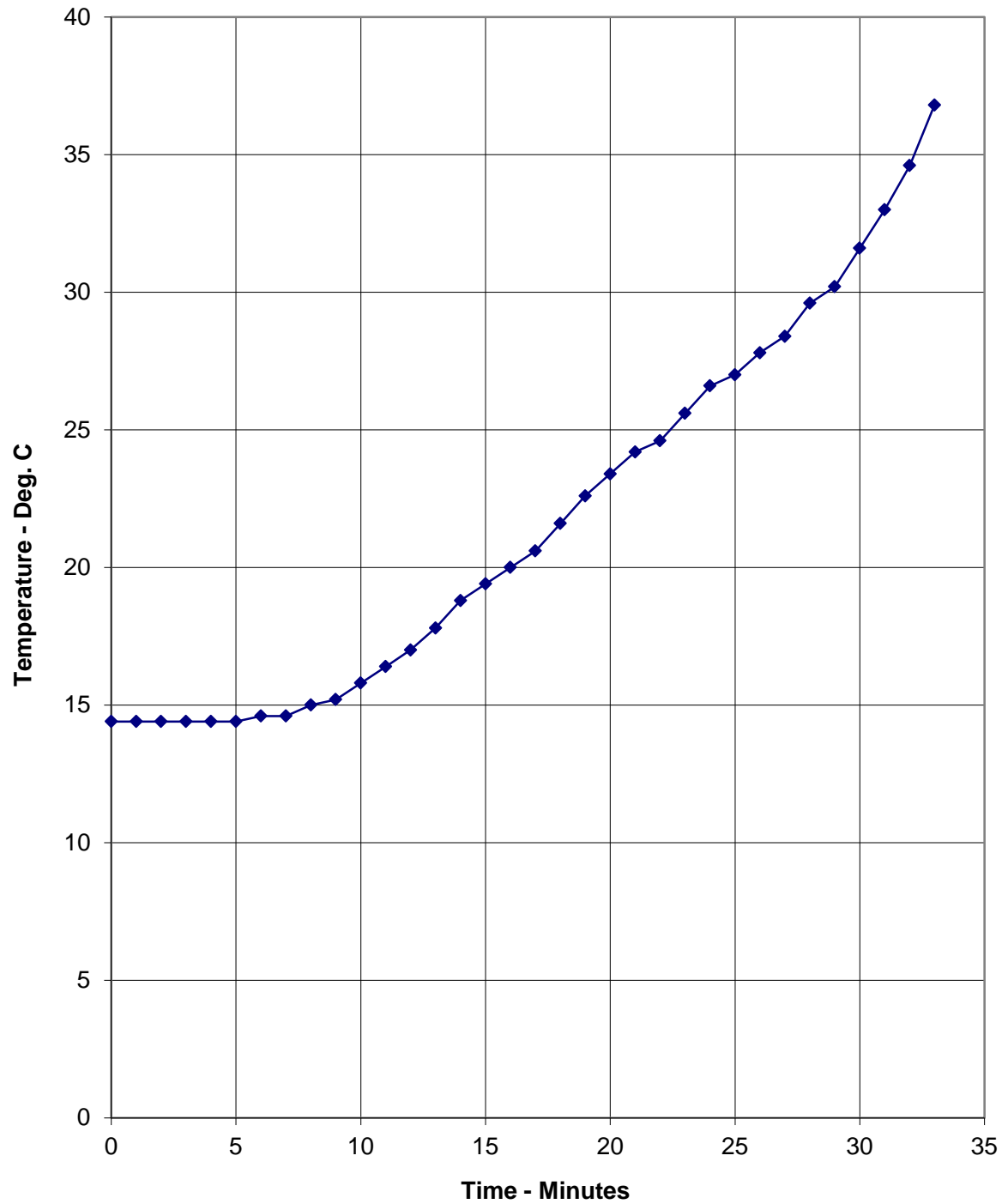
| Time Mins | T/C Number 222 Deg. C | T/C Number 223 Deg. C | T/C Number 224 Deg. C | T/C Number 225 Deg. C |
|--------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| 0 | 20 | 20 | 20 | 20 |
| 1 | 20 | 21 | 21 | 21 |
| 2 | 41 | 43 | 37 | 38 |
| 3 | 54 | 57 | 52 | 53 |
| 4 | 61 | 62 | 59 | 59 |
| 5 | 65 | 65 | 64 | 61 |
| 6 | 67 | 65 | 67 | 64 |
| 7 | 70 | 69 | 69 | 67 |
| 8 | 70 | 70 | 70 | 71 |
| 9 | 71 | 70 | 71 | 71 |
| 10 | 73 | 74 | 74 | 72 |
| 11 | 76 | 79 | 75 | 75 |
| 12 | 82 | 91 | 77 | 79 |
| 13 | 92 | 97 | 79 | 83 |
| 14 | 95 | 100 | 84 | 89 |
| 15 | 97 | 105 | 91 | 95 |
| 16 | 100 | 110 | 97 | 97 |
| 17 | 104 | 114 | 102 | 100 |
| 18 | 109 | 119 | 104 | 103 |
| 19 | 115 | 127 | 108 | 108 |
| 20 | 123 | 136 | 109 | 116 |
| 21 | 142 | 152 | 119 | 131 |
| 22 | 157 | 175 | 139 | 148 |
| 23 | 175 | 196 | 156 | 166 |
| 24 | 191 | 217 | 169 | 182 |
| 25 | 203 | 238 | 194 | 203 |
| 26 | 218 | 241 | 216 | 218 |
| 27 | 229 | 253 | 227 | 220 |
| 28 | 235 | 264 | 232 | 224 |
| 29 | 235 | 270 | 240 | 231 |
| 30 | 244 | 270 | 244 | 238 |
| 31 | 248 | 281 | 252 | 248 |
| 32 | 257 | 288 | 253 | 256 |
| 33 | 265 | 292 | 270 | 260 |

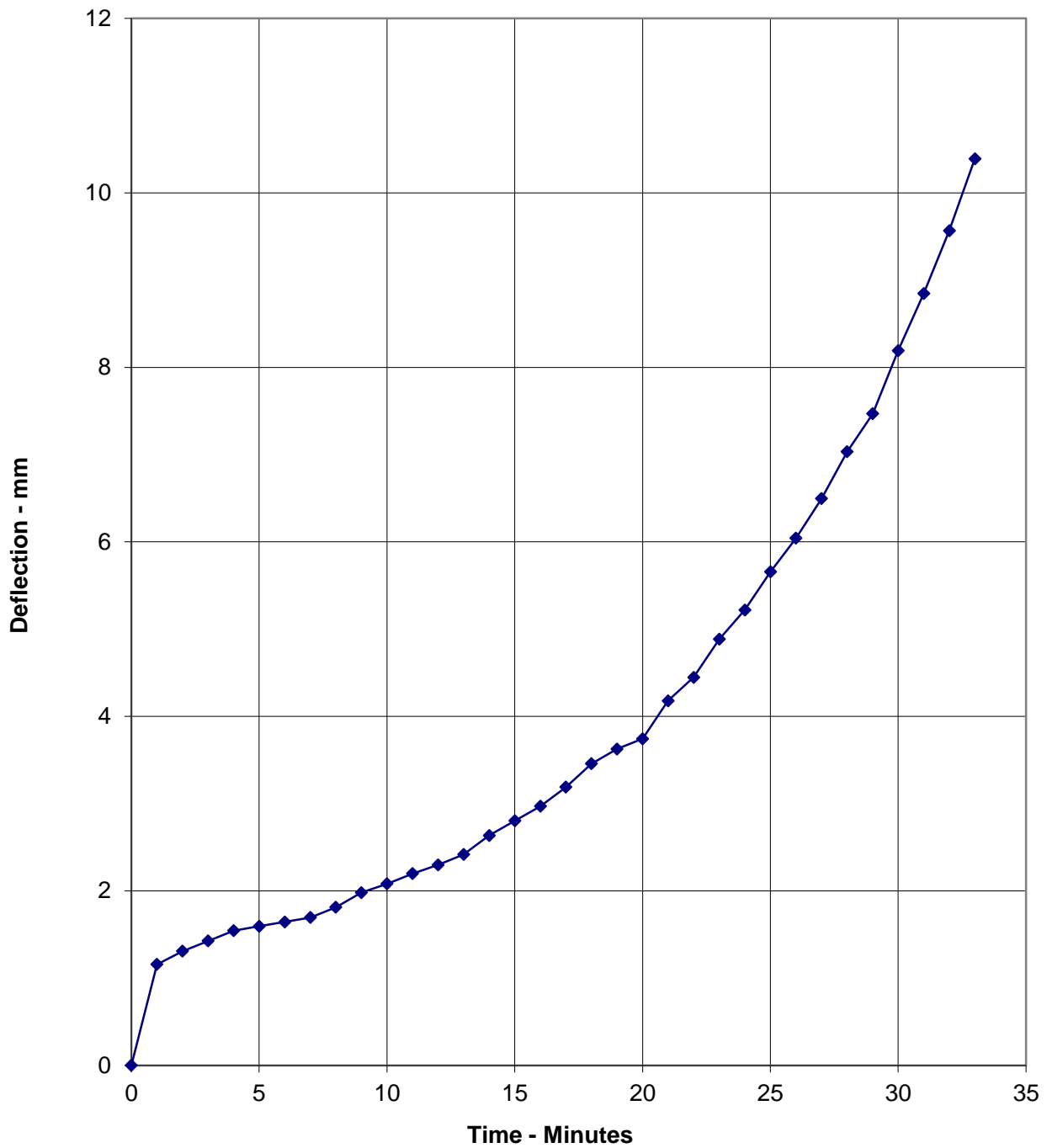
Central Vertical Deflection Of The Specimen

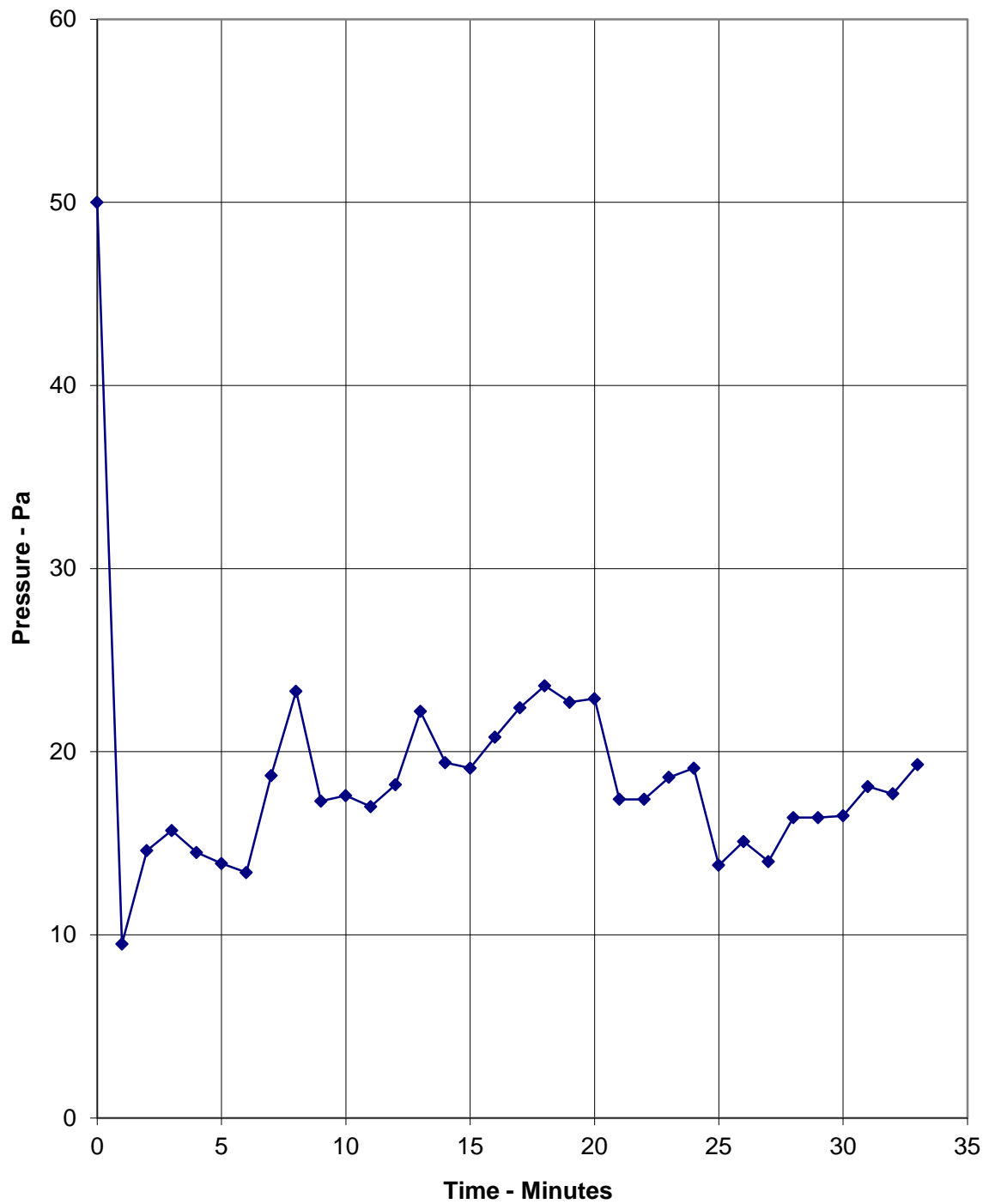
| Time Mins | Central Vertical Deflection mm | Rate Of Deflection mm/min |
|--------------|---|------------------------------------|
| 0 | 0.000 | 0.000 |
| 1 | 1.158 | 0.000 |
| 2 | 1.309 | 1.158 |
| 3 | 1.427 | 0.151 |
| 4 | 1.544 | 0.117 |
| 5 | 1.595 | 0.117 |
| 6 | 1.645 | 0.050 |
| 7 | 1.695 | 0.050 |
| 8 | 1.813 | 0.050 |
| 9 | 1.981 | 0.117 |
| 10 | 2.081 | 0.168 |
| 11 | 2.199 | 0.101 |
| 12 | 2.299 | 0.117 |
| 13 | 2.417 | 0.101 |
| 14 | 2.635 | 0.117 |
| 15 | 2.803 | 0.218 |
| 16 | 2.971 | 0.168 |
| 17 | 3.189 | 0.168 |
| 18 | 3.458 | 0.218 |
| 19 | 3.626 | 0.269 |
| 20 | 3.743 | 0.168 |
| 21 | 4.179 | 0.117 |
| 22 | 4.448 | 0.436 |
| 23 | 4.884 | 0.269 |
| 24 | 5.220 | 0.436 |
| 25 | 5.656 | 0.336 |
| 26 | 6.043 | 0.436 |
| 27 | 6.496 | 0.386 |
| 28 | 7.033 | 0.453 |
| 29 | 7.469 | 0.537 |
| 30 | 8.191 | 0.436 |
| 31 | 8.846 | 0.722 |
| 32 | 9.567 | 0.655 |
| 33 | 10.390 | 0.722 |

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

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 416098, dated 1st 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.

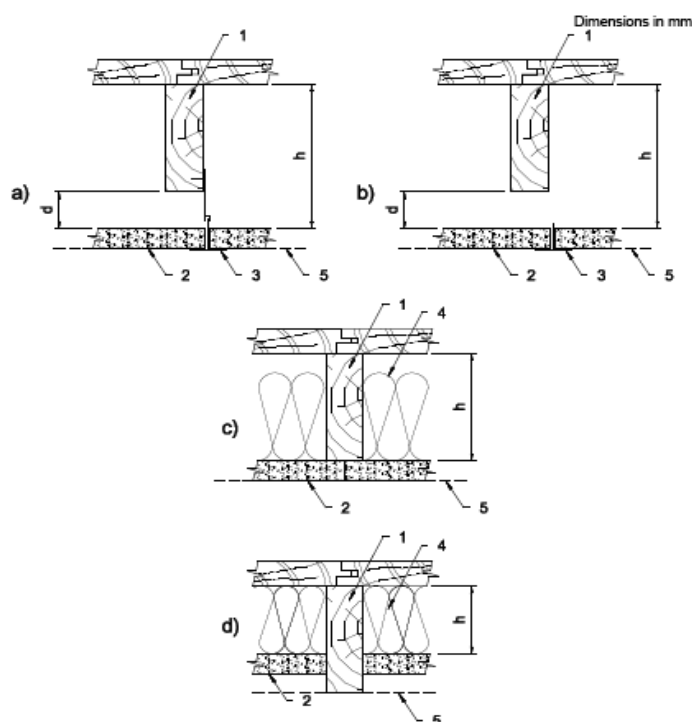
b) With respect to the ceiling system:

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 | |