

Title:

Fire Resistance Test
In Accordance With
BS EN 1365-2: 2014,
On A Loadbearing
Timber Floor
Construction Protected
By A Plasterboard
Ceiling When
Incorporating Twelve
Downlighter Light
Fitting Assemblies.

Date of Test:

4th July 2023

Issue 1

13 December 2023

WF Report No.

527456/R



Prepared for:

JCC Lighting Products
Ltd

Lux Park,
Chichester Business
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0249

Test Assembly

Summary of Tested Assembly

The timber floor had overall nominal dimensions of 4330 mm long by 3000 mm wide by 228.5 mm deep. The floor comprised 195 mm high C16 softwood solid timber joists at 600 mm centres. The unexposed face of the floor comprised nominally 22 mm thick tongue and groove chipboard. The floor assembly was protected by a single layer of 12.5 mm thick 'Gyproc Wallboard', through fixed to the timber framework with screws.

The ceiling incorporated twelve specimen downlighter light fittings. The lights were referenced as follows:

Test Ref.	Model Ref.	Cut Out Diameter.
1	JC1001	70 mm
2	JC10010	70 mm
3	JC1101	68 mm
4	JC1102	82 mm
5	JC1020	70 mm
6	JC010036	68 mm
7	JC010037	90 mm
8	JC010038	125 mm
9	JC010039	157 mm
10	JC010040	90 mm
11	JC010041	125 mm
12	JC010042	157 mm

The floor supported a uniformly distributed load of 0.79 kN/m². 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

This is the time in completed minutes for which the test specimen continues to maintain its ability to support the test load during the test. Support of the test load is determined by both the amount and the rate of Deflection. The limiting deflection and the limiting rate of deflection for the specimen, as specified by the Standard, are calculated as:

Criteria	Value
<i>L</i> : Clear span - in mm	4150
<i>d</i> : Depth of structural section - in mm	195
Limiting deflection ($L^2/400d$) - in mm	220.8
Limiting rate of deflection ($L^2/9000d$) - in mm/min	9.8
Measured Deflection $1.5 \times (L^2/400d)$ - in mm	331.2

Failure to support the load is deemed to have occurred when a '**Measured Deflection**' greater than or equal to '**1.5 x Limiting Deflection**' is observed

Or

Both the '**Limiting rate of deflection**' and '**Limiting deflection**' are exceeded.

The criterion was satisfied for 43 minutes after 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: 2020
- sustained flaming on the unexposed surface
- subsequent failure of loadbearing capacity

These requirements were satisfied for the periods shown below:

Sustained flaming

43 minutes*

Gap gauge

43 minutes No failure*

Cotton pad

43 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:

Specimen

43 minutes No failure*

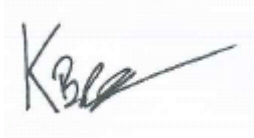
*Test was discontinued after a period of 43 minutes.

Date of Test

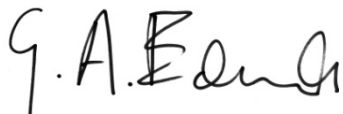
4th July 2023

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Senior Technical Officer

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

Report Issued: 13 December 2023

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Revision History

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Revised By:	Approved By:
Reason for Revision:	

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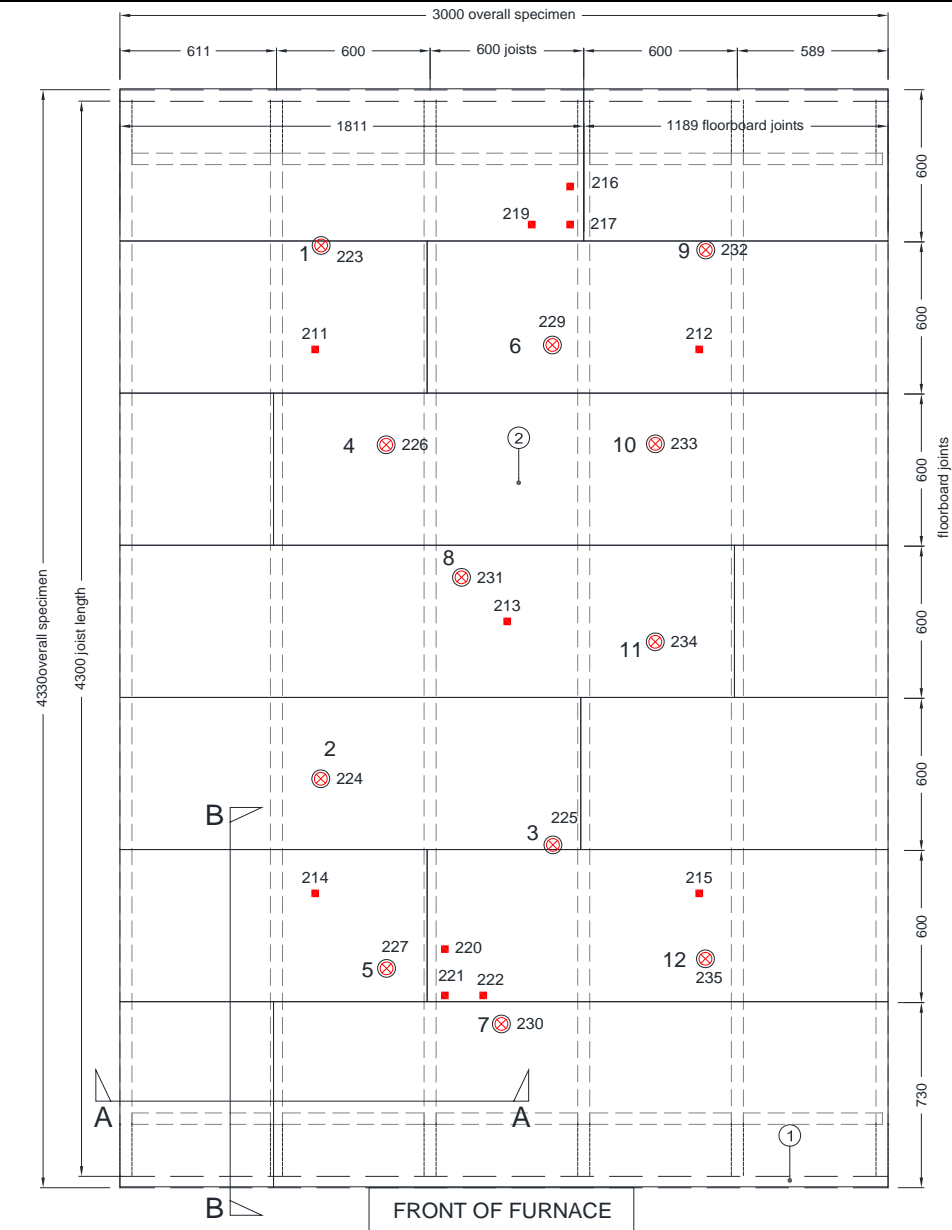
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Test Conditions

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 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 received and tested by Warringtonfire.</p>
Installation	<p>Representatives of Warringtonfire assembled the floor construction and installed the downlighters between the 29th June and the 3rd July 2023</p>
Conditioning	<p>The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 8 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 17.5°C to 29°C and 41% to 71% respectively.</p>
Instruction to Test	<p>The test was conducted on the 4th July 2023 at the request of JCC Lighting Products Ltd, the test sponsor.</p>
Ambient Temperature	<p>The ambient air temperature in the vicinity of the test construction was 25°C at the start of the test with a maximum variation of -1°C & +2°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: 2020 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 unexposed surface and internal thermocouples are shown in Figure 1.</p>
Application of the load	<p>The full test load was applied via dead load and hydraulic rams uniformly distributed over the test Specimen 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: 2020, 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>

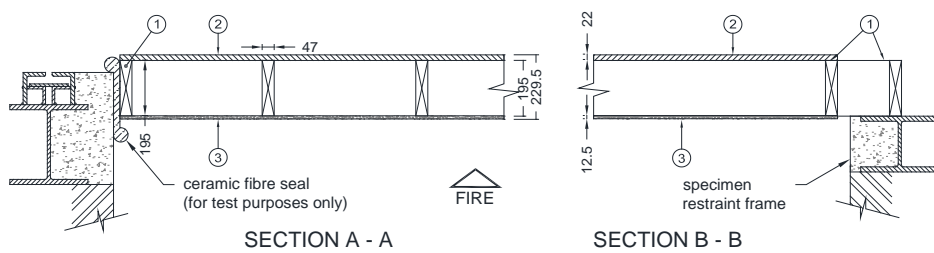
Test Construction

Figure 1 – General plan view of test specimen showing thermocouple positions- unexposed face and section A-A and section B-B



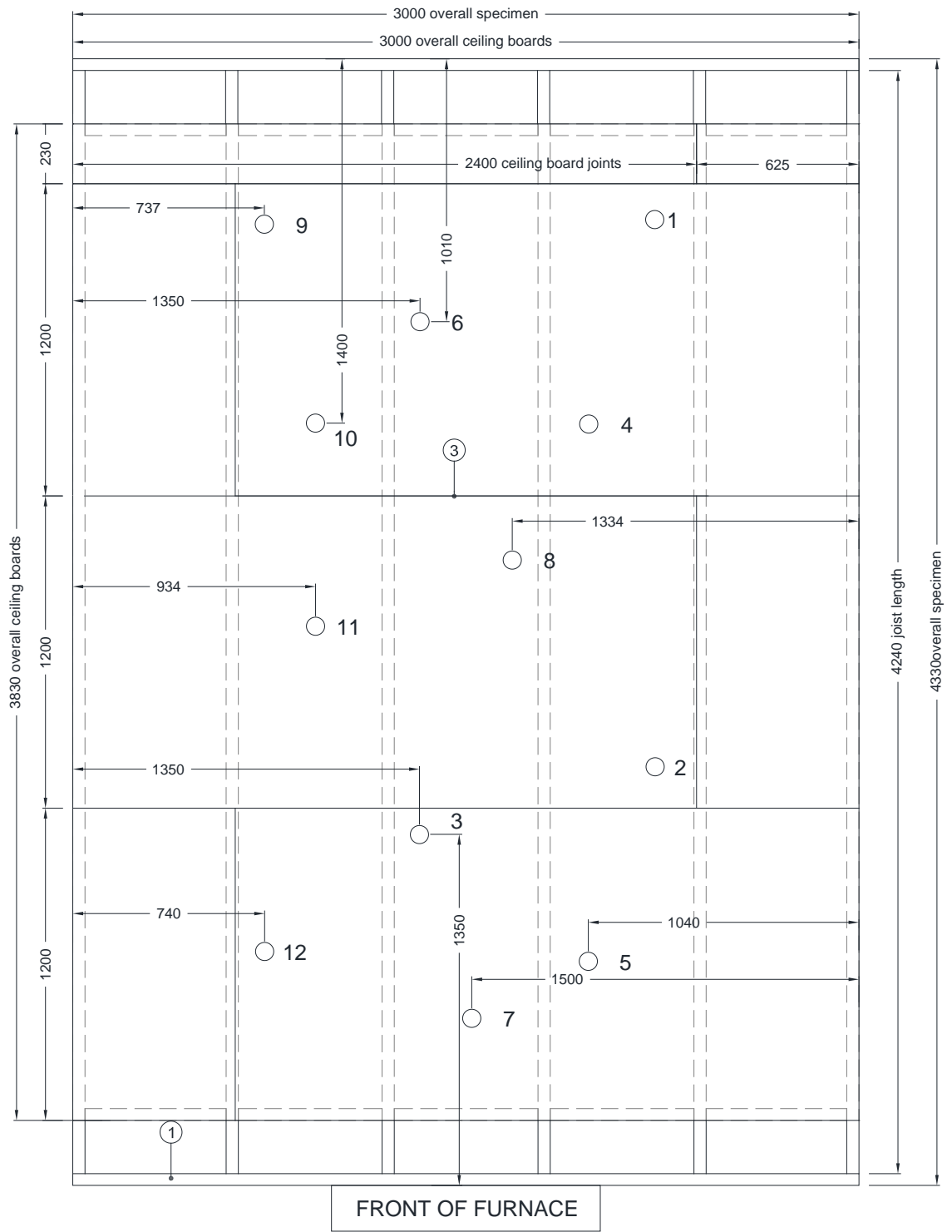
GENERAL PLAN VIEW OF TEST SPECIMEN SHOWING THERMOCOUPLE POSITIONS - UNEXPOSED FACE

- Positions of surface thermocouples
- ⊗ Positions of mineral insulated thermocouples at mid-cavity, adjacent to each downlight



Do not scale. All dimensions are in mm

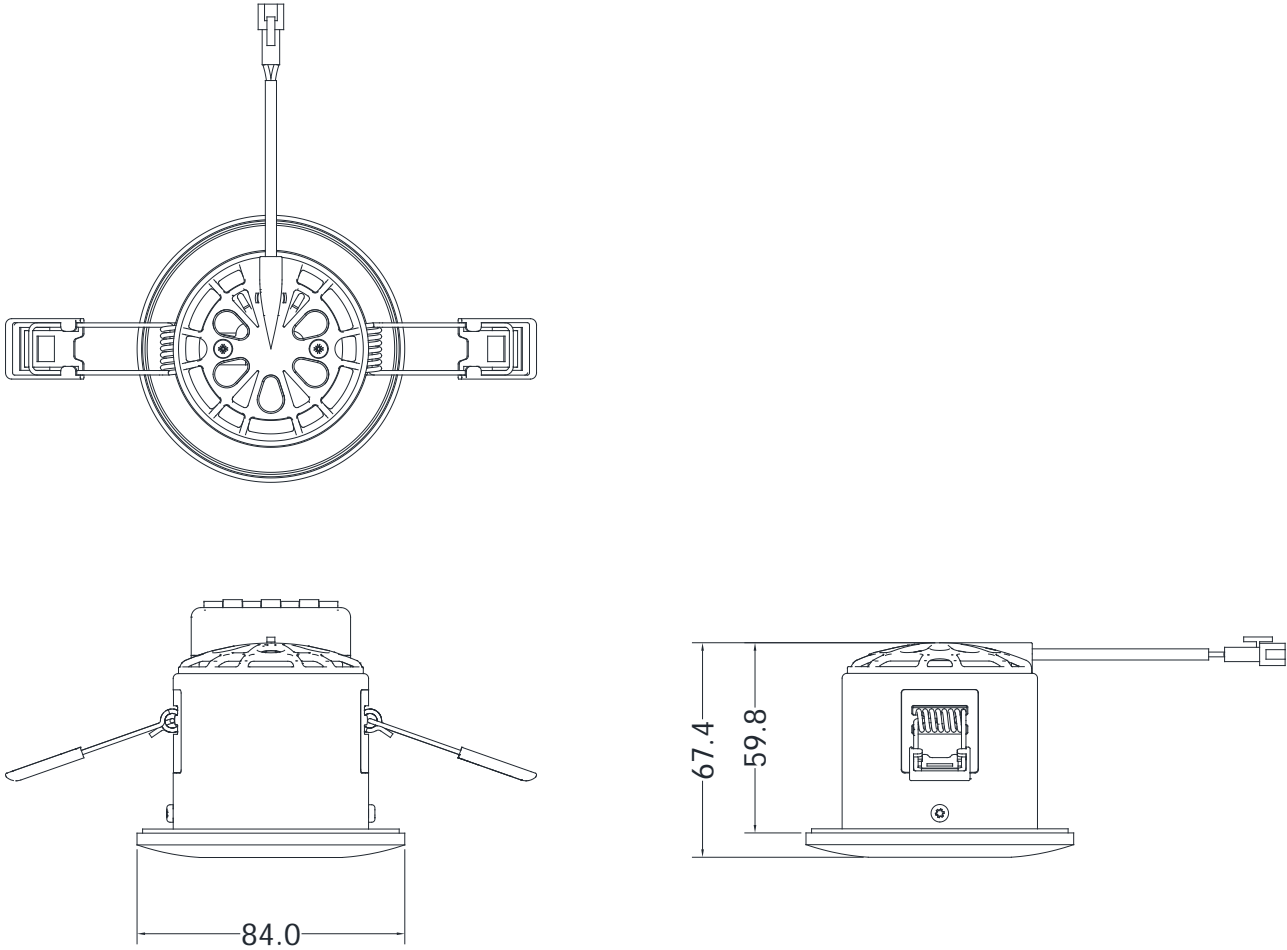
Figure 2 – General plan view of test specimen- exposed face



GENERAL PLAN VIEW OF TEST SPECIMEN -
EXPOSED FACE

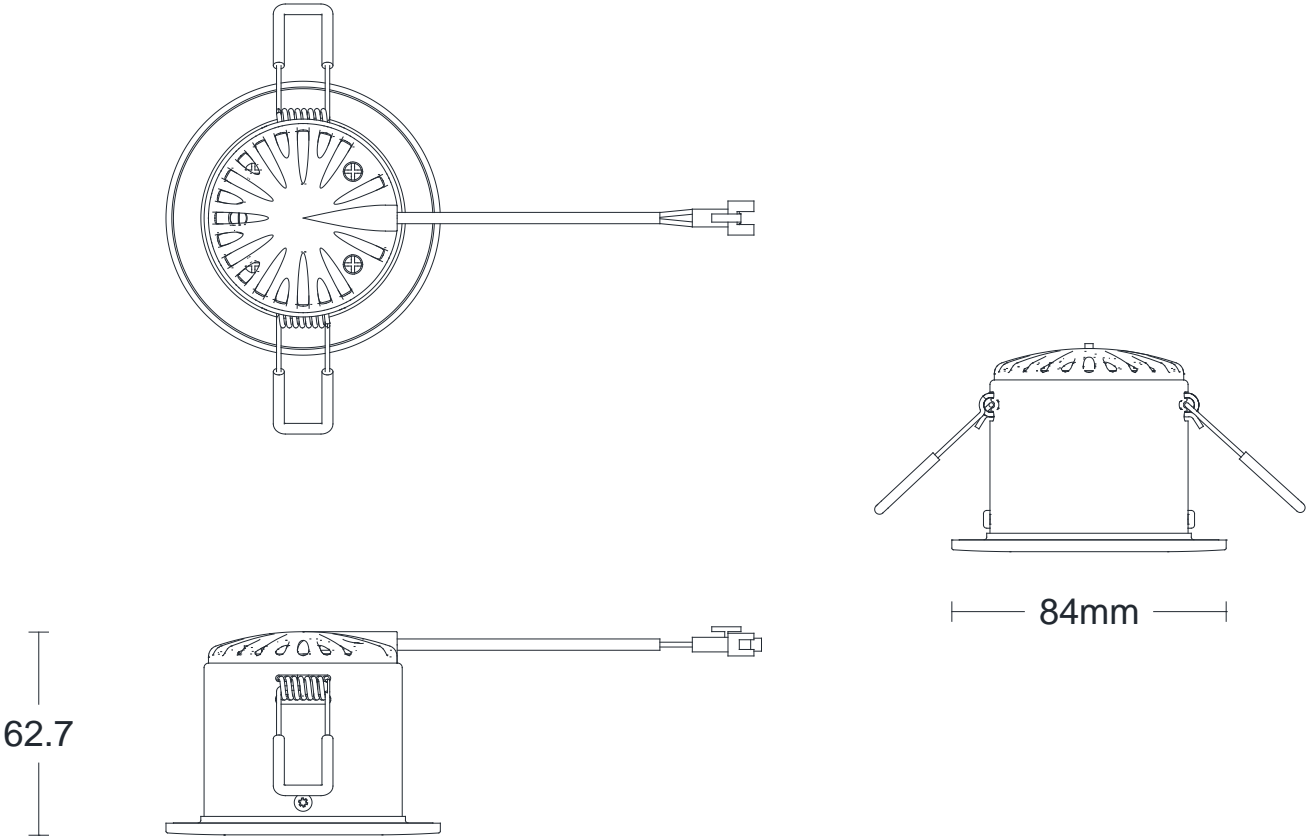
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Figure 3 – Downlight 1- JC1001



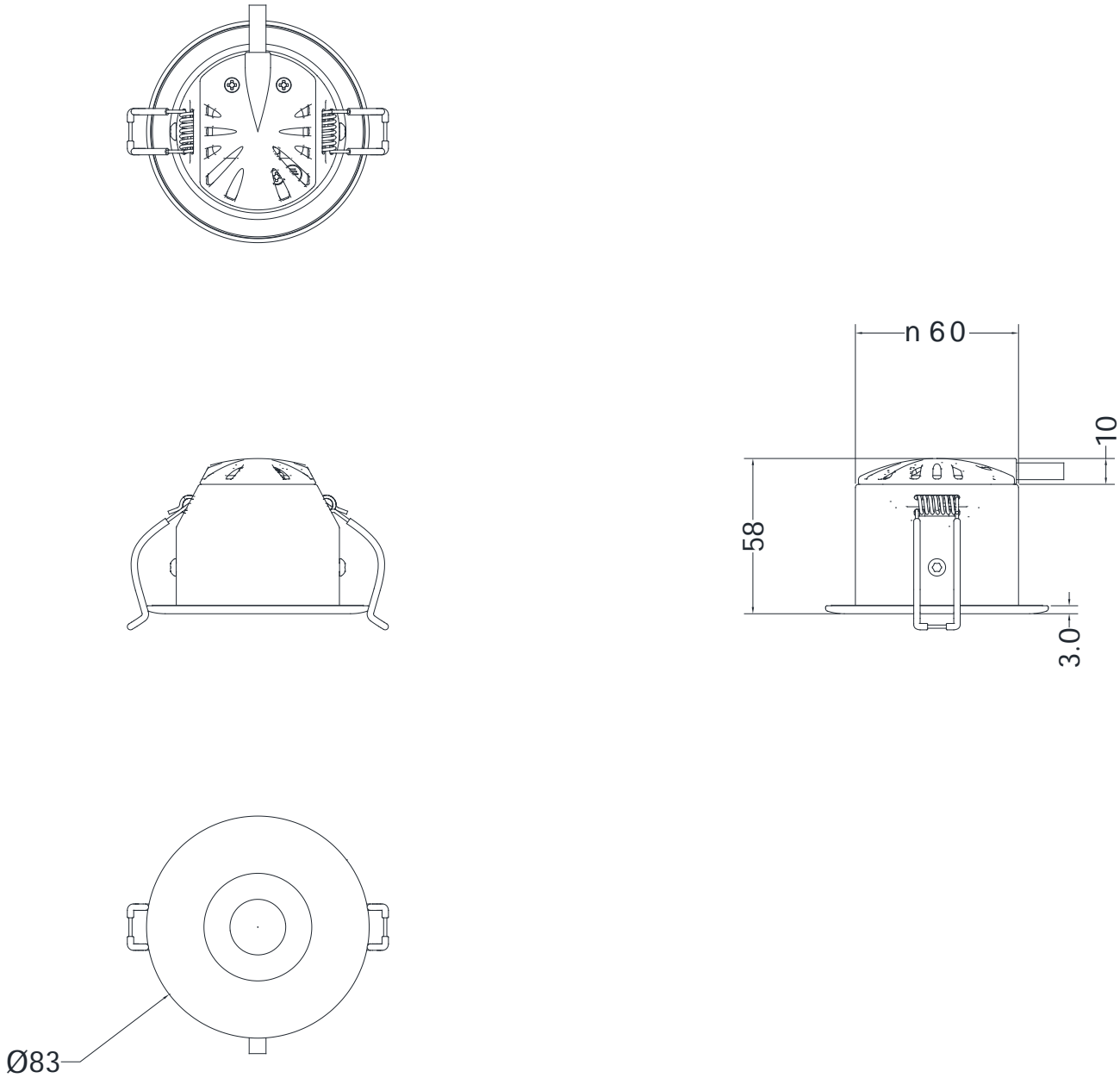
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Figure 4 – Downlight 2- JC10010



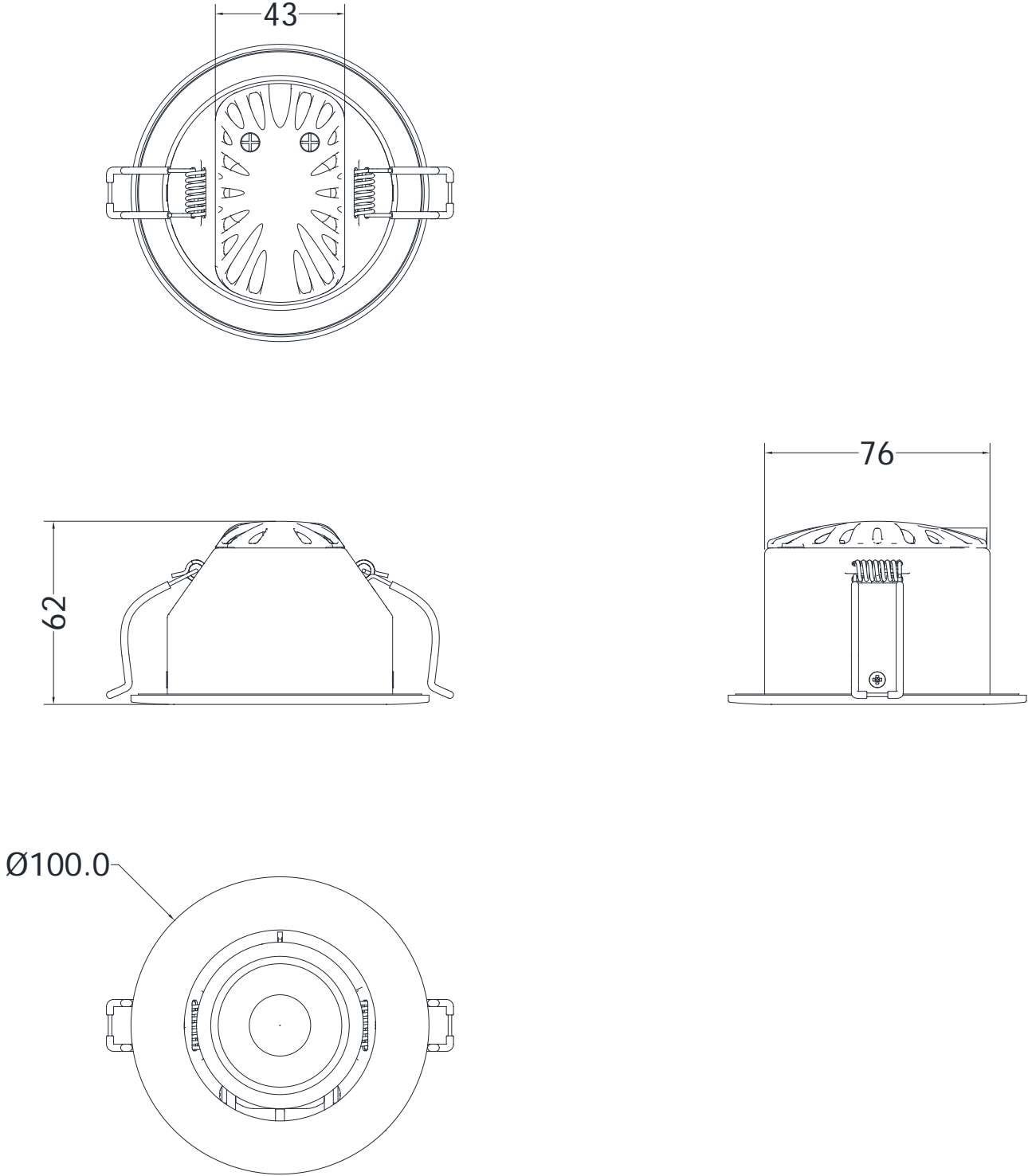
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Figure 5 – Downlight 3- JC1101



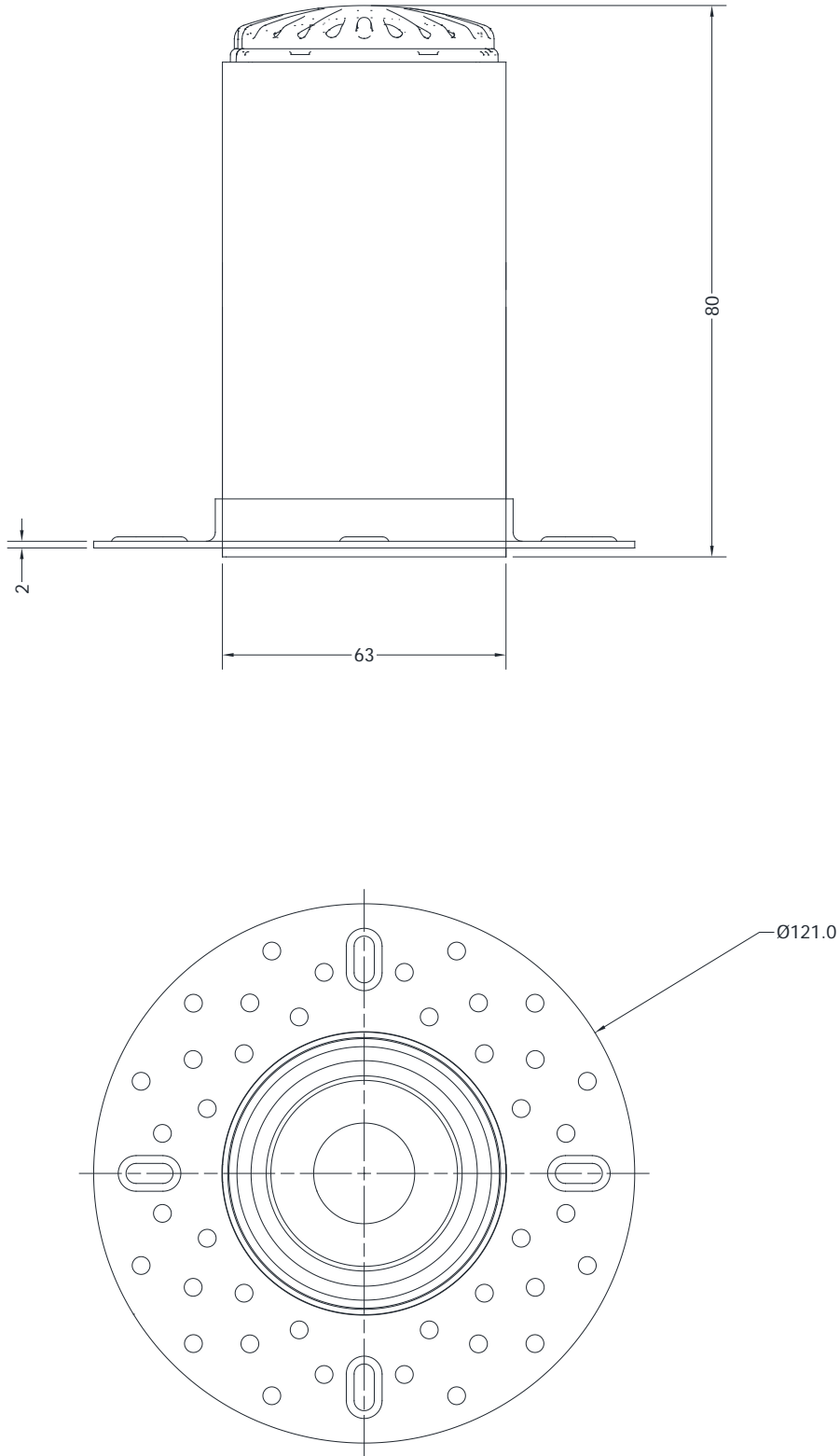
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Figure 6 – Downlight 4- JC1102



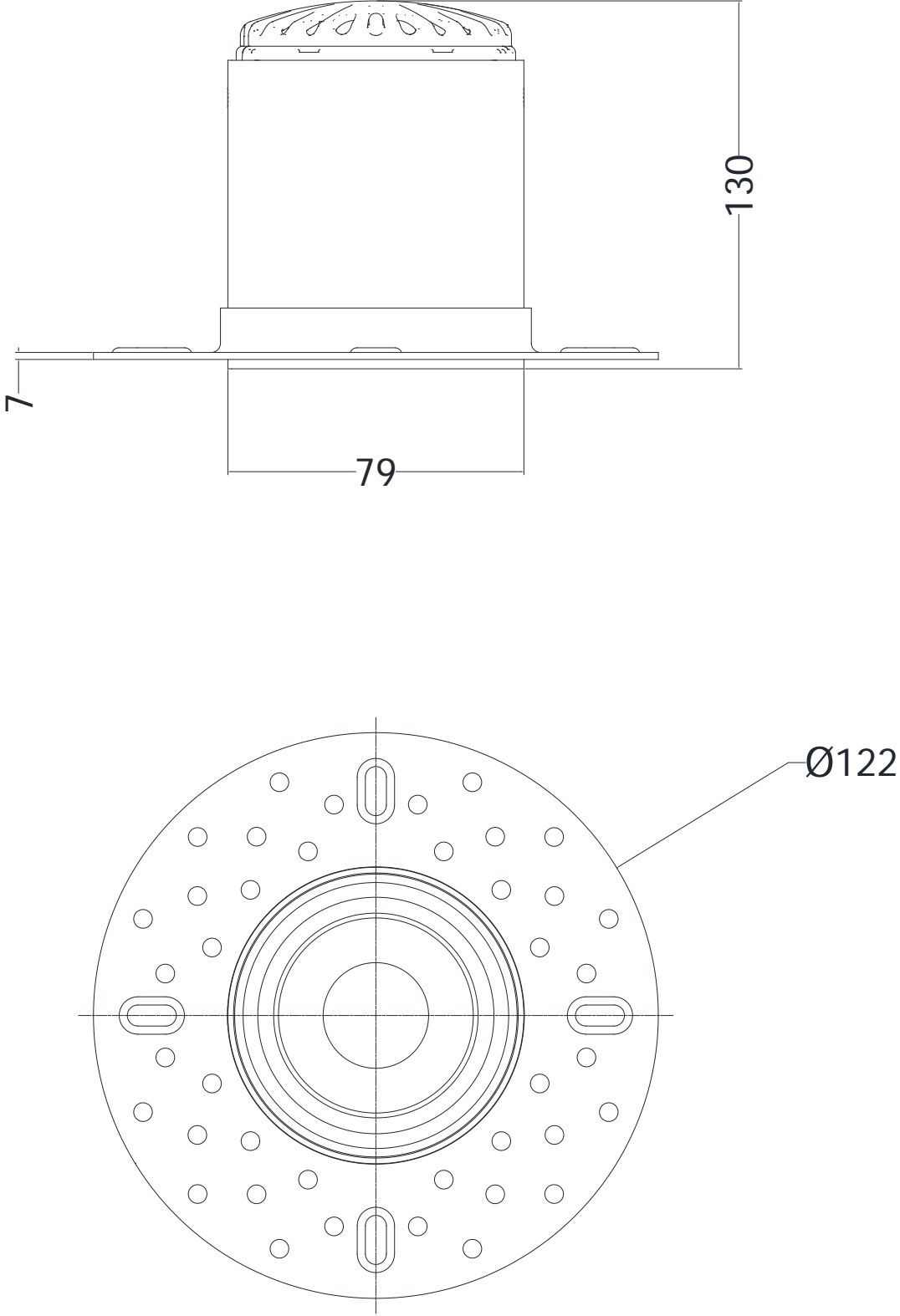
Do not scale. All dimensions are in mm

Figure 7 – Downlight 5- JC1020



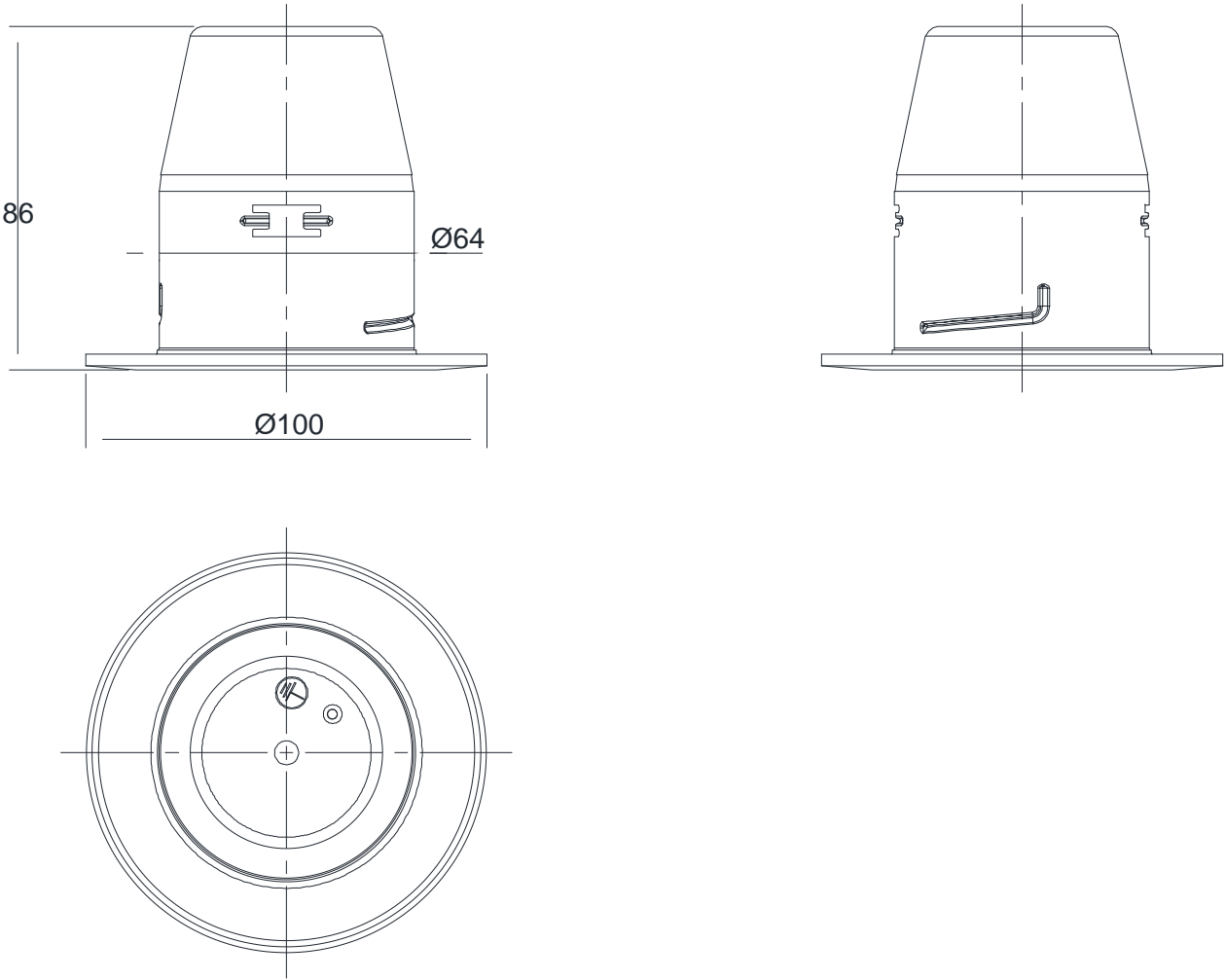
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Figure 8 – Downlight 6- JC010036



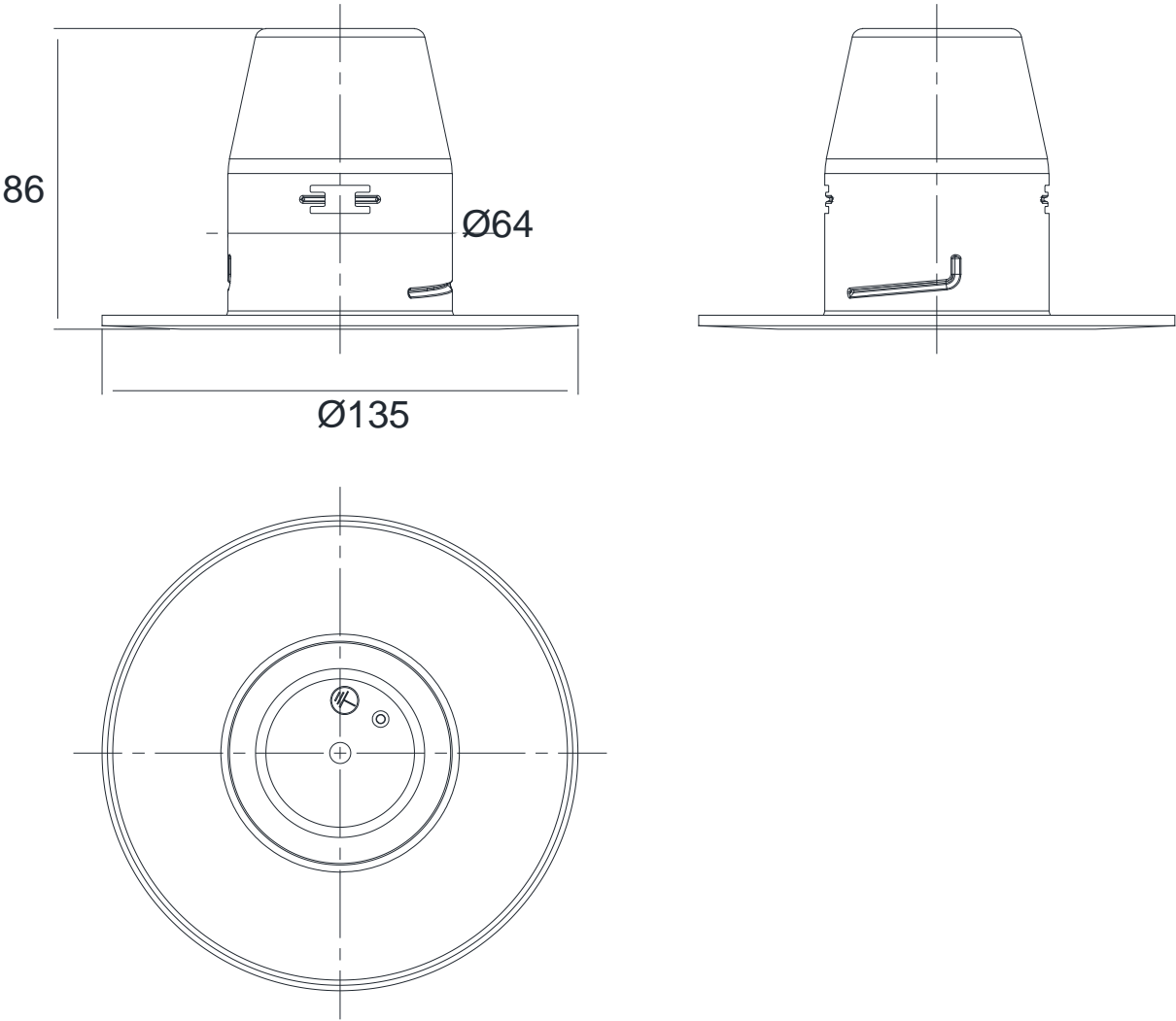
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Figure 9 – Downlight 7- JC010037



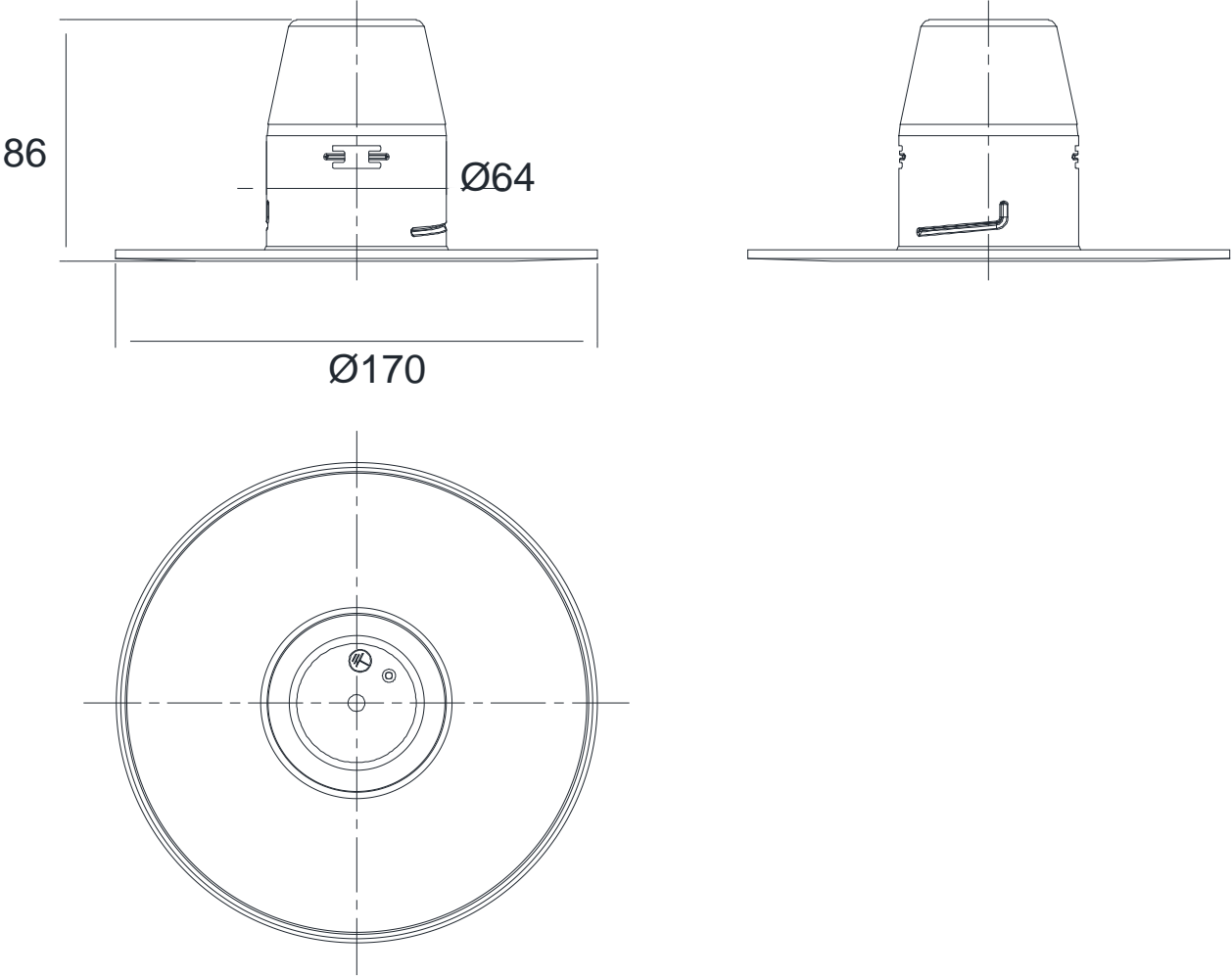
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Figure 10 – Downlight 8- JC010038



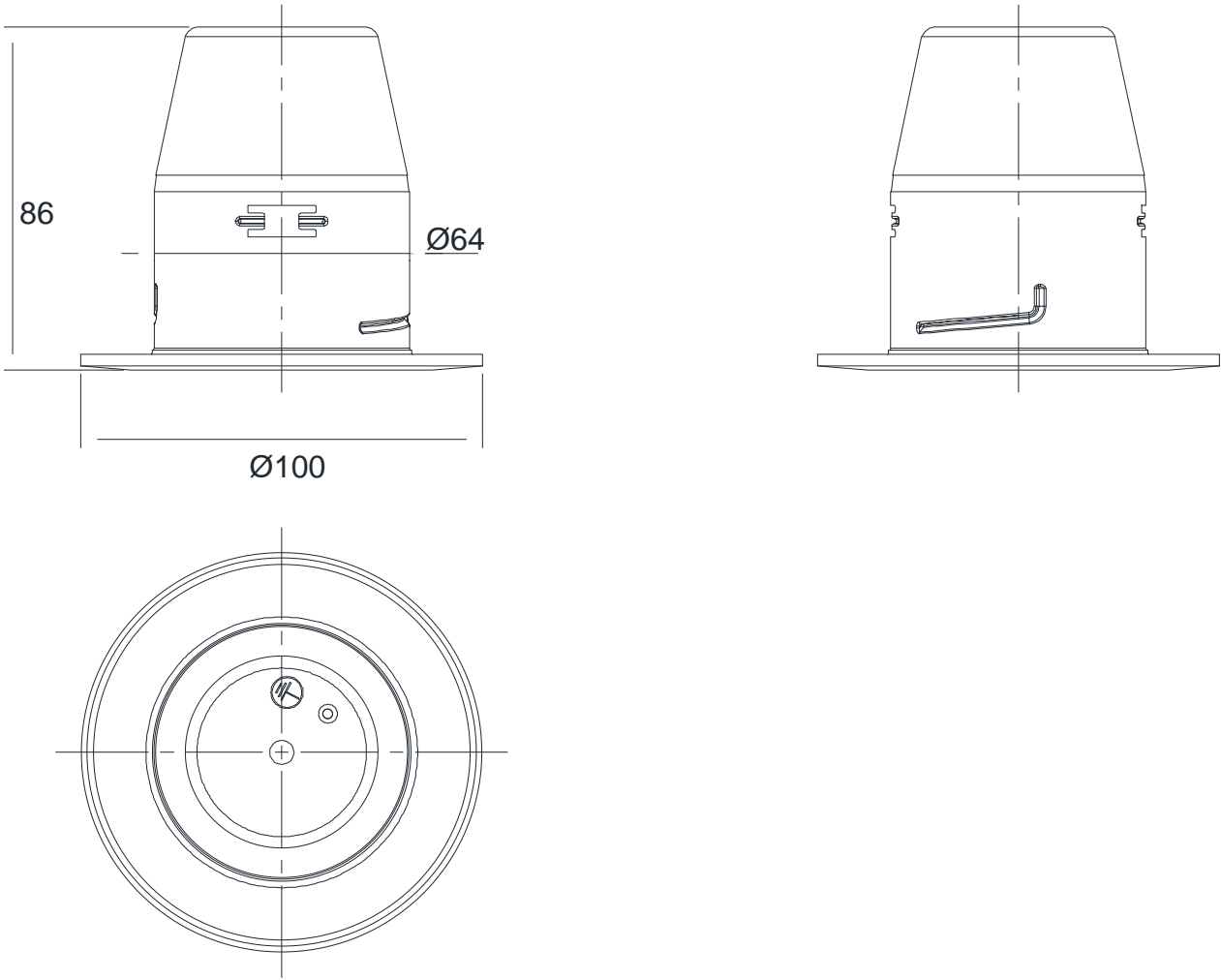
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Figure 11 – Downlight 9- JC010039



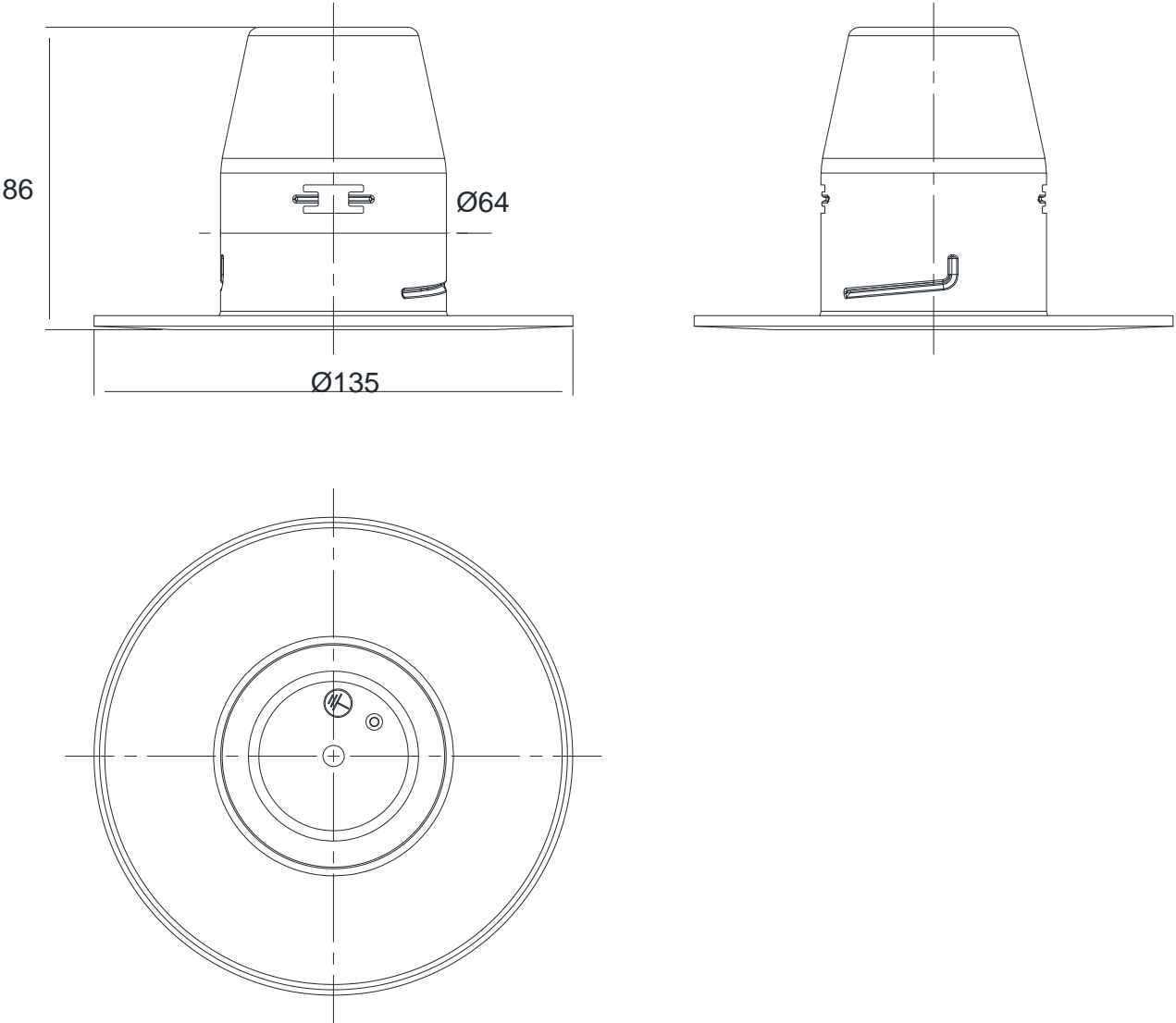
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Figure 12 – Downlight 10- JC010040



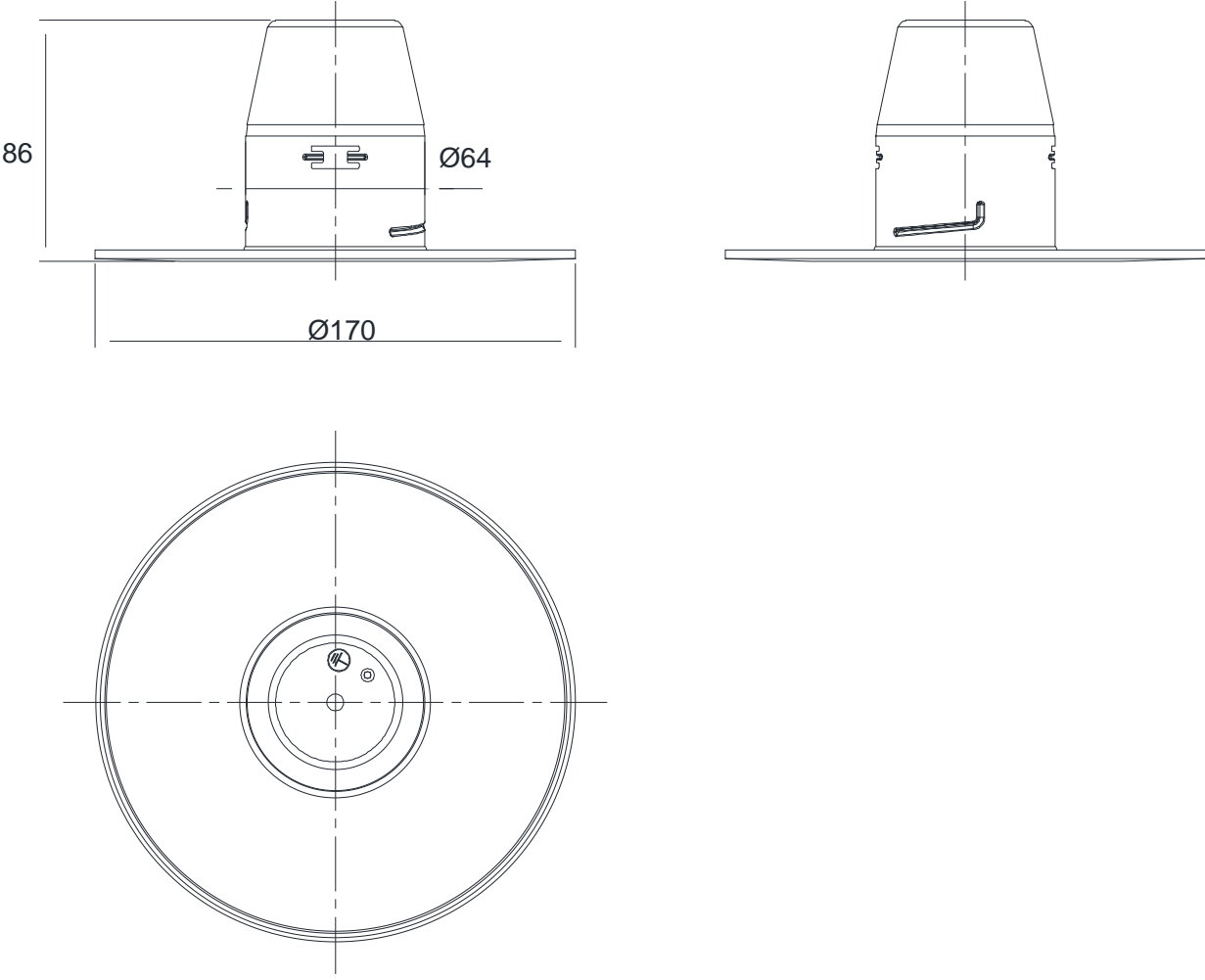
Do not scale. All dimensions are in mm

Figure 13 – Downlight 11- JC010041



Do not scale. All dimensions are in mm

Figure 14 – Downlight 12- JC010042



Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 14)

(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Timber framework	
Material	: C24 softwood
Section size	: 195 mm deep x 47 mm wide
Density	: 420 kg/m ³ (stated)
Fixing method	: End beams through fixed with six nails to each joist joint. Noggins fixed to joists with two nails per joint. Joists were spaced at 600mm nominal centres.
Fixings	
i. type	: Ring shank nails
ii. size	: 100 mm long x 3.8 mm diameter
2. Floorboards	
Manufacturer	: Norbord
Reference	: Caberfloor P5
Material	: Chipboard (tongue & groove)
Thickness	: 18 mm
Density	: 669 kg/m ³ (stated)
Fixing method	: Through fixed to timber framework with screws. Adhesive was applied to the top of joists and to tongue and groove joints
Fixings	
i. manufacturer	: Reisser
ii. reference	: Cutter High Performance Wood Screws
iii. type	: Yellow tropicalised steel screws
iv. size	: 60 mm long x 4.0 mm diameter
v. centres	: 200 mm
Adhesive	
i. reference	: Caberfix
ii. type	: D4 grade adhesive
3. Ceiling boards	
Manufacturer	: British Gypsum
Reference	: Gyproc WallBoard
Material	: Aerated high-density gypsum core encased in strong paper liners
Thickness	: 12.5mm
Density	: 616 kg/m ³ (stated)
Fixing method	: Through fixed to internal framework with screws. Board joints were taped and filled
Fixings	
i. manufacturer	: British Gypsum
ii. reference	: 55 mm Collated Drywall Screws
iii. type	: Black phosphate coated steel screws
iv. size	: 55 mm long x 3.5 mm diameter
v. centres	: 200mm
Tape	
i. manufacturer	: British Gypsum
ii. reference	: 48mm FibaTape
Filler	

<u>Item</u>	<u>Description</u>
3. Ceiling boards (continued)	
i. manufacturer	: British Gypsum
ii. reference	: Gyproc Ready Mix Joint Cement
4. Downlight 1	
Manufacturer	: JCC Lighting
Reference	: JC1001
Description	: Fixed LED recessed downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 48mm (can), 58 mm (overall)
ii. overall diameter	: 84mm
iii. cut-out diameter	: 70 mm
5. Downlight 2	
Manufacturer	: JCC Lighting
Reference	: JC10010
Description	: Fixed LED Recessed Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 46 mm
ii. overall diameter	: 80 mm
iii. cut-out diameter	: 70 mm
6. Downlight 3	
Manufacturer	: JCC Lighting
Reference	: JC1101
Description	: X50 Fire Rated Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 58 mm (can), 60 mm (overall)
ii. overall diameter	: 83 mm
iii. cut-out diameter	: 68 mm
7. Downlight 4	
Manufacturer	: JCC Lighting
Reference	: JC1102
Description	: X50 Tilt Fire Rated Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 62 mm
ii. overall diameter	: 100 mm
iii. cut-out diameter	: 82 mm
8. Downlight 5	
Manufacturer	: JCC Lighting
Reference	: JC1020
Description	: LED Recessed Plaster in Downlight
Material	: Mild steel (can), aluminium (bezel) polycarbonate (connection block)
Overall sizes	:
i. height	: 80mm

<u>Item</u>	<u>Description</u>
8. Downlight 5 (continued)	
ii. overall diameter	: 121
iii. cut-out diameter	: 70 mm
9. Downlight 6	
Manufacturer	: JCC Lighting
Reference	: JC010036
Description	: GU10 Recessed Plaster in downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 130mm
ii. overall diameter	: 122 mm
iii. cut-out diameter	: 68 mm
10. Downlight 7	
Manufacturer	: JCC Lighting
Reference	: JC010037
Description	: GU10 Recessed 100mm Converter Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 86 mm
ii. overall diameter	: 100 mm
iii. cut-out diameter	: 90 mm
11. Downlight 8	
Manufacturer	: JCC Lighting
Reference	: JC010038
Description	: GU10 Recessed 135mm Converter Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip) polycarbonate (connection block)
Overall sizes	:
i. height	: 86 mm
ii. overall diameter	: 135 mm
iii. cut-out diameter	: 125 mm
12. Downlight 9	
Manufacturer	: JCC Lighting
Reference	: JC010039
Description	: GU10 Recessed 170mm Converter Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate connection block)
Overall sizes	:
i. height	: 86 mm
ii. overall diameter	: 170 mm
iii. cut-out diameter	: 157 mm
13. Downlight 10	
Manufacturer	: JCC Lighting
Reference	: JC010040
Description	: GU10 Recessed 100mm Converter Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 86 mm

<u>Item</u>	<u>Description</u>
13. Downlight 10 (continued)	
ii. overall diameter	: 100 mm
iii. cut-out diameter	: 90 mm
14. Downlight 11	
Manufacturer	: JCC Lighting
Reference	: JC010041
Description	: GU10 Recessed 135mm Converter Downlight
Material	: Mild steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 86 mm
ii. overall diameter	: 135 mm
iii. cut-out diameter	: 125 mm
15. Downlight 12	
Manufacturer	: JCC Lighting
Reference	: JC010042
Description	: GU10 Recessed 170mm Converter Downlight
Material	: Steel (can), aluminium (bezel), steel (spring clip), polycarbonate (connection block)
Overall sizes	:
i. height	: 86 mm
ii. overall diameter	: 170 mm
iii. cut-out diameter	: 157 mm

Test Observations

Time		All observations are from the exposed face unless noted otherwise.
- 60	00	Load applied
00	00	The test commences.
06	00	Smoke and steam release around the perimeter of the specimen.
07	00	When viewed from the exposed face, downlight 1 is melting from the ceiling.
11	00	When viewed from the exposed face, jointing compound is starting to detach exposing the joints to the heating conditions.
18	00	When viewed from the exposed face, the long edges of the boards are starting to ripple and downlighter 10 is detached.
20	00	When viewed from the exposed face, downlighter 11 detached.
27	00	When viewed from the exposed face, multiple downlighters detached and flaming through the apertures.
33	00	When viewed from the exposed face, the ceiling boards have detached, and the furnace has engulfed in flames.
43	00	Test discontinued owing to load bearing failure.

Test Photographs

The exposed 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 30 minutes of testing



The unexposed face of the floor assembly after 43 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: 2020

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	33
2	445	339
4	544	550
6	603	600
8	646	634
10	678	677
12	706	706
14	728	731
16	748	749
18	766	764
20	781	783
22	796	796
24	809	808
26	820	823
28	832	831
30	842	840
32	852	859
34	860	853
36	869	868
38	877	880
40	885	881
42	892	895
43	896	900

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	29	29	29	29	29	29
2	29	29	29	29	29	29
4	29	29	29	29	29	29
6	29	29	29	29	29	29
8	29	30	29	29	29	29
10	30	31	30	30	30	30
12	31	32	31	31	32	31
14	33	34	32	33	33	33
16	35	36	34	35	35	35
18	37	37	35	36	36	36
20	38	39	37	38	38	38
22	40	40	38	40	40	40
24	42	42	40	42	41	41
26	45	45	41	47	43	44
28	49	50	43	59	45	49
30	56	57	47	79	49	58
32	63	66	51	89	54	65
34	76	80	63	85	61	73
36	82	85	73	84	75	80
38	85	86	80	84	82	83
40	85	87	84	87	83	85
42	88	89	87	91	86	88
43	89	91	93	93	87	91

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 219 Deg. C	T/C Number 220 Deg. C	T/C Number 221 Deg. C	T/C Number 222 Deg. C
0	29	29	30	28	29	25
2	29	29	30	28	29	25
4	29	29	30	28	29	25
6	29	29	30	29	29	25
8	29	30	30	29	29	26
10	30	31	31	30	30	27
12	31	32	33	31	31	28
14	32	34	34	32	33	29
16	34	36	36	34	35	31
18	36	37	38	36	36	33
20	37	39	40	37	38	35
22	39	42	42	39	40	37
24	40	44	44	41	42	39
26	42	46	47	42	44	41
28	45	49	53	44	46	44
30	49	54	59	47	50	49
32	55	60	65	51	54	55
34	63	67	73	58	59	61
36	79	78	80	80	68	73
38	84	81	83	89	76	79
40	84	84	85	90	81	82
42	84	87	88	90	84	85
43	85	89	108	91	86	86

Individual Temperatures Recorded At Mid-Height Of The Cavity Coincidental With The Light Fittings

Time Mins	T/C Number 223 Deg. C	T/C Number 224 Deg. C	T/C Number 225 Deg. C	T/C Number 226 Deg. C	T/C Number 227 Deg. C	T/C Number 229 Deg. C
0	30	31	31	31	32	34
2	36	34	34	44	36	36
4	66	68	65	84	66	67
6	86	87	75	105	81	79
8	103	104	93	119	97	93
10	116	103	101	117	115	116
12	106	111	108	117	122	131
14	107	114	120	115	133	139
16	116	114	122	131	145	145
18	137	126	132	167	154	155
20	155	143	158	207	160	171
22	187	190	201	246	194	198
24	207	226	233	273	228	223
26	230	250	256	295	250	243
28	245	270	282	329	265	262
30	259	287	296	346	284	273
32	277	304	716	356	299	288
34	323	653	785	546	364	359
36	375	802	817	613	759	414
38	444	824	836	743	800	611
40	567	840	845	801	823	773
42	623	853	853	841	831	810
43	660	848	870	859	837	820

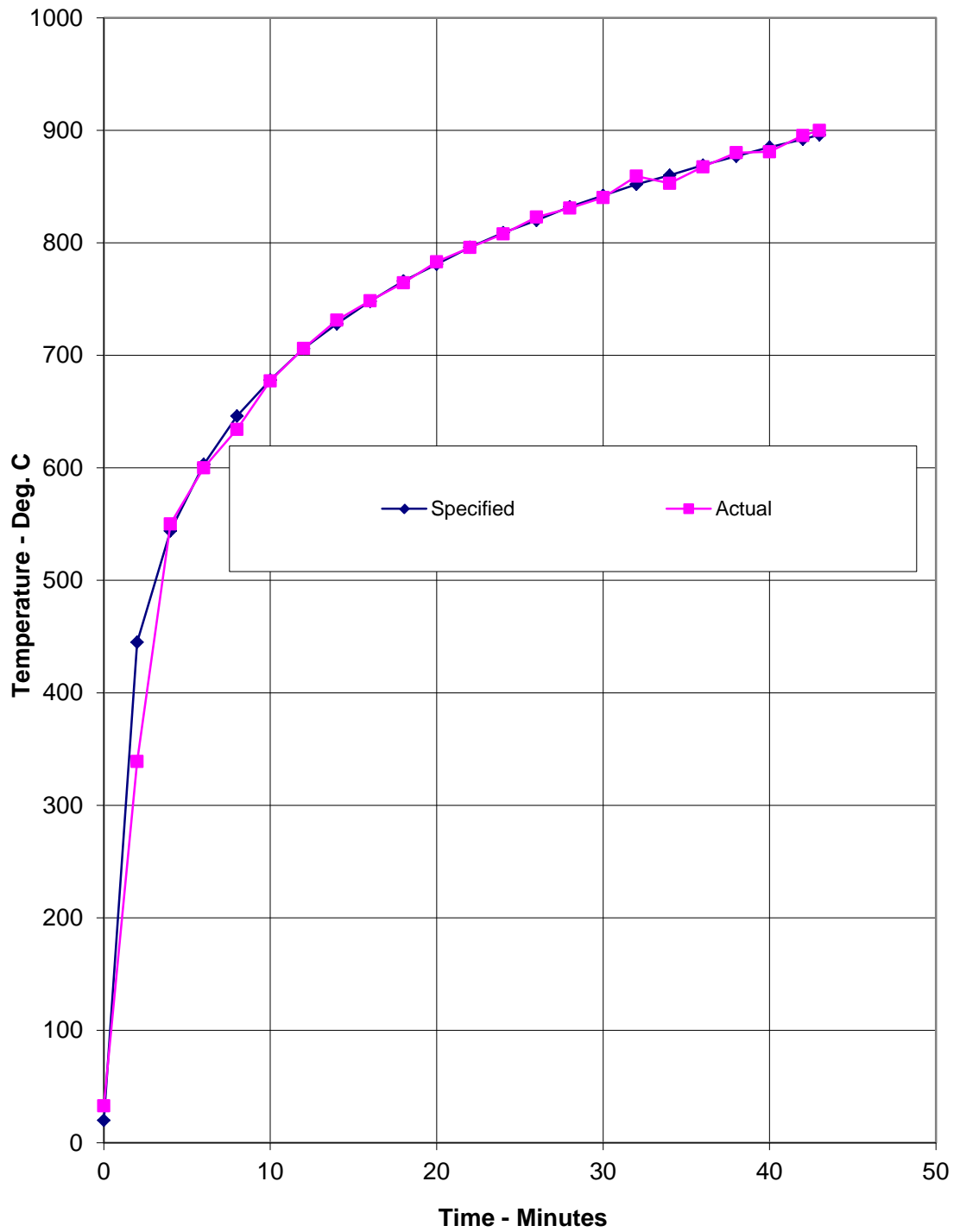
Individual Temperatures Recorded At Mid-Height Of The Cavity Coincidental With The Light Fittings

Time Mins	T/C Number 230 Deg. C	T/C Number 231 Deg. C	T/C Number 232 Deg. C	T/C Number 233 Deg. C	T/C Number 234 Deg. C	T/C Number 235 Deg. C
0	33	34	33	34	34	35
2	38	39	42	39	40	46
4	69	69	70	72	73	76
6	82	85	90	95	88	91
8	96	91	102	105	107	116
10	103	102	114	141	134	138
12	163	109	120	152	149	155
14	203	112	128	142	154	163
16	191	116	132	159	169	169
18	173	129	139	162	162	190
20	176	166	163	189	199	214
22	202	205	192	212	246	241
24	238	234	218	249	260	351
26	260	259	244	265	337	379
28	285	282	258	281	346	462
30	312	304	279	330	378	484
32	723	344	334	368	464	710
34	775	759	398	592	753	747
36	801	807	596	752	791	788
38	820	829	694	796	817	798
40	835	847	697	799	812	797
42	834	862	724	820	836	814
43	845	881	749	831	840	816

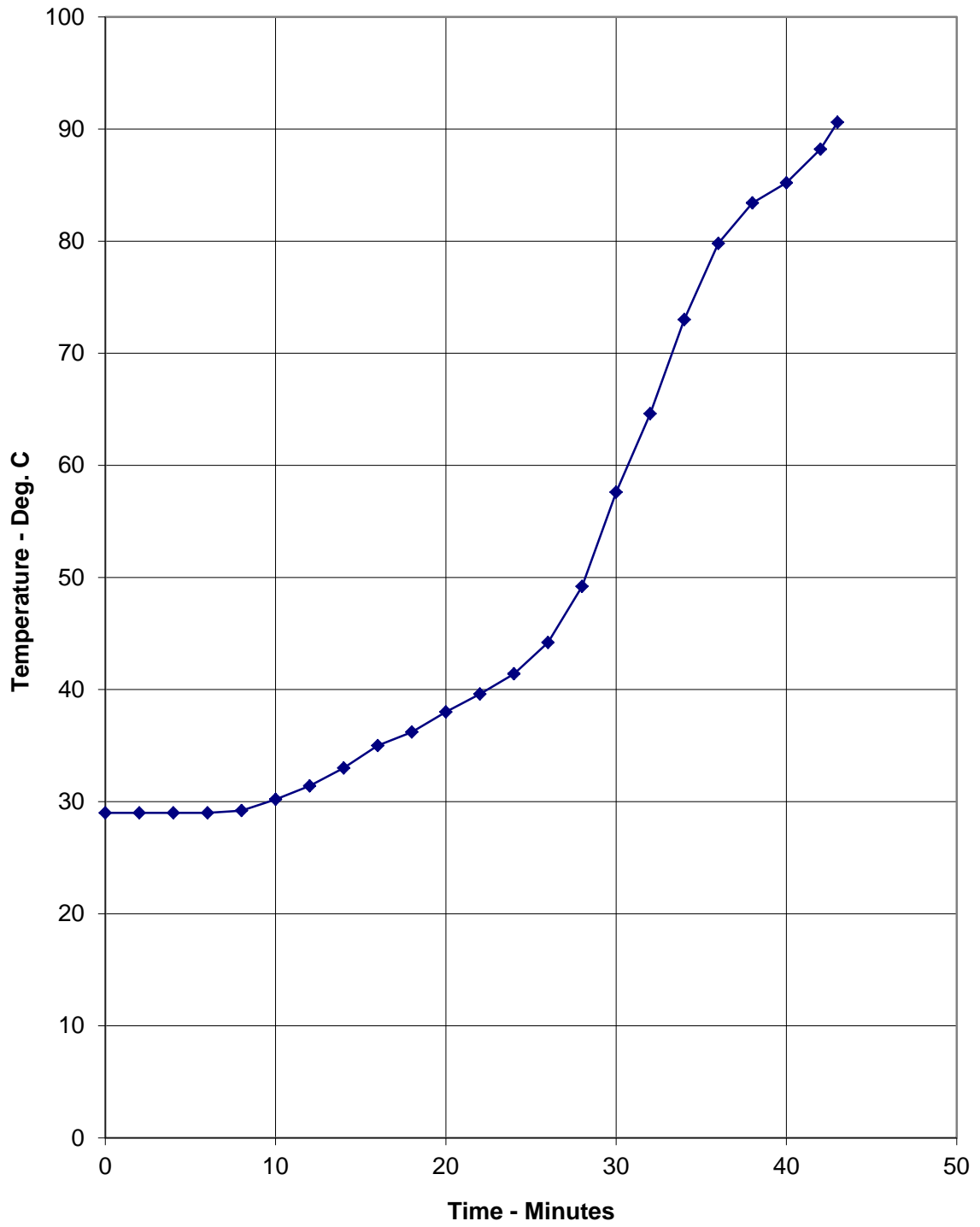
Central Vertical Deflection Of The Specimen

Time Mins	Central Vertical Deflection mm	Rate Of Deflection mm/min
0	0.0	0.0
2	2.0	0.6
4	2.7	0.1
6	3.6	0.5
8	4.7	0.5
10	5.9	0.7
12	7.3	0.7
14	8.5	0.8
16	9.7	0.7
18	10.9	0.7
20	12.2	0.6
22	13.2	0.6
24	14.5	0.7
26	16.1	0.8
28	18.1	1.3
30	20.8	1.6
32	24.0	1.6
34	34.1	6.5
36	48.4	7.1
38	62.4	7.2
40	80.2	8.6
42	98.7	9.4
43	165.5	66.8

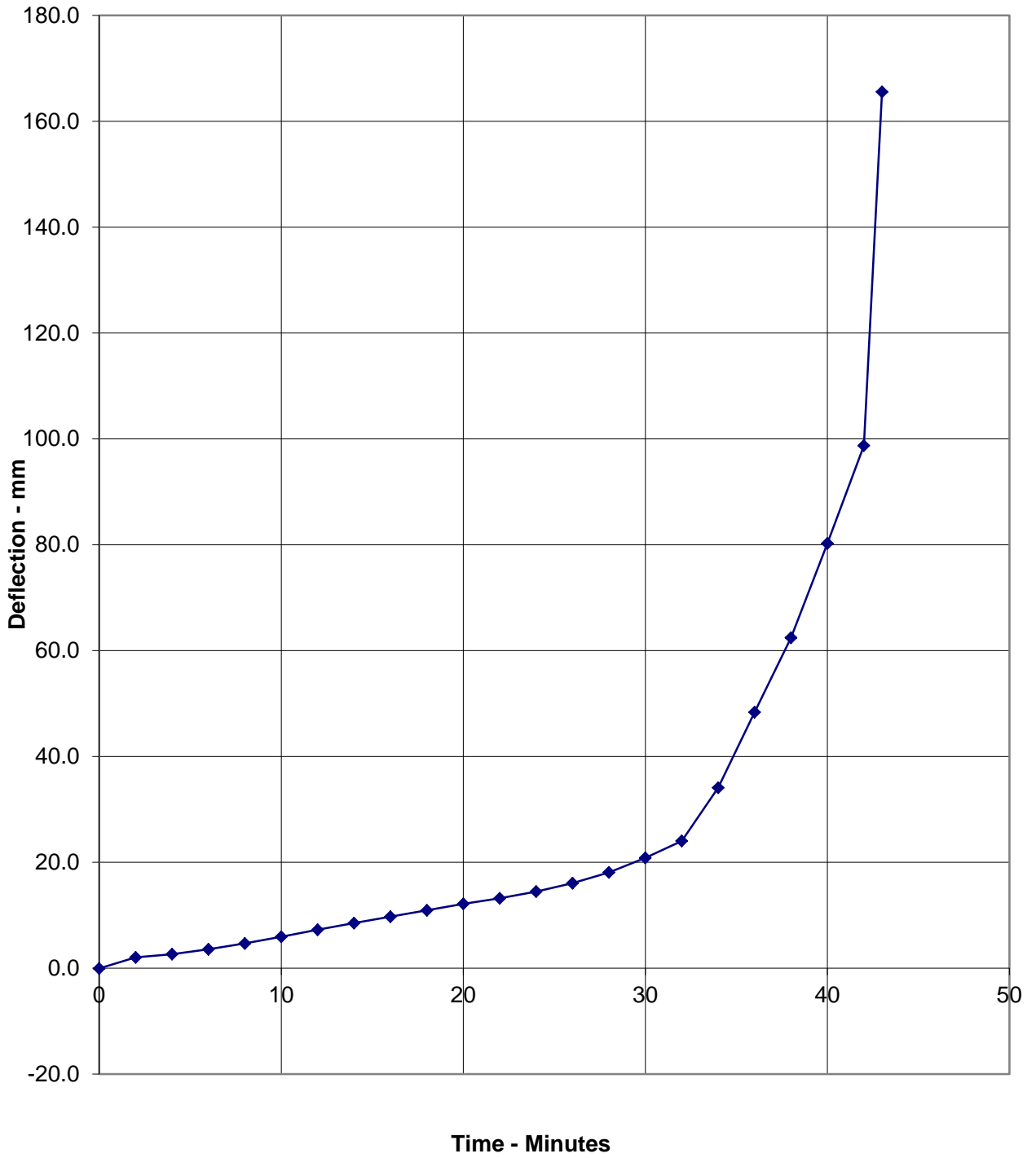
Graph Showing Mean Furnace Temperature, Together With The Temperature/Time Relationship Specified In The Standard



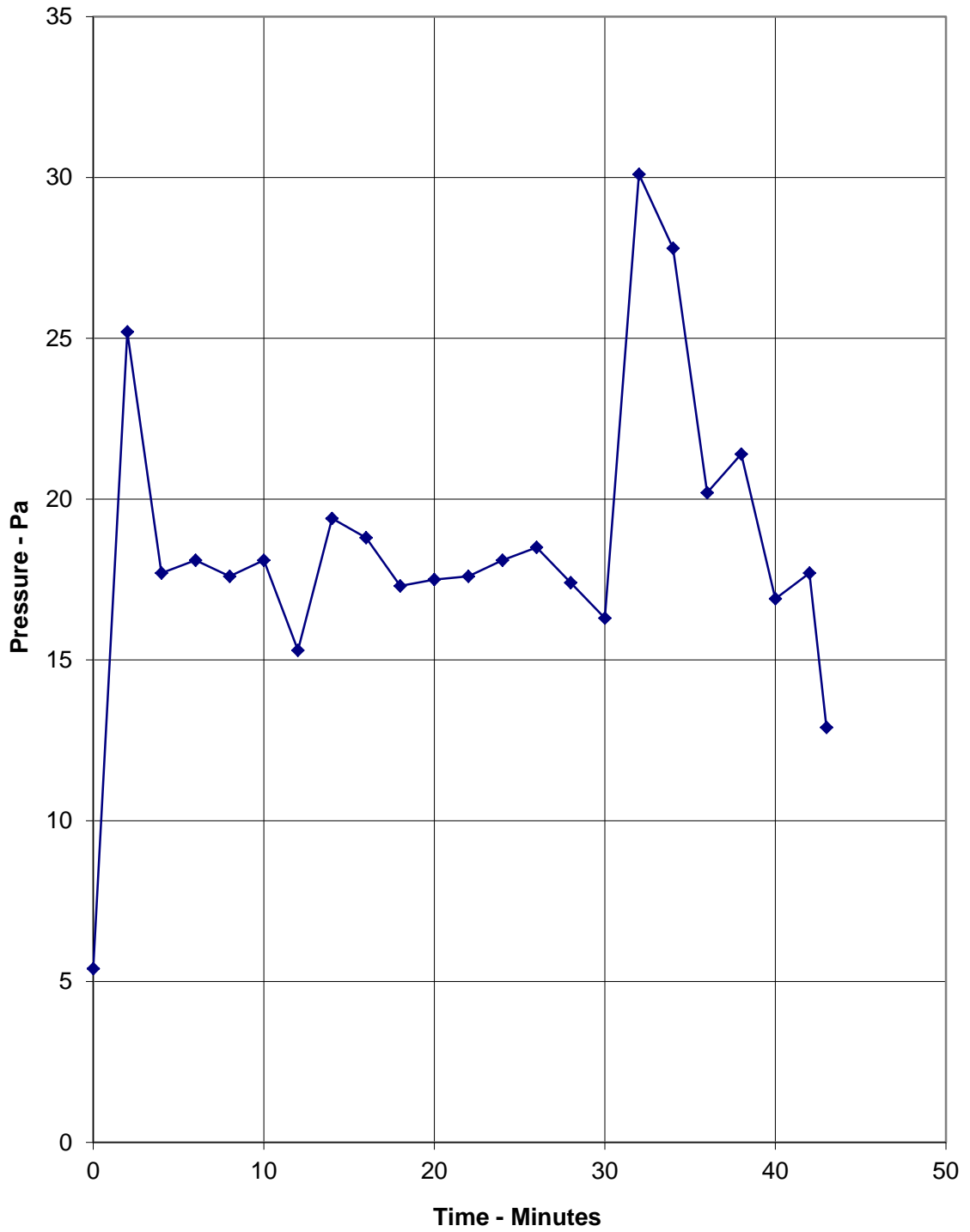
Graph Showing Mean Temperature Recorded On The Unexposed Surface Of The Specimen



Graph Showing The Recorded Vertical Deflection Of The Specimen



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



Load Calculation

Physical parameters of timber joists

Depth :	195	mm
Thickness :	38	mm
Centres (M) :	600	mm
Span (L) :	4150	mm
Ceiling length	3985	mm
Floor boards length	3985	mm
Timber grade :	c16	

Parameters -BS 5268 - Part 2: 2002

Basic dry stress in bending:	5.3	N/mm ²
Modification factor for loading:	1.1	(Section 2.9 (a))
Therefore working stress (F):	5.83	N/mm ²
Nominal density:	535	kg/m ³

Total loading required per joist

moment of inertia (I) bd ³ /12:	23480438	mm ⁴
Distance from neutral axis to base of joist (y):	97.5	mm
Maximum bending stress w (F/y):	1404009.8	N/mm ²
w = load per unit length		
maximum bending stress = w x L ² /8		
therefore w= maximum bending stress x 8 / L ² :	0.652174655	N/mm
	652.1746552	N/m
Therefore total loading (w):	2706.524819	N
Converted to kg (/ 9.80665)	275.9887239	kg

Dead weight

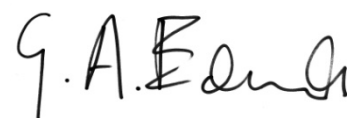
Density of joist:	498.842	kg/m ³
Density of floor boarding	666.364	kg/m ³
Density of ceiling (layer 1)	681.065	kg/m ³
Effective width of floor supported per joist (m):	0.6	m
weight of joist	15.34014	kg
weight of floorboard	35.052079	kg
weight of ceiling (layer 1)	24.426396	kg
Total ceiling weight:	24.426396	kg
Totak dead weight per joist	74.818615	kg

Imposed Load

total load per joist - dead weight per joist:	201.17011	kg
Convert to kN ((x 9.80665)/1000)	1.9728048	kN
Assusming even distribution of loading		
Maximim imposed load per meter square:	0.792291103	kN/m ²
converted to kg (x101.9716005)	81	kg/m ²



Calculation made by
P. White
Technical Officer



Calculation checked by
G. Edmonds
Senior Technical Officer

*For and on behalf of **Warringtonfire**

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: 2020, 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: 2020, 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.

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.

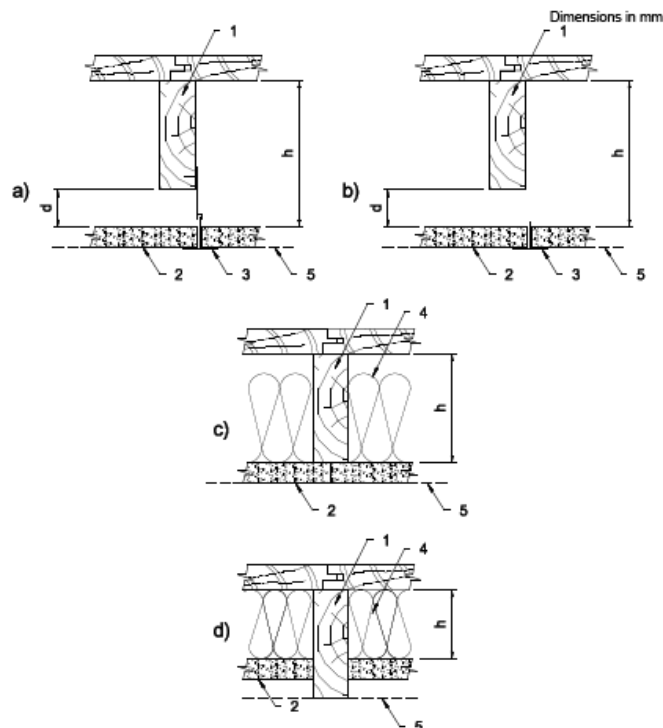
b) With respect to the ceiling system:

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 | |