

Title:

The Fire Resistance
Performance of a
Loadbearing Timber Floor
Assembly Protected by a
Plasterboard Ceiling
Designed to Provide 90
Minutes Fire Resistance,
Incorporating Ten
Downlight Fittings, When
Tested Accordance with
BS EN 1365 - 2: 2014

WF Report No:

412951



Prepared for:

Orlight LTD
Victor Way,
Radlett Road,
Colney Street,
St Albans,
AL2 2FL

Date:

18th November 2019



0249

Summary

Objective To determine the fire resistance performance of a loadbearing timber floor assembly protected by a plasterboard ceiling designed to provide 90 minutes fire resistance, incorporating ten light fittings, when tested in accordance with BS EN 1365 - 2: 2014.

Sponsor **Orlight LTD**, Victor Way, Radlett Road, Colney Street, St Albans, AL2 2FL

Summary of Tested Assembly The timber floor had overall nominal dimensions of 4500 mm long by 2960 mm wide and comprised softwood timber 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 underside by a direct fixed ceiling, formed from three layers of 12.5 mm plasterboard referenced 'Gyproc Fireline Wallboard'.

The floor supported an evenly distributed load of 1.246 kN/m².

The ceiling incorporated ten down lighter light fittings referenced as follows:

Test Ref.	Model Ref.	Type
A	ORL1009-HS-IP44	IP44 Fixed Magnetic Downlight
B	ORL009-TL-CL-IP44-NL	Tilttable Anti-glare Downlight
C	ORL009-TR-IP44-NL	Trimless IP Rated Fixed Anti-glare Downlight
D	ORL019MAXI-IP54-NL	IP Rated Adjustable Maxi Downlight
E	AQUASPOT-NL	IP65 Aquaspot
F	ORLCL-IP54	Fixed Minimal Trim Downlight
G	ORION	Adjustable LED Downlight
H	ORION-XL	Adjustable LED Downlight
I	ORL009-IP44-NL	Fixed IP Rated Anti-glare Downlight
J	ORL1019-HS-IP54	IP 54 Tilt Magnetic Downlight

Test Results:

Loadbearing Capacity	91 minutes*
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Integrity Performance	Sustained flaming	91 minutes*
	Gap gauge	91 minutes*
	Cotton pad	91 minutes*

Insulation	91 minutes*
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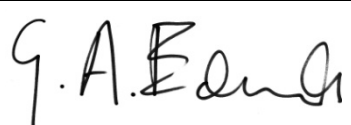
*The test duration. The test was discontinued after a period of 91 minutes.

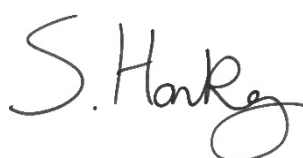
Date of Test 6th June 2019

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

Report Issued
Date : 18 th November 2019

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Revision History

Issue No : 2	Re-issue Date:19 th November 2019
Revised By: J. King	Approved By:
Reason for Revision: Model reference amended for specimen I on page 2	

Issue No :	Re-issue Date:
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Reason for Revision:	

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Test Procedure

Introduction

The specimen tested was of a loadbearing timber floor construction protected by a direct fix ceiling assembly. The test was conducted in accordance with BS EN 1365-2: 2014, 'Fire resistance tests for loadbearing elements – Part 2: Floors and Roofs'. This test report should be read in conjunction with that Standard and with BS EN 1363-1: 2012, 'Fire resistance tests part 1, general requirements' and BS EN 1363-2: 1999, 'Fire resistance tests part 2, alternative and additional procedures'.

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.

The specimen was judged on its ability to comply with the performance criteria for loadbearing capacity, integrity and insulation, as required by BS EN 1365-2: 2014.

Fire Test Study Group/EGOLF

Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and 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.

Instruction To Test

The test was conducted on the 6th June 2019 at the request of **Orlight LTD**, the test sponsor.

No representatives of the test sponsor witnessed the test.

Test Assembly Construction

A comprehensive description of the test construction is given in the Schedule of Components. The description is based on a detailed survey of the specimen light fittings and information supplied by the sponsor of the test.

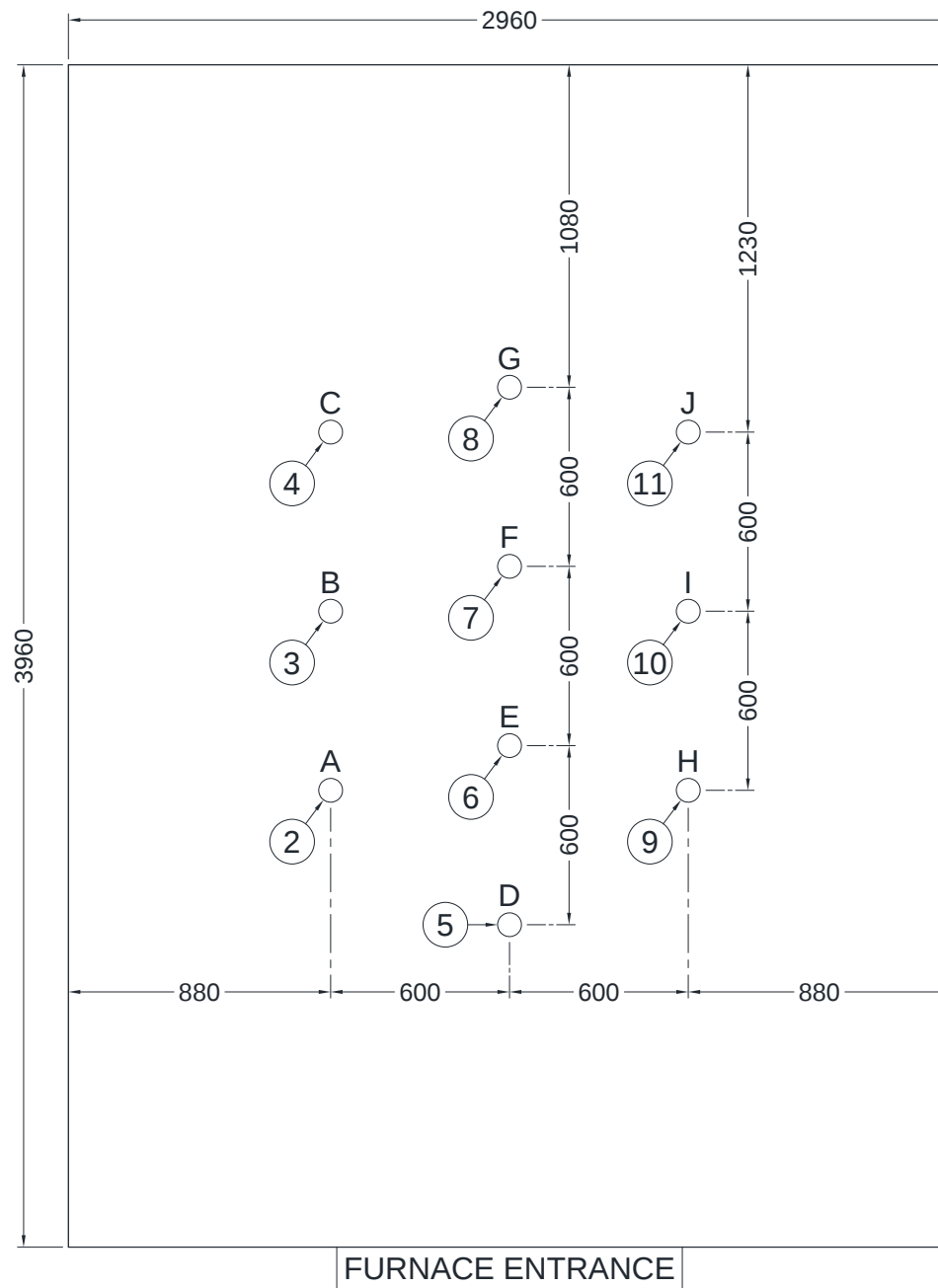
Installation

Representatives of **Warringtonfire** assembled the floor construction and installed the down lighters on 4th June 2019.

Conditioning

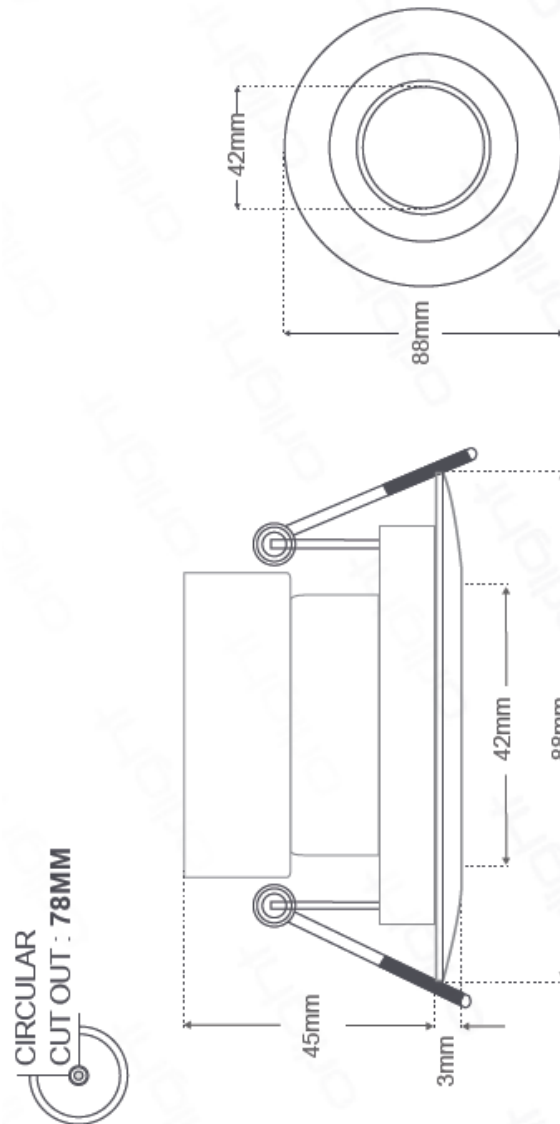
The specimens' storage, construction, and test preparation took place in the test laboratory over a total combined time of days. Throughout this period of time both the temperature and the humidity of the 2 laboratory were measured and recorded as being within a range of from 17°C to 26°C and 48% to 72% respectively.

Figure 2 – Details of Downlighter Positions Within the Ceiling Boards



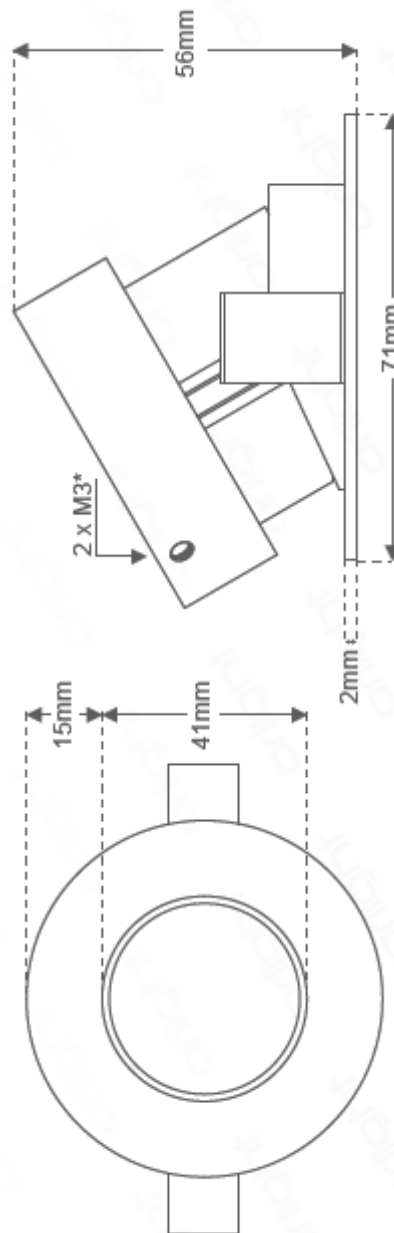
Do not scale. All dimensions are in mm

Figure 3 – Details of Downlighter Specimen A



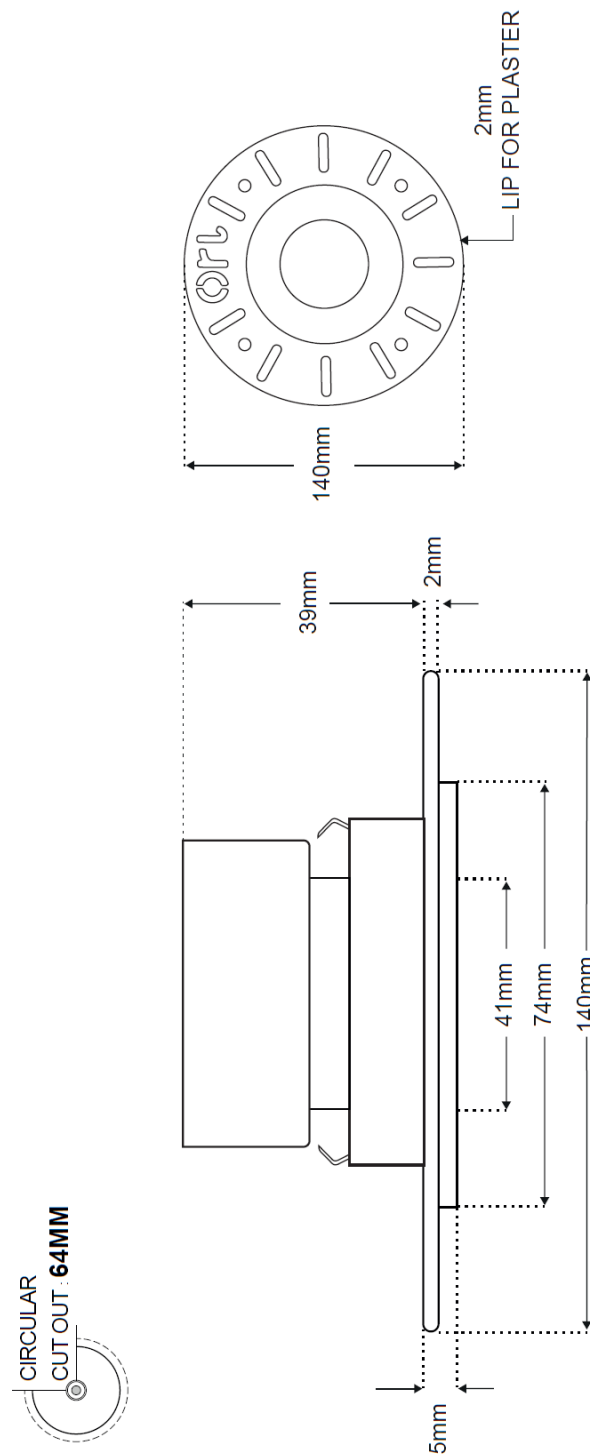
Do not scale. All dimensions are in mm

Figure 4 – Details of Downlighter Specimen B



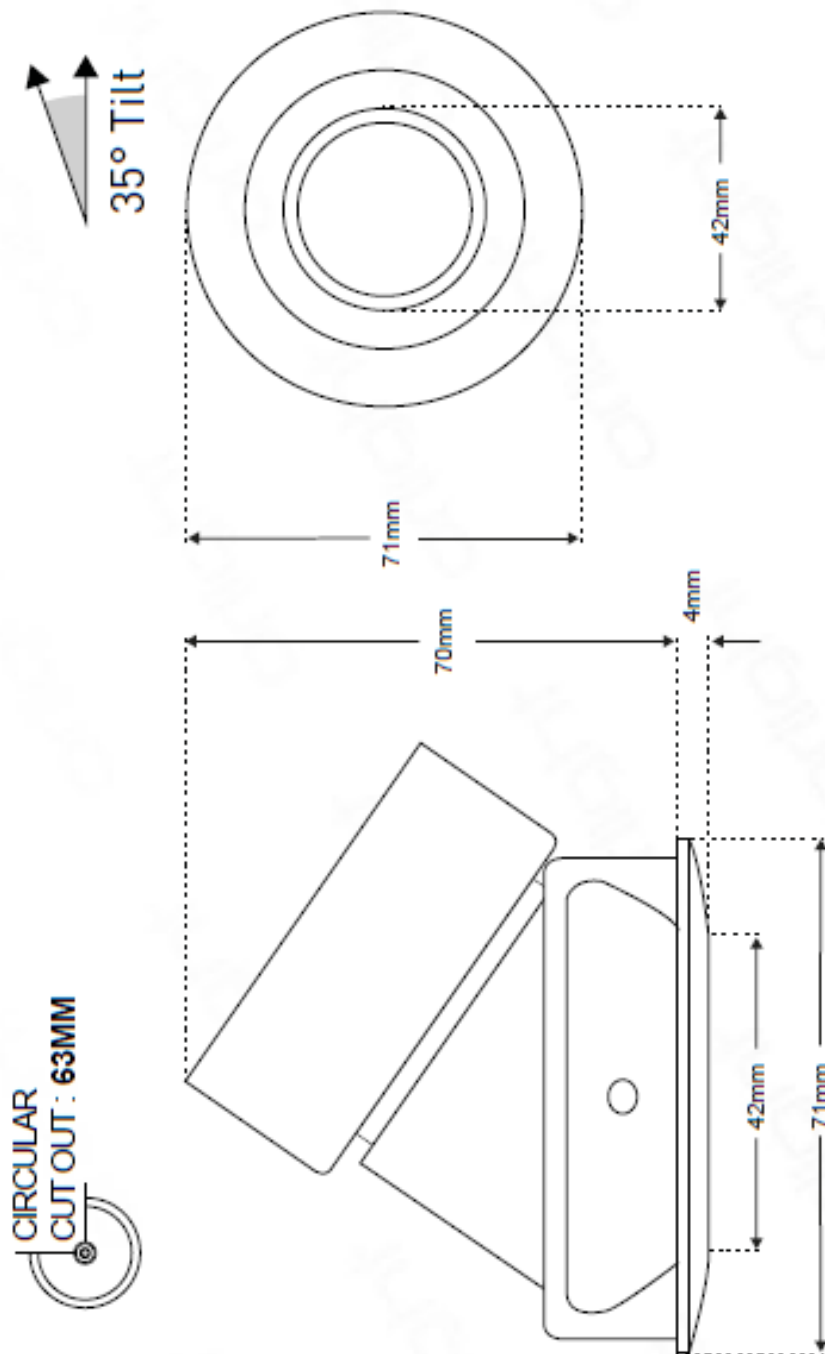
Do not scale. All dimensions are in mm

Figure 5 – Details of Downlighter Specimen C



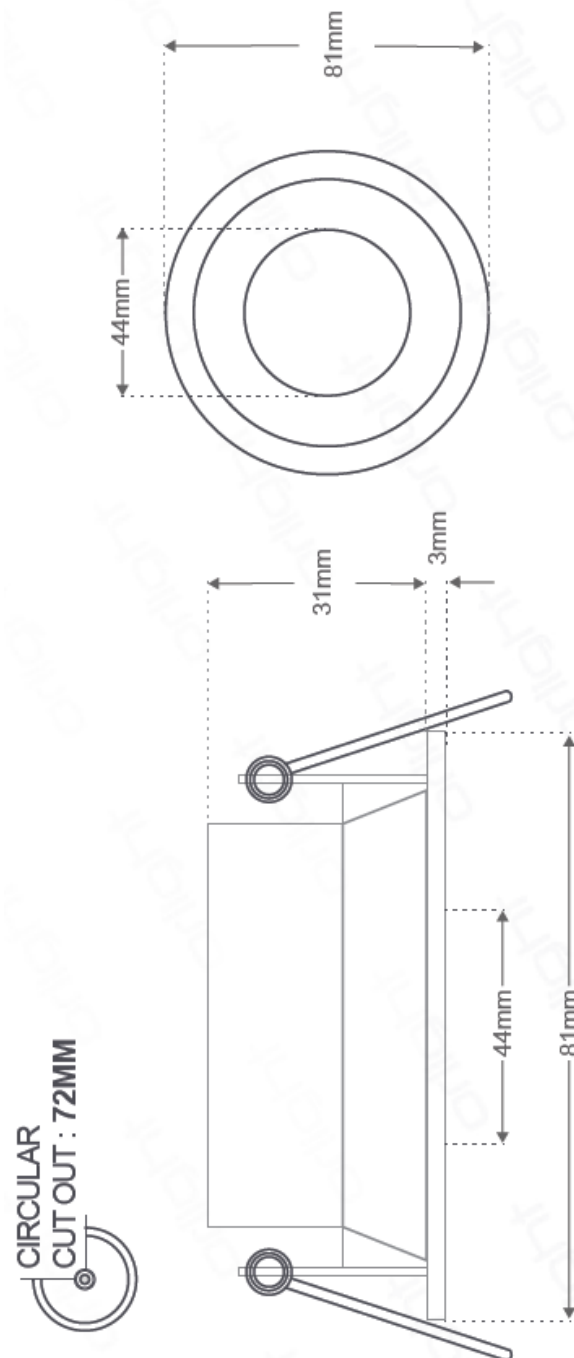
Do not scale. All dimensions are in mm

Figure 6 – Details of Downlighter Specimen D



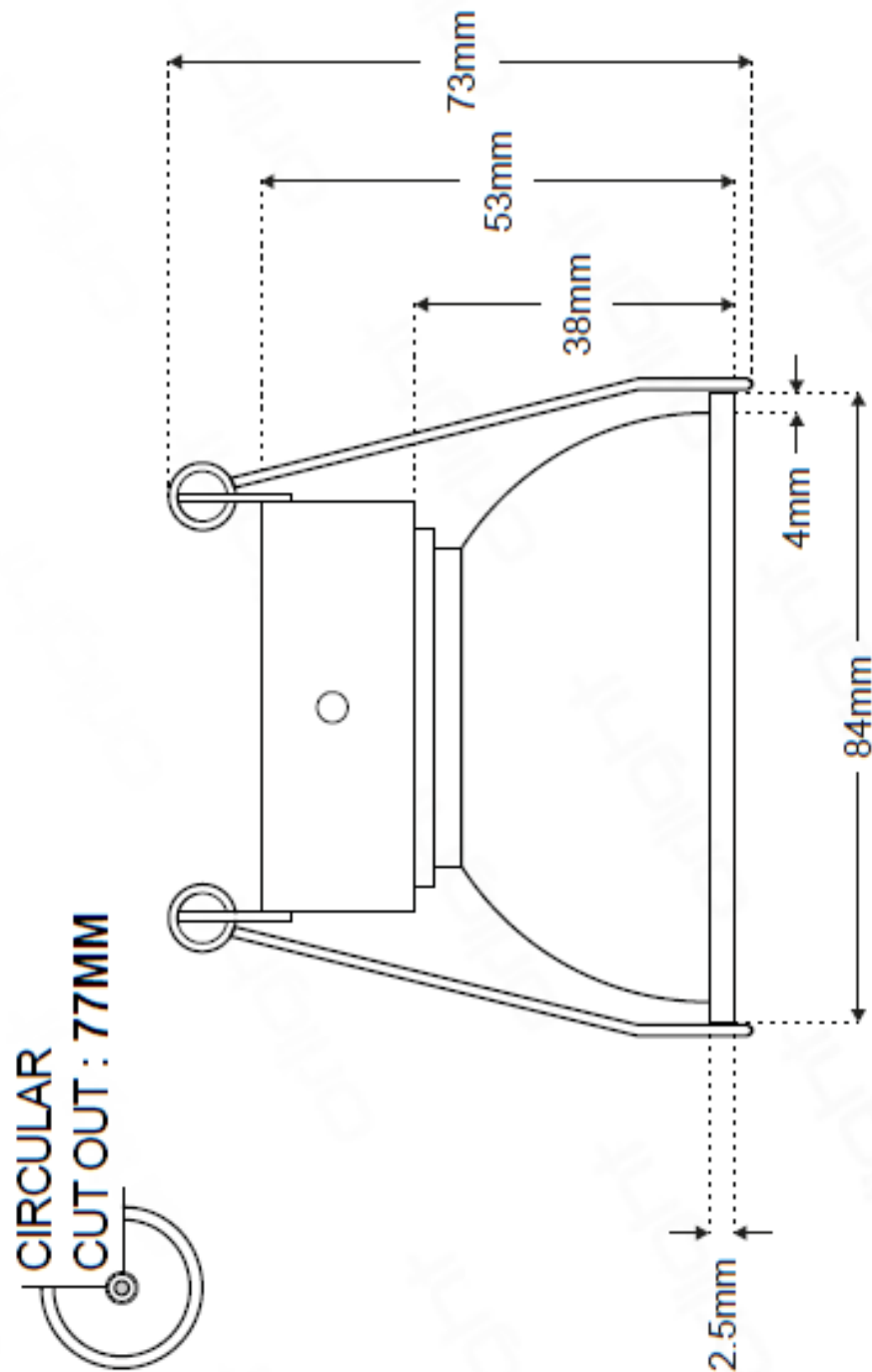
Do not scale. All dimensions are in mm

Figure 7 – Details of Downlighter Specimen E



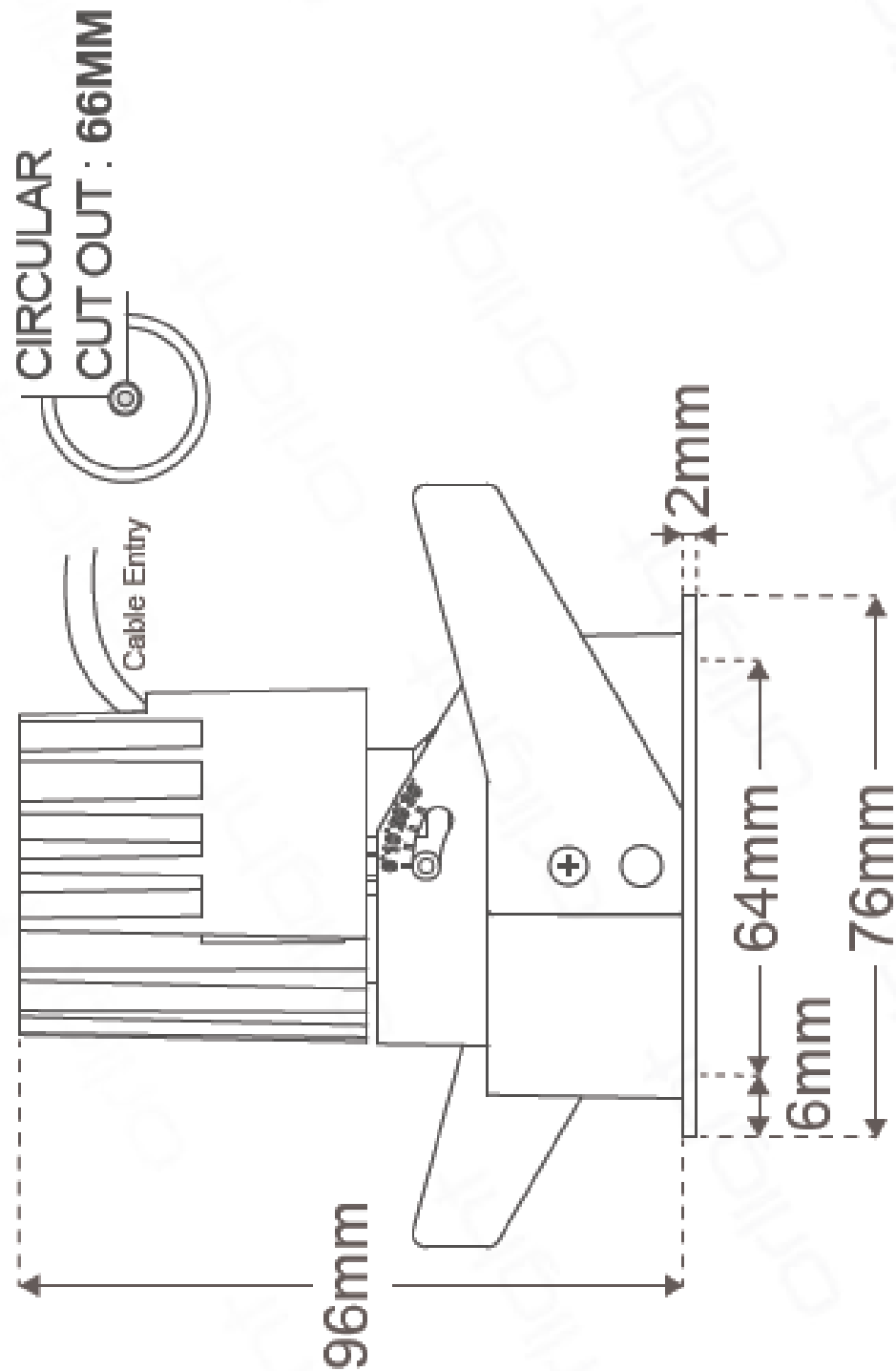
Do not scale. All dimensions are in mm

Figure 8 – Details of Downlighter Specimen F



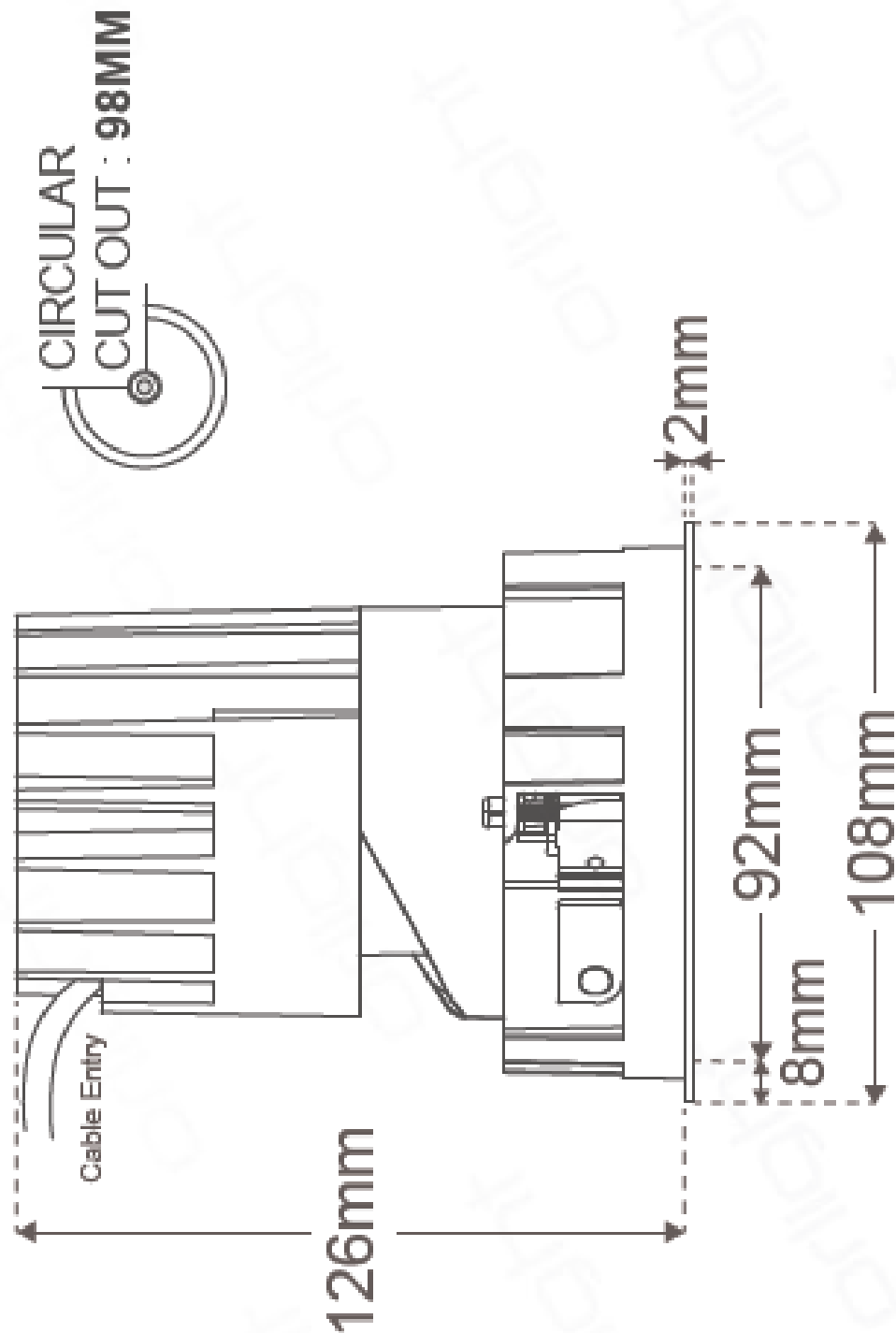
Do not scale. All dimensions are in mm

Figure 9 – Details of Downlighter Specimen G



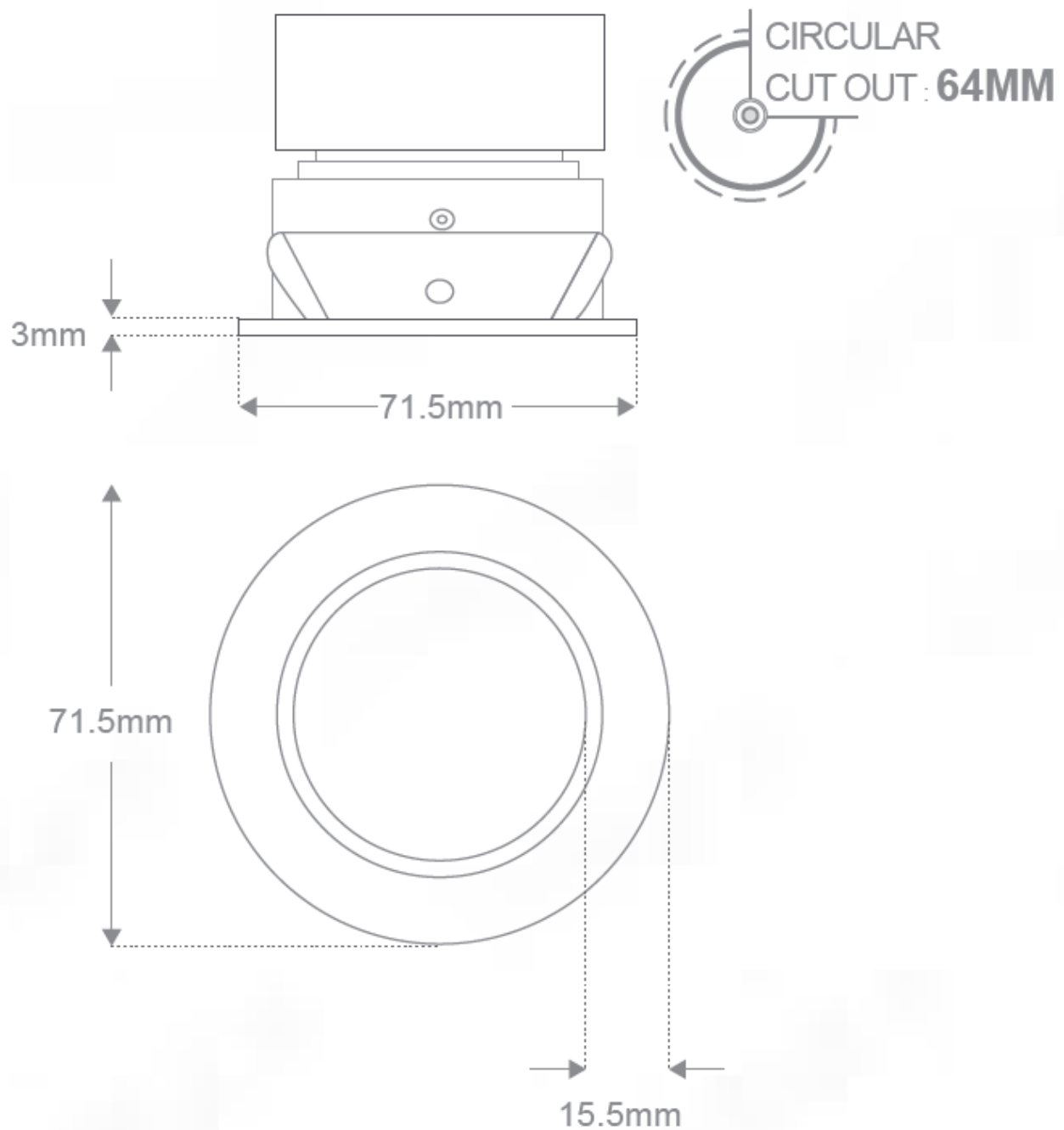
Do not scale. All dimensions are in mm

Figure 10 – Details of Downlighter Specimen H



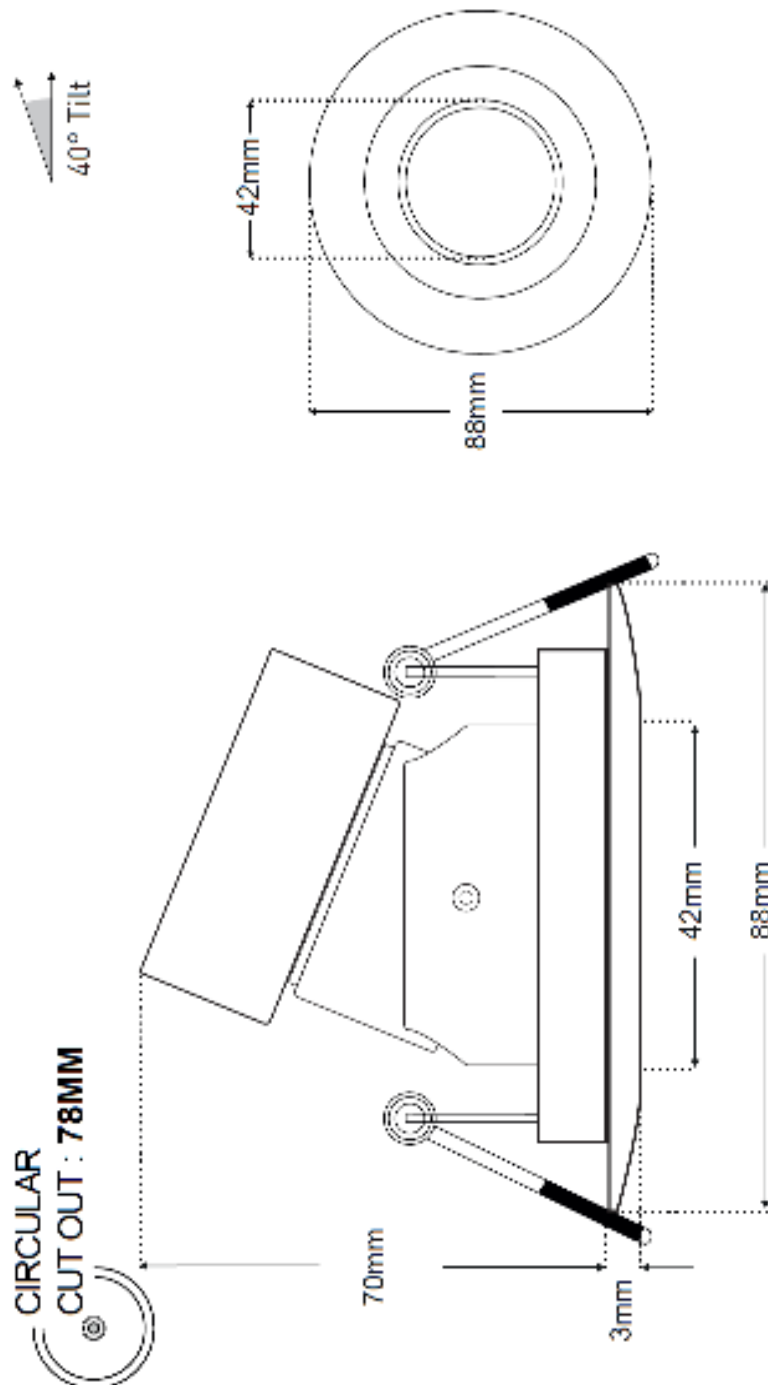
Do not scale. All dimensions are in mm

Figure 11 – Details of Downlighter Specimen I



Do not scale. All dimensions are in mm

Figure 12 – Details of Downlighter Specimen J



Do not scale. All dimensions are in mm

Schedule of Components

(Refer to Figures 1 to 12)
(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	: C24, to BS EN 519
Density	: 511 kg/m ³
Size	: 45 mm x 197 mm
Joist centres	: 600 mm
1.2 Noggins	
Material	: British Home-grown, rough sawn softwood, kiln dried
Grade	: C24, to BS EN 519
Density	: 511 kg/m ³
Size	: 65 mm x 45 mm
Joist centres	: 1200 mm
1.3 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 65 mm long x 4 mm diameter countersunk steel screws to floor joists at 300 mm centres
1.4 Ceiling Boards	
Manufacturer	: British Gypsum
Type / reference	: Gyproc Fireline Wallboard
Density	: 803 kg/m ³
Thickness	: 37.5 mm, 3 layers of 12.5 mm thick
Fixing	
i. method	: The boards were screw fixed to the soffit of the joists with all joints in the second layer staggered with respect to those of the first layer
ii. fixings	: Drill point drywall screws, 25 mm 38 mm and 50 mm long for the 1 st , 2 nd and 3 rd board layers respectively
iii. frequency	: 150 mm centres along joints and 150 mm to the perimeter of the ceiling
2. Specimen A	
Manufacturer	: Orlight Ltd
Reference	: ORL1009-IP44-NL
Overall dimensions and construction	: See Figure 3 for details
Luminaire Details	
i. lamps	: Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	: Aluminium frame / Magnetic suspension
iii. lamp change	: Magnetic lamp change mechanism

<u>Item</u>	<u>Description</u>
2. Specimen A (Continued)	
Luminaire Details	
iv. power consumption	: Variable light source - LED module / GU10
v. voltage	: Max 240V
vi. tilt	: Fixed
vii. cut out	: 78mm diameter
viii. anti-glare	: Yes
ix. IP rating	: IP44
x. accessories	: GU10 lamp holder
xi. finish	: White - RAL9016
3. Specimen B	
Manufacturer	: Orlight Ltd
Reference	: ORL009-TL-CL-IP44-NL
Overall dimensions and construction	: See Figure 4 for details
Luminaire Details	
i. lamps	: Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	: Aluminium
iii. lamp change	: Removal of fixture
iv. tilt	: 30 ⁰
v. cut out	: 64mm diameter
vi. anti-glare	: Yes
vii. IP rating	: IP20 (optional IP44 also available)
viii. finish	: White - RAL9016
4. Specimen C	
Manufacturer	: Orlight Ltd
Reference	: ORL009-TR-IP44-NL
Overall dimensions and construction	: See Figure 5 for details
Luminaire Details	
i. lamps	: DB-R999 Range
ii. construction	: Aluminium frame
iii. lamp change	: Clip change
iv. power consumption	: Variable light source
v. tilt	: Fixed
vi. rotation	: Fixed
vii. cut out	: 64mm diameter
viii. anti-glare	: Yes
ix. IP rating	: IP44
x. finish	: Solid colours – Epoxy powder coat
5. Specimen D	
Manufacturer	: Orlight Ltd
Reference	: ORL019MAXI-IP54-NL
Overall dimensions and construction	: See Figure 6 for details
Luminaire Details	
i. lamps	: Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	: Aluminium frame
iii. lamp change	: Removable facia
iv. power consumption	: Variable light source - LED modules
v. voltage	: Max 240V
vi. tilt	: 25 ⁰
vii. rotation	: 360 ⁰
viii. cut out	: 63mm diameter

<u>Item</u>	<u>Description</u>
5. Specimen D (Continued)	
Luminaire Details	
ix. anti-glare	: Yes
x. IP rating	: IP54
xi. accessories	: GU10 lamp holder
xii. finish	: Solid colours - Epoxy powder coat; Metallic finishes - Electroplated
6. Specimen E	
Manufacturer	: Orlight Ltd
Reference	: AQUASPOT-NL
Overall dimensions and construction	: See Figure 7 for details
Luminaire Details	
i. lamps	: Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	: Aluminium frame
iii. lamp change	: Removal of fixture
iv. power consumption	: Variable light source
v. voltage	: Max 240V
vi. tilt	: Fixed
vii. rotation	: Fixed
viii. cut out	: 72mm diameter
ix. anti-glare	: Yes
x. IP rating	: IP65
xi. accessories	: 12V / 240V lamp holder
xii. finish	: Solid colours – Epoxy powder coat; Metallic finishes - Electroplated
7. Specimen F	
Manufacturer	: Orlight Ltd
Reference	: ORLCL-IP54
Overall dimensions and construction	: See Figure 8 for details
Luminaire Details	
i. lamps	: DB-R999 Range
ii. construction	: Aluminium
iii. lamp change	: Removal of fixture
iv. power consumption	: Variable light source
v. voltage	: Max 240V
vi. tilt	: Fixed
vii. rotation	: Fixed
viii. cut out	: 77mm diameter
ix. finish	: White - RAL9016, Powder coat and textured finish
8. Specimen G	
Manufacturer	: Orlight Ltd
Reference	: ORION
Overall dimensions and construction	: See Figure 9 for details
Luminaire Details	
i. chipset	: Citizen CLU701-1002C4
ii. dimming options	: Switched; Mains; 1-10V; Dali
iii. driver	: Remote driver
iv. power consumption	: 11W module power / 13W circuit power
v. current	: 350mA
vi. colour temperature	: 2700K - 3000K - 4000K

Item

Description

8. Specimen G (Continued)

Luminaire Details

vii. light output -	:	804lm - 874lm - 947lm
viii. lm per watt -	:	60lm/W - 70lm/W - 74lm/W
ix. CRI	:	>91 - >91 - >91
x. beam angle	:	40° (24° and 55° order only accessory)
xi. binning	:	3 step MacAdams ellipse
xii. chip life TM-21	:	L80 > 50,000 hours
xiii. cut out	:	68mm diameter
xiv. tilt	:	30°
xv. rotation	:	355°
xvi. IP rating	:	IP20
xvii. weight	:	325g
xviii. finish	:	Aluminium

9. Specimen H

Manufacturer	:	Orlight Ltd
Reference	:	ORION - XL
Overall dimensions and construction	:	See Figure 10 for details

Luminaire Details

i. chipset	:	Citizen CLU028-1204C4
ii. dimming options	:	Switched; 1-10V; Dali
iii. driver	:	Remote driver
iv. power consumption	:	18W module power / 21W circuit power
v. voltage	:	32-38V
vi. current	:	500mA
vii. colour temperature	:	2700K - 3000K - 4000K
viii. light output -	:	1515lm - 1539lm - 1578lm
ix. lm per watt -	:	72lm/W - 73lm/W - 75lm/W
x. CRI	:	>91 - >91 - >91
xi. beam angle	:	40° (24° and 55° order only accessory)
xii. binning	:	3 step MacAdams ellipse
xiii. chip life TM-21	:	L80 > 50,000 hours
xiv. cut out	:	100mm diameter
xv. tilt	:	30°
xvi. rotation	:	355°
xvii. IP rating	:	IP20
xviii. weight	:	590g
xix. finish	:	Aluminium

10. Specimen I

Manufacturer	:	Orlight Ltd
Reference	:	ORL009-HS-IP44
Overall dimensions and construction	:	See Figure 11 for details

Luminaire Details

i. lamps	:	Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	:	Aluminium frame
iii. lamp change	:	Clip change
iv. power consumption	:	Variable light source - LED module / GU10
v. voltage	:	Max 240V
vi. tilt	:	Fixed
vii. rotation	:	Fixed
viii. cut out	:	64mm diameter

Item

Description

10. Specimen I (Continued)

Luminaire Details

ix. anti-glare	:	Yes
x. IP rating	:	IP44
xi. accessories	:	GU10 lamp holder (MC2)
xii. finish	:	Solid colours - Epoxy powder coat

11. Specimen J

Manufacturer

: Orlight Ltd

Reference

: ORL019-HS-IP54

Overall dimensions and construction

: See Figure 12 for details

Luminaire Details

i. lamps	:	Lumenplus 3; Lumenstar 3; DB-R999 Range
ii. construction	:	Aluminium frame / Magnetic suspension
iii. lamp change	:	Magnetic lamp change mechanism
iv. power consumption	:	Variable light source - LED module / GU10
v. voltage	:	Max 240V
vi. tilt	:	400
vii. rotation	:	3600
viii. cut out	:	78mm diameter
ix. anti-glare	:	Yes
x. IP rating	:	IP54
xi. accessories	:	GU10 lamp holder (MC2)
xii. finish	:	White - RAL9016

Instrumentation

General	The instrumentation was provided in accordance with the requirements of the BS EN 1365 - 2: 2014.
Furnace	The furnace was controlled so that its mean temperature complied with the requirements of BS EN 1363-1: 2012, using eight plate thermometers distributed over a plane 100 mm from the underside of the test construction.
Thermocouple Allocation	Thermocouples were provided to monitor the unexposed surface of the floor assembly and the internal cavity, 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.
Roving Thermocouple	A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position which might appear to be hotter than the temperatures indicated by the fixed thermocouples.
Furnace Pressure	After the first five minutes of testing and for the remainder of the test. The calculated pressure differential relative to the laboratory atmosphere 100 mm away from the underside of the assembly was 18 (+0, -5) Pa between 5 and 10 minutes of testing and 18 (+0, -3) Pa after 10 minutes of testing and for the remainder of the test.
Loadbearing Capacity Criteria	Linear deflection transducer was provided at the approximate centre on the unexposed surface of the specimen to record its vertical deflection.
Integrity Criteria	Cotton pads and gap gauges were available to evaluate the integrity of the floor assembly.

Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	
		The ambient air temperature in the vicinity of the test construction was 22°C at the start of the test with a maximum variation of +1°C during the test.
-60	00	Load applied
00	00	The test commences.
02	59	Steam/smoke release at the blanked off edges.
08	58	When viewed from the exposed face, the tape over the joints can be seen to be detaching.
10	53	When viewed from the exposed face, the cover plate from specimens C and F has detached.
18	58	When viewed from the exposed face specimens C and H have become detached. The ceiling is glowing orange in colour. All of the tape over the joints has detached.
23	25	Continued steam/smoke release at the perimeter of the test assembly, at the blanked off edges.
25	00	When viewed from the exposed face, specimen E has detached from the ceiling assembly. Joints between the boards are beginning to open and widen.
30	48	When viewed from the exposed face, specimen D has detached.
32	51	Test assembly satisfies load bearing, integrity, and insulation performance criteria.
39	43	When viewed from the exposed face, specimens B, I and G have detached.
47	22	When viewed from the exposed face, specimens J and A have detached. Boards remain in place and are glowing a bright orange.
52	16	When viewed from the exposed face, flaming can be seen from the location of specimen I.
60	00	Test assembly satisfies load bearing, integrity, and insulation performance criteria.
60	40	Slight steam/smoke release from joint in floorboard close to thermocouple 220 location. Steam/smoke release from the test assembly perimeter at the blanked off edges is sustained.
61	51	When viewed from the exposed face, the wire from specimen A is protruding into the furnace chamber. The flaming from the position of specimen I has stopped. Board joint shows no significant visible change.
70	18	When viewed from the expose face, no significant visible change in joints between boards.

Time

mins secs

72	14	Steam/smoke release is maintained.
72	30	When viewed from the exposed face approximately 30% of the central section of the first layer of board has detached.
76	53	When viewed from the exposed face approximately 40% of first layer of board has detached.
80	00	When viewed from the exposed face the second layer of board is moving into the furnace chamber. Approximately 70% of first layer of board has detached.
83	05	When viewed from the exposed face the second layer of board is beginning to detach.
86	14	When viewed from the exposed face approximately 10% of second layer of board has detached.
87	25	When viewed from the exposed face the second layer of board continues to detach.
91	00	Test discontinued as per client request.

Test Photographs

The exposed face of the test assembly prior to the start of the test



The unexposed face of the test assembly prior to the start of the test



The unexposed
face of the
assembly after a
test duration of 10
minutes



The unexposed
face of the
assembly after a
test duration of 50
minutes



The unexposed
face of the
assembly after a
test duration of 91
minutes



Temperature, Pressure & Deflection Data

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

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	38
3	502	516
6	603	581
9	663	656
12	706	708
15	739	747
18	766	773
21	789	795
24	809	808
27	826	827
30	842	842
33	856	855
36	869	870
39	881	881
42	892	892
45	902	902
48	912	912
51	921	921
54	930	929
57	938	937
60	945	945
63	953	952
66	960	959
69	966	966
72	973	973
75	979	981
78	985	985
81	990	993
84	996	1000
87	1001	1002
90	1006	1014
91	1008	1018

Individual And Mean Temperatures Recorded On The Unexposed Surface Of The Floor Assembly

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	20	20	19	20	22	20
3	20	20	19	20	22	20
6	20	20	19	20	23	20
9	20	20	19	20	24	21
12	22	21	19	20	25	21
15	23	22	20	21	26	22
18	25	24	21	21	28	24
21	27	26	22	23	30	26
24	29	28	25	25	32	28
27	31	30	27	27	35	30
30	33	32	27	29	39	32
33	34	34	30	31	42	34
36	36	36	31	33	45	36
39	37	38	33	35	47	38
42	38	39	35	37	49	40
45	39	40	36	39	52	41
48	40	41	38	41	53	43
51	41	42	40	42	55	44
54	42	43	41	43	57	45
57	43	44	43	44	58	46
60	44	44	43	45	59	47
63	45	45	44	46	59	48
66	46	45	46	47	60	49
69	47	46	46	48	61	50
72	48	47	46	48	62	50
75	50	47	47	49	63	51
78	51	48	48	50	64	52
81	53	49	48	51	65	53
84	55	50	48	51	68	54
87	60	51	53	52	71	57
90	66	55	55	52	74	60
91	69	58	57	52	75	62

Individual Temperatures Recorded Adjacent To Joints In The Flooring

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	22	21	22	22	23	23
3	22	21	23	22	23	23
6	22	22	23	22	24	24
9	23	22	23	22	26	25
12	24	23	24	23	27	27
15	26	23	25	23	29	29
18	28	24	26	24	31	31
21	31	25	28	25	35	35
24	35	26	31	26	39	38
27	40	28	34	27	44	42
30	44	29	37	28	49	46
33	47	30	40	30	54	50
36	49	32	43	31	58	53
39	51	33	45	32	62	56
42	53	34	47	34	63	57
45	54	35	49	35	64	58
48	55	36	51	36	66	59
51	57	37	52	37	67	60
54	58	38	53	38	67	60
57	59	39	54	39	69	60
60	60	39	55	39	69	62
63	62	40	56	40	70	62
66	63	41	57	41	71	63
69	65	42	58	43	73	63
72	66	42	59	43	73	63
75	69	43	59	43	72	63
78	71	44	60	44	72	63
81	73	45	61	45	73	63
84	75	45	63	46	73	64
87	77	46	66	47	74	66
90	79	49	73	49	77	68
91	80	50	76	50	78	69

Individual Temperatures Recorded In The Air Cavity Adjacent To The Lights

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	T/C Number 226 Deg. C
0	30	32	29	31	32
3	39	136	81	50	90
6	41	175	84	62	124
9	66	191	95	85	131
12	90	187	102	116	138
15	105	189	277	128	129
18	125	193	246	144	115
21	134	189	152	158	124
24	137	184	136	183	113
27	127	183	140	205	109
30	133	176	137	210	113
33	158	176	132	214	115
36	169	171	143	228	121
39	170	178	133	222	127
42	158	175	136	240	132
45	160	182	152	235	135
48	155	197	160	240	138
51	176	209	161	231	146
54	161	208	165	227	149
57	168	211	166	216	151
60	160	215	176	234	152
63	160	208	188	257	152
66	163	214	196	273	154
69	163	224	220	260	150
72	156	246	325	281	148
75	146	378	293	235	171
78	152	369	269	218	197
81	190	333	316	216	232
84	190	358	352	261	279
87	224	360	332	240	327
90	273	344	326	285	330
91	293	373	346	281	344

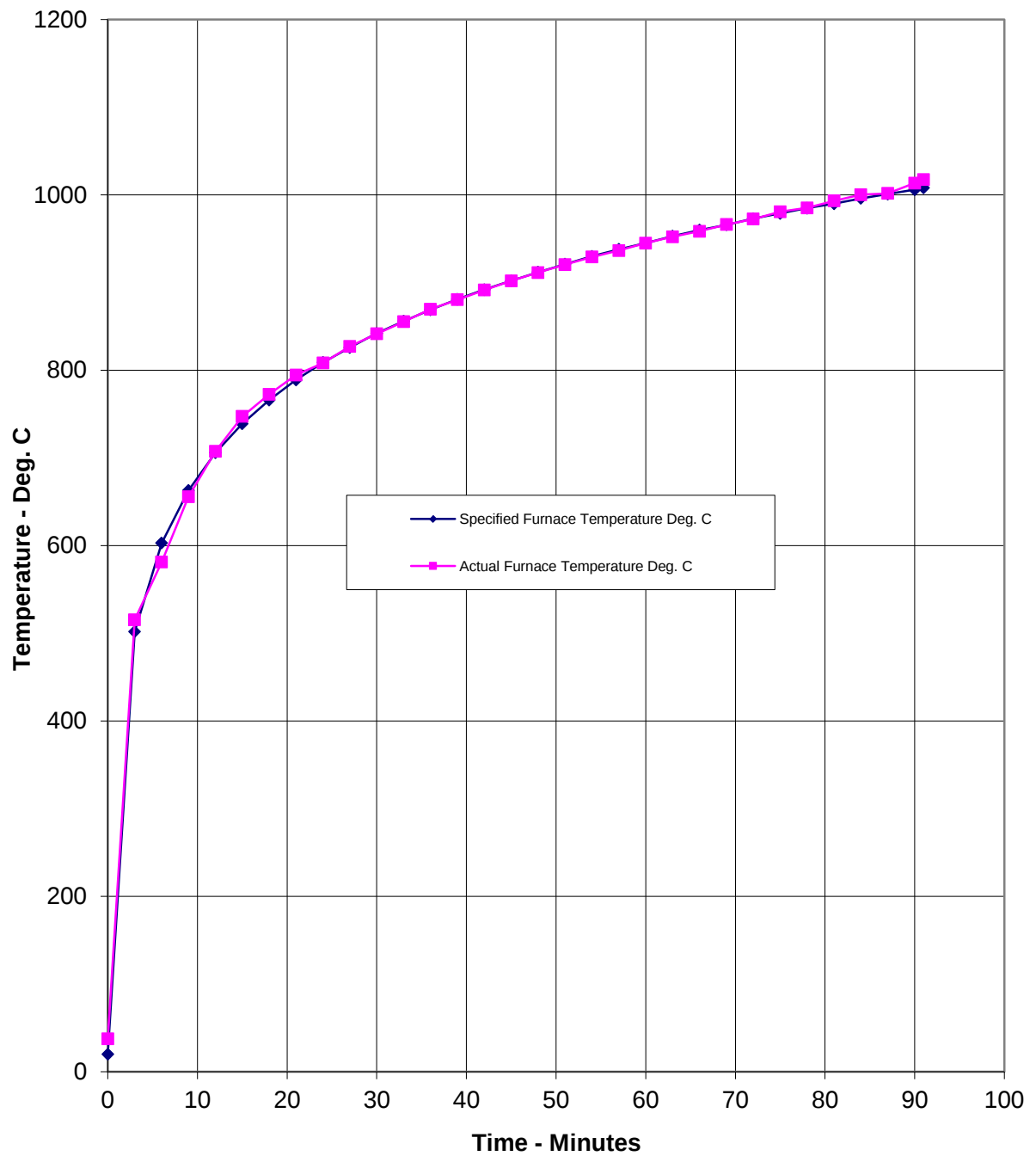
Individual Temperatures Recorded In The Air Cavity Adjacent To The Lights Continued

Time Mins	T/C Number 227 Deg. C	T/C Number 228 Deg. C	T/C Number 229 Deg. C	T/C Number 230 Deg. C	T/C Number 231 Deg. C
0	31	34	31	31	31
3	64	91	141	48	53
6	64	85	152	82	78
9	83	85	165	108	87
12	101	93	167	127	94
15	139	115	189	138	102
18	143	117	336	118	131
21	187	104	317	130	148
24	166	118	262	127	130
27	137	135	260	132	116
30	125	132	244	131	131
33	122	137	220	112	122
36	127	138	238	116	120
39	129	153	267	110	127
42	133	174	287	109	132
45	131	195	320	137	117
48	137	187	307	148	120
51	171	129	311	128	137
54	167	175	305	130	148
57	188	174	313	128	181
60	184	168	310	125	196
63	186	169	335	124	186
66	199	179	338	123	188
69	209	178	350	125	193
72	206	163	335	138	175
75	223	186	361	147	171
78	246	177	377	150	181
81	262	202	408	170	187
84	296	251	406	190	210
87	306	300	403	221	260
90	331	356	406	258	334
91	342	364	419	274	362

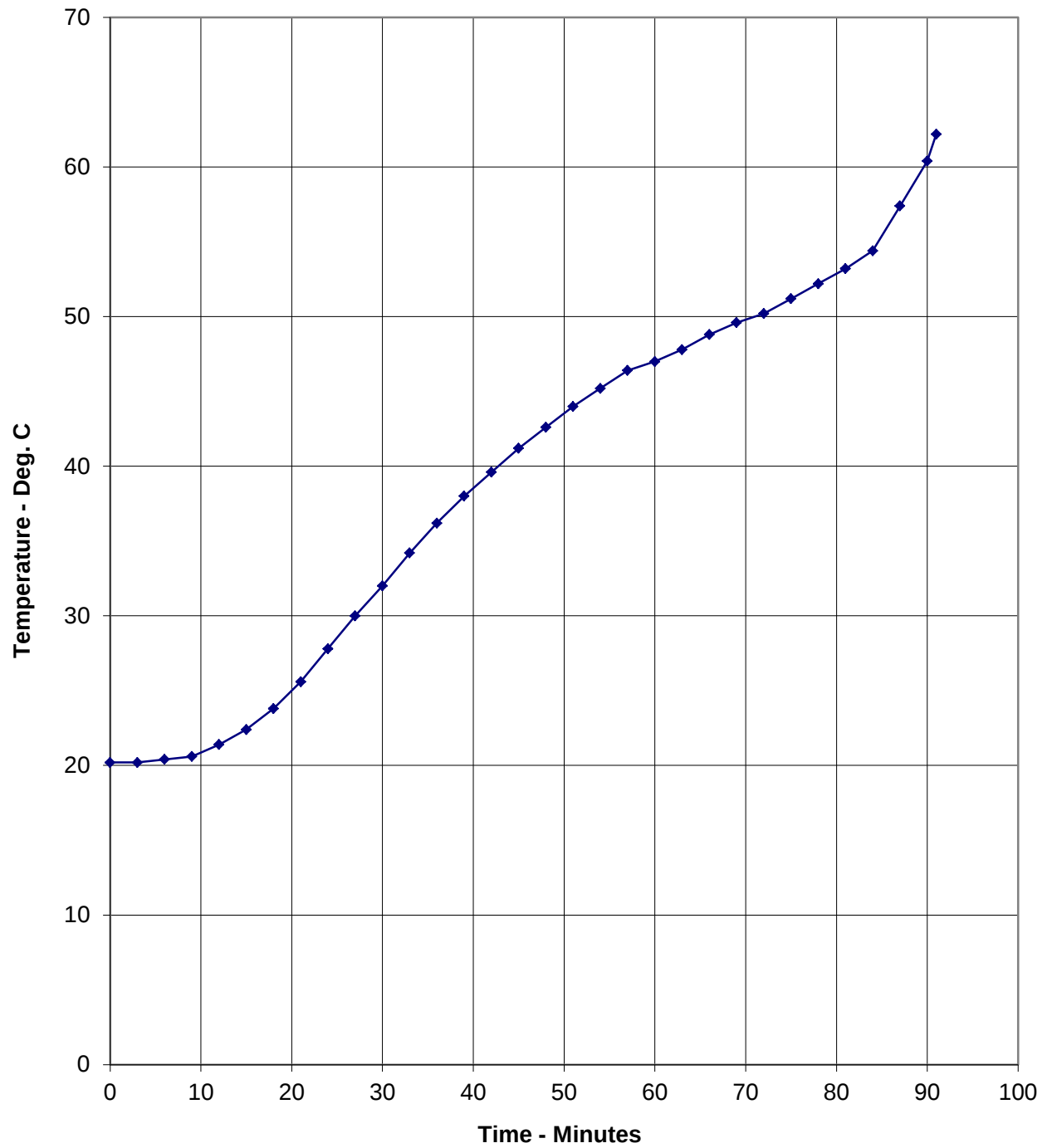
Deflection Of The Floor Assembly During The Test

Time Mins	Central Vertical Deflection mm	Rate Of Deflection mm/min
0	0	0
3	1	0
6	2	0
9	2	0
12	2	0
15	4	1
18	4	0
21	4	0
24	6	0
27	6	0
30	7	0
33	7	0
36	8	0
39	8	0
42	9	0
45	9	0
48	10	0
51	10	0
54	11	1
57	11	0
60	12	0
63	12	0
66	13	0
69	13	0
72	14	0
75	14	0
78	15	0
81	16	0
84	16	0
87	18	0
90	20	1
91	20	1

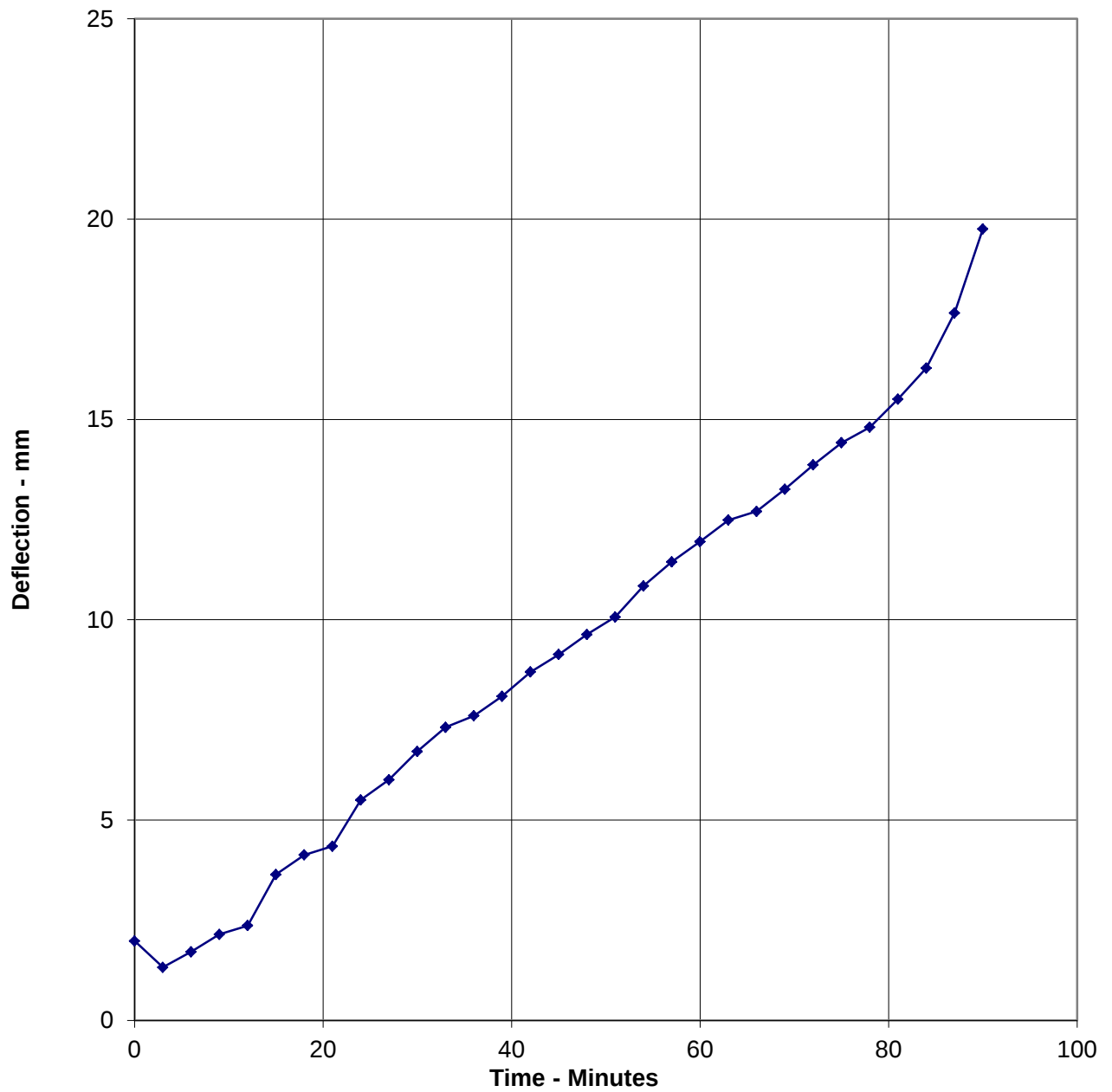
Graph Showing Specified And Actual Furnace Temperatures



Graph Showing Mean Unexposed Surface Temperature Of The Floor Assembly



Graph Showing The Central Vertical Deflection Of The Floor Assembly During The Test



Load Calculations

1. Physical Parameters of Timber Joists

Measured Joist dimensions (d x b)	: 195 mm deep by 45 mm thick
Mean spacing (M)	: 600 mm
Effective span (L)	: 4250 mm (4500 Specimen length)
Timber grade of joists	: C24

2. Parameters - BS 5268: Part 2: 1996

Basic dry stress in bending	: 7.5 N/mm ² (Table 8)
Modification factor for loading	: 1.1 (Table 2.9 (a))
Therefore working stress (F)	: 8.25 N/mm ²
Nominal density	: 535 kg/m ³

3. Total Loading Required Per Joist

Moment of Inertia (I)	: $bd^3/12$: $(45 \times 195^3)/12$: 27805781 mm ⁴
Distance from neutral axis to base of joist (y)	: 97.5 mm
Maximum bending stress	: Fl/y : $(8.25 \times 27805781)/97.5$: 2352797 N/mm ²
Also maximum bending stress	: $wL^2/8$: 2352797 N/mm ²
Where w	= Load per unit length
∴ w	= $(2352797 \times 8) / (4250 \times 4250)$ = 1.0421 N/mm = 1042.1 N/m
∴ Total loading (W)	: 4429 N : 452 kg

4. Dead Weight

Combined weight of overall specimen:

Actual density of joist	: 534 kg/m ³
Actual density of floor boarding	: 625 kg/m ³
Actual density of ceiling board	: 813 kg/m ³

Effective width of floor supported per joist (m) : 0.6 m

Weight of joist	: 20 kg
Weight of floorboard	: 35 kg (22 mm thick)
Weight of ceiling (3 layers of board)	: 73 kg (12.5 mm thick, three layers)

Total dead weight per joist : 128 kg

5. **Imposed Load**

Imposed load per joist required : total load per joist - dead weight per joist
: 452 – 128
: 324 kg

Assuming even distribution of loading

Maximum imposed load per metre square : $(324 \times 9.81) / (4.25 \times 0.60)$
: 1246 N/m²
: **1.246 kN/m²**
: 127 kg/m²

Calculation made by



J. King
Technical Officer
For and on behalf of
Warringtonfire

Checked by



W. Drazkiewicz
Technical Manager
Fire Resistance Department
Warringtonfire

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 232 mm and 10 mm per minute respectively. The allowable rate of deflection criteria is not applicable for the first 10 minutes of the test. This criterion was satisfied for the 91 minute total test duration.

Integrity

It is required that specimens retain their separating function, without:

- Causing ignition of a cotton pad when applied
- Permitting the penetration of a gap gauge in the prescribed manner
- Sustained flaming on the unexposed surface
- Integrity failure also occurs simultaneously with loadbearing capacity failure.

These requirements were satisfied for the duration of the test:

Sustained flaming

91 minutes*

Gap gauge

91 minutes*

Cotton pad

91 minutes*

*The test duration. The test was discontinued after a period of 91 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 occurs simultaneously with integrity failure. The insulation requirements were satisfied for the 91 minute test duration.

Ongoing Implications

Limitations

This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedures 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.

Conclusions

Evaluation against objective

A specimen of a loadbearing timber floor assembly protected by a direct fix ceiling assembly incorporating ten light fittings, has been subjected to a fire resistance test in accordance with the procedures given in BS EN 1365-2:2014. The specimen satisfied the performance requirements for the periods shown below:

Loadbearing capacity

91 minutes*

Integrity performance

Sustained flaming

91 minutes*

Gap Gauge

91 minutes*

Cotton pad

91 minutes*

Insulation performance

91 minutes*

The test was discontinued after a period of 91 minutes*

Direct Field Of Application

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

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

With respect to the ceiling system:

The size of panels of the ceiling lining shall not be changed.

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.

With respect to the cavity:

The height of the cavity or cavities is equal to or greater than the height tested.

No combustible or insulating material is added to the cavity unless the same amount (fire load) of combustible or insulating material was included in the test specimen.