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CNAS L0057

GML-V023

FLOOR ASSEMBLY FIRE TEST REPORT

Sponsor: JCC LIGHTING PRODUCTS

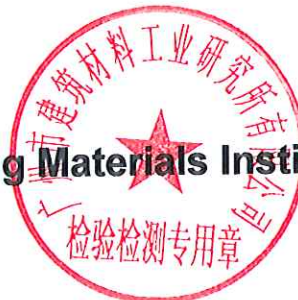
Address of Sponsor: INNOVATION CENTRE SOUTHERN
CROSS TRADING ESTATE BEEDING
CLOSE BOGNOR REGIS PO22 9TS

Test Method: BS 476-21:1987, BS 476-20:1987

Date of issues: March 24, 2020

Test Report No.: V03-20000055(E)

Guangzhou Building Materials Institute Limited Company



FLOOR ASSEMBLY FIRE TEST REPORT

Tested by: Wu Xin	Sign: 
Checked by: Wu Yulong	Sign: 
Certified by: Liu Jianyong	Sign: 

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SUMMARY

Objective

To determine the fire resistance of a timber floor assembly protected by a plasterboard ceiling designed to provide 31 minutes fire resistance, incorporating eight downlight fittings, when tested in accordance with Clause 7 of BS 476-21:1987 "Fire tests on building materials and structures – Part 21: Methods for determination of the fire resistance of loadbearing elements of construction".

Summary of Tested Assembly

The timber floor assembly had overall nominal dimensions of 4700 mm long by 3230 mm wide and comprised joists at 600mm centres. The depth of the each joist was 220mm. The upper surface of the floor comprised nominally 22mm thick P5 T&G Chipboard, and screwed fixed to the top chord of the joists. The floor assembly was protected on its underside by a direct fixed ceiling, formed from a single layer of 15mm thick Type A BG wallboard, the ceiling was screw fixed to the bottom chord of the floor joists.

The floor supported a uniformly distributed load of 855.7 N/m². This load was specified by the sponsor of the test.

The ceiling incorporated eight downlight fittings referenced as follows:

Test Ref.	Product Name	Reference
A	V50 Fixed Downlight	JC1001
B	V50 Tilt Downlight	JC1002
C	FG2 IP65 Downlight	JC94110
D	FG2 Fixed Downlight	JC94113
E	FG2 Tilt Downlight	JC94114
F	Fireguard Fixed Downlight	JC010010
G	Fireguard Tilt Downlight	JC010023
H	Fireguard IP65 Downlight	JC010016

Test Results :

Loadbearing Capacity: 31min (No failure)

Integrity: 31min (No failure)

Insulation: 31min (No failure)

Date of Test March 17, 2020

Note: According to sponsor requirements, the test was discontinued after a period of 31 minutes.



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SCHEDULE OF COMPONENTS

(Refer to Figures 1 to 11)

(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
1. Floor I-Joists	
Material	: 2 rectangular timber flanges and OSB web
Size	: 220mm High; Timber flanges: 47mmx47mm
Centres:	: 600 mm
2.Floorboards	
Material	: P5 T&G Chipboard
Thickness	: 22mm
Fixing method	: All board joints staggered with respect to adjacent layer and screw fixed to all joists
3.Ceiling boards	
Material	: 1 layer, Type A BG wallboard
Thickness	: 15mm
Fixing method	: All board fixed to joists with Drywall screws at max.230mm c/c. The joints between the boards were filled with joint filler with was also used to cover the heads of the screws. The perimeter joints between the floor construction and the supporting construction were filled with intumescent sealant.

4. End Joists

Material	: Glulam rimboard
Size	: 47mm thick x 220mm high
Fixing method	: Fitted across the ends of the I-joists and through screwed to the top and bottom flanges of each joist.

5. Specimen 'A'

Product Name	: V50 Fixed Downlight
Reference	: JC1001 V50 Fixed Downlight
Manufacturer	: JCC Lighting
Type	: Recessed Downlight
Overall dimensions and construction	: See figure 4
Hole size in ceiling boards	: 70 mm diameter
Materials	i: Casing: Mild Steel ii: Cover: Polycarbonate iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight: 0.29 Kg
Details of fireproof material	i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm
Details of Expanding material	i. Manufacturer: Tai-G ii. Type: SM43.5-1.0mm iii. Material: Fire Reactive Expandable Graphite iv. Thickness: 1.0mm v. Location: Top of 'Can'

6. Specimen 'B'

Product Name	: V50 Tilt Downlight
Reference	: JC1002 V50 Tilt Downlight
Manufacturer	: JCC Lighting



Type	: Recessed Downlight
Overall dimensions and construction	: See figure 5
Hole size in ceiling boards	: 85 mm diameter
Materials	<ul style="list-style-type: none"> i: Casing: Mild Steel ii: Cover: Polycarbonate iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight: 0.46 Kg
Details of fireproof material	<ul style="list-style-type: none"> i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm
Details of Expanding material	<ul style="list-style-type: none"> i. Manufacturer: Tai-G ii. Type: SM43.5-1.0mm iii. Material: Fire Reactive Expandable Graphite iv. Thickness: 1.0mm v. Location: Top of 'Can'

7.Specimen 'C'

Product Name	: FG2 IP65 Downlight
Reference	: JC94110 FG2 IP65 Downlight
Manufacturer	: JCC Lighting
Type	: Recessed Downlight
Overall dimensions and construction	: See figure 6
Hole size in ceiling boards	: 74 mm diameter
Materials	<ul style="list-style-type: none"> i: Casing: Mild Steel ii: Cover: Mild Steel iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight:0.27 Kg
Details of fireproof material	<ul style="list-style-type: none"> i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can'



Details of Expanding material

- iii: Thickness: 0.8mm
- i. Manufacturer: Tai-G
- ii. Type: SM43.5-1.0mm
- iii. Material: Fire Reactive Expandable Graphite
- iv. Thickness: 1.0mm
- v. Location: Top of 'Can'

8.Specimen 'D'

Product Name : FG2 Fixed Downlight
Reference : JC94113 FG2 Fixed Downlight
Manufacturer : JCC Lighting
Type : Recessed Downlight
Overall dimensions and construction : See figure 7
Hole size in ceiling boards : 74 mm diameter
Materials
i: Casing: Mild Steel
ii: Cover: Mild Steel
iii: Spring clip: Steel
iv: Connection block: Polycarbonate Housing
Approx. weight:0.25 Kg

Details of fireproof material

- i: Manufacturer: JCC Lighting Products
- ii: Type: Mild Steel 'Can'
- iii: Thickness: 0.8mm

Details of Expanding material

- i. Manufacturer: Tai-G
- ii. Type: SM43.5-1.0mm
- iii. Material: Fire Reactive Expandable Graphite
- iv. Thickness: 1.0mm
- v. Location: Top of 'Can'

9.Specimen 'E'

Product Name : FG2 Tilt Downlight
Reference : JC94114 FG2 Tilt Downlight
Manufacturer : JCC Lighting



Type	: Recessed Downlight
Overall dimensions and construction	: See figure 8
Hole size in ceiling boards	: 85 mm diameter
Materials	i: Casing: Mild Steel ii: Cover: Mild Steel iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight:0.32 Kg
Details of fireproof material	i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm
Details of Expanding material	i. Manufacturer: Tai-G ii. Type: SM43.5-1.0mm iii. Material: Fire Reactive Expandable Graphite iv. Thickness: 1.0mm v. Location: Top of 'Can'

10.Specimen 'F'

Product Name	: Fireguard Fixed Downlight
Reference	: JC010010 Fireguard Fixed Downlight
Manufacturer	: JCC Lighting
Type	: Round, tilt downlight
Overall dimensions and construction	: See figure 9
Hole size in ceiling boards	: 78 mm diameter
Materials	i: Casing: Mild Steel ii: Cover: White/Chrome/Brushed Nickel iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight:0.21 Kg
Details of fireproof material	i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm

11. Specimen 'G'

Product Name	: Fireguard Tilt Downlight
Reference	: JC010023 Fireguard Tilt Downlight
Manufacturer	: JCC Lighting
Type	: Recessed Downlight
Overall dimensions and construction	: See figure 10
Hole size in ceiling boards	: 84 mm diameter
Materials	i: Casing: Mild Steel ii: Cover: White/Chrome/Brushed Nickel iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight: 0.26 Kg
Details of fireproof material	i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm

12. Specimen 'H'

Product Name	: Fireguard IP65 Downlight
Reference	: JC010016 Fireguard IP65 Downlight
Manufacturer	: JCC Lighting
Type	: Recessed Downlight
Overall dimensions and construction	: See figure 11
Hole size in ceiling boards	: 72 mm diameter
Materials	i: Casing: Mild Steel ii: Cover: White/Chrome/Brushed Nickel iii: Spring clip: Steel iv: Connection block: Polycarbonate Housing Approx. weight: 0.23 Kg
Details of fireproof material	i: Manufacturer: JCC Lighting Products ii: Type: Mild Steel 'Can' iii: Thickness: 0.8mm

TEST PROCEDURE

General

The test was carried out on March 17, 2020 at the request of JCC LIGHTING PRODUCTS, the test sponsor. The ambient temperature at the beginning of the test was 22 °C.

Furnace Temperature

The furnace temperature was measured by means of nine thermocouples distributed evenly in the furnace, with their measuring junctions $100 \text{ mm} \pm 10 \text{ mm}$ from the exposed surface of the specimen. The furnace was controlled so that the mean of the nine thermocouple readings followed as closely as possible the time/temperature relationship specified in Clause 3.1 of BS 476-20:1987.

Furnace Pressure

After the first five minutes of the test, the furnace pressure was maintained at 0 ± 2 Pa at 1,000 mm from the notional floor level.

Thermocouple Allocation

Thermocouples were provided to monitor the unexposed surface of the floor assembly and 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 3.

TEST DATA AND INFORMATION

Test Specimen Information

Details of the specimen structure are shown in Figure 1 to 11. The photographs of the Downlights are shown in Photo 1 to 16.

Observations

Photographs of the test are shown in Photos 17 to 26. A summary of the observations made on the general behavior of the specimen is given in Appendix 1.

Furnace Temperature Measurements

The mean furnace temperature records are shown in Appendix 2, and the actual time-temperature curve of furnace in relation to the specified time-temperature curve is shown in Figure 12.

Unexposed Surface Temperature Measurements

The unexposed surface temperature records are shown in Appendix 3, and the individual temperatures recorded adjacent to the spotlight fittings at mid-height of the cavity are shown in Appendix 4. The unexposed surface maximum and mean temperature curve are shown in Figure 13.

Deflection

The vertical deflection at the centre of the floor assembly was continuously measured during the test, and the data records are given in Appendix 5. The deflection curve is shown in Figure 14.

PERFORMANCE CRITERIA

This test was according to performance criteria which specified in BS 476-21:1987, section 7.6 to determine the loadbearing capacity, integrity and insulation of the specimen:

Loadbearing capacity: A failure of the test construction to maintain its loadbearing capacity shall be deemed to have occurred when any of the requirements specified in given as follow are exceeded.

a) a deflection of $L/20$,

in this test:

$$\text{Limiting deflection} = 4500/20 = 225 \text{ (mm); or}$$

b) where the rate of deflection (in mm/min), calculated over 1 min intervals, starting at 1 min from the commencement of the heating period, exceeds the limit set by the following equation:

$$\text{Rate of deflection} = \frac{L^2}{9000d},$$

in this test:

$$\text{Limiting rate of deflection} = \frac{(4500)^2}{9000 \times 257} = 8.8 \text{ (mm/min);}$$

Where

L is the clear span of specimen (in mm);

d is the distance from the top of the structural section to the bottom of the design tension zone (in mm).

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Integrity: A failure of the test construction to maintain integrity shall be deemed to have occurred when collapse or sustained flaming on the unexposed face occurs or the criteria given as follow for impermeability are exceeded.

a) For situations where the cotton pad is suitable, failure shall be deemed to have occurred when flames and/or hot gases cause flaming or glowing of the cotton fiber pad.

b) For situations where the use of the cotton pad is not suitable, failure shall be deemed to have occurred when either:

1) the 6 mm diameter gap gauge can penetrate a through gap such that the end of the gauge projects into the furnace and the gauge can be moved in the gap for a distance of at least 150 mm; or

2) the 25 mm diameter gap gauge can penetrate a through gap such that the end of the gauge projects into the furnace.

Insulation: Failure shall be deemed to have occurred when one of the following occurs:

a) When the mean unexposed face temperature increases by more than 140°C above its initial value;

b) When the temperature recorded at any positions on the unexposed face is in excess of 180°C above the initial mean unexposed face temperature;

c) When integrity failure occurs.



CONCLUSIONS

A specimen of a timber floor assembly protected by a plasterboard ceiling incorporating eight downlight fittings has been subjected to a fire resistance test in accordance with BS 476-21:1987, Clause 7.

At the heating period of 31 minutes, the maximum deflection was 10.1 mm; the rate of deflection was 0.5 mm/min. The loadbearing capacity was satisfied.

At the heating period of 31 minutes, there was no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. The integrity requirement was satisfied.

At the heating period of 31 minutes, the mean temperature rise of the unexposed face was 27.8°C, the maximum temperature rise of the unexposed face was 30.5°C. The insulation requirement was satisfied.

The floor assemblies satisfied the performance requirements specified in Clause 7 of BS 476-21:1987, for the following periods:

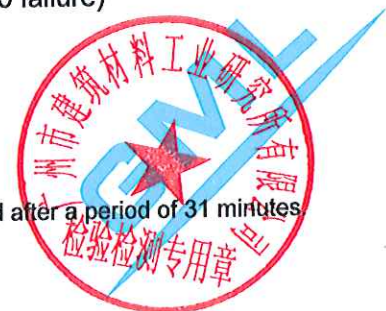
Loadbearing Capacity: 31min (No failure)

Integrity: 31min (No failure)

Insulation: 31min (No failure)

Date of Test March 17, 2020

Note: According to sponsor requirements, the test was discontinued after a period of 31 minutes



TEST PHOTOGRAPHS

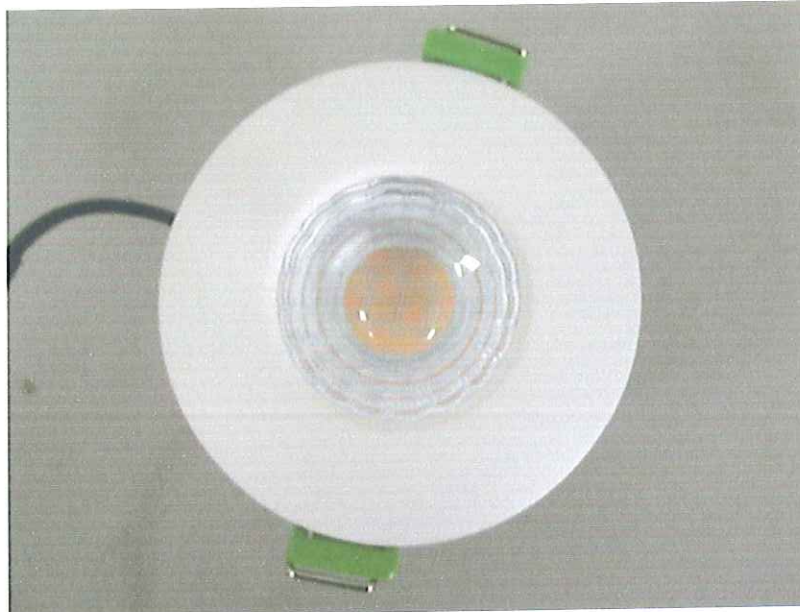


Photo 1



Photo 2

Photo 1: Front view of specimen 'A'
Photo 2: Side view of specimen 'A'

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Photo 3



Photo 4

Photo 3: Front view of specimen 'B'
Photo 4: Side view of specimen 'B'

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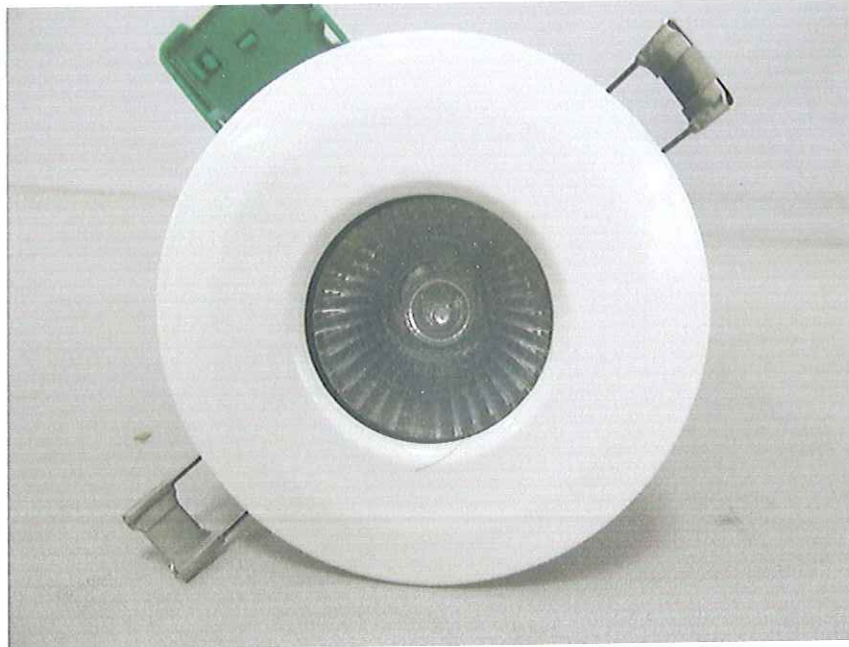


Photo 5

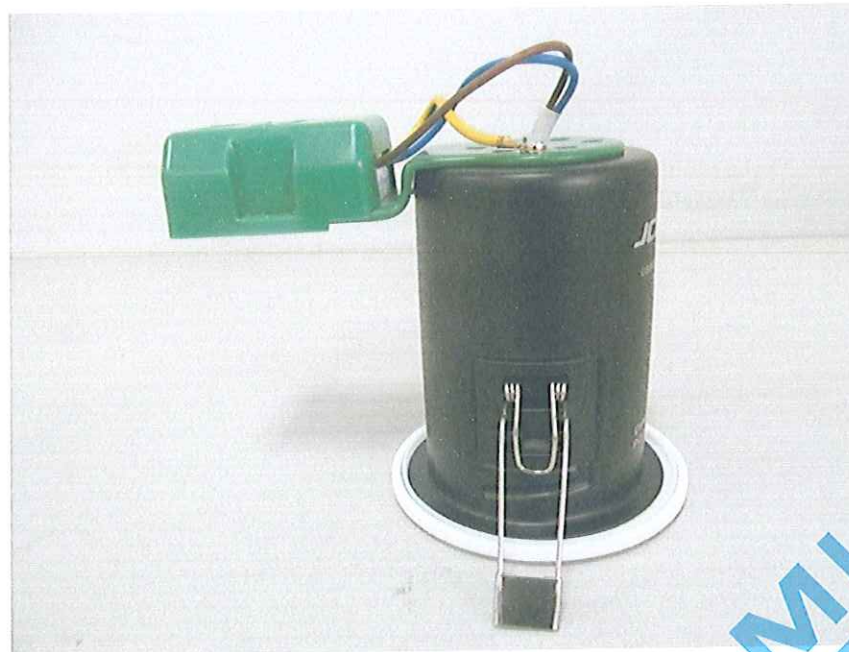


Photo 6

Photo 5: Front view of specimen 'C'
Photo 6: Side view of specimen 'C'

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Photo 7



Photo 8

Photo 7: Front view of specimen 'D'
Photo 8: Side view of specimen 'D'

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Photo 9

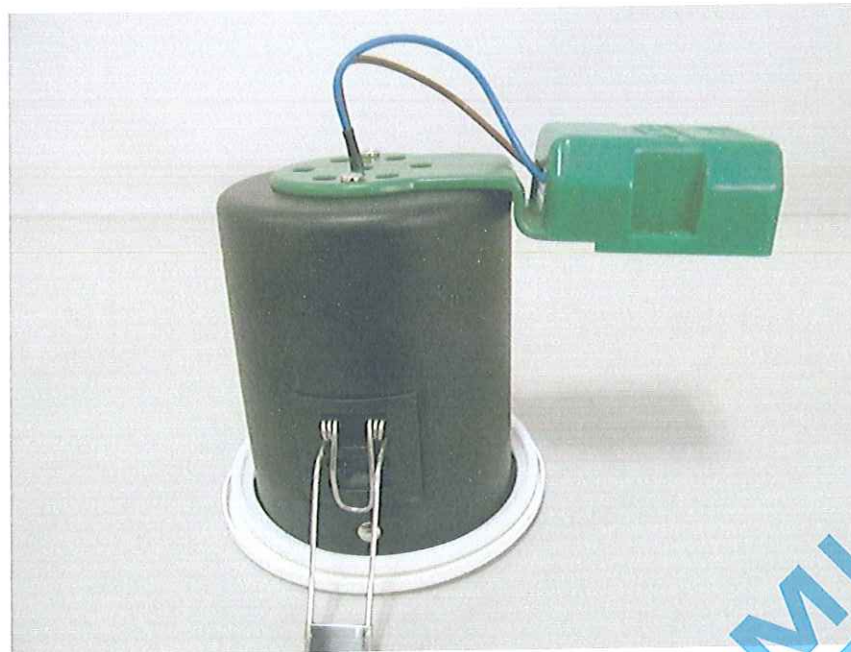


Photo 10

Photo 9: Front view of specimen 'E'
Photo 10: Side view of specimen 'E'

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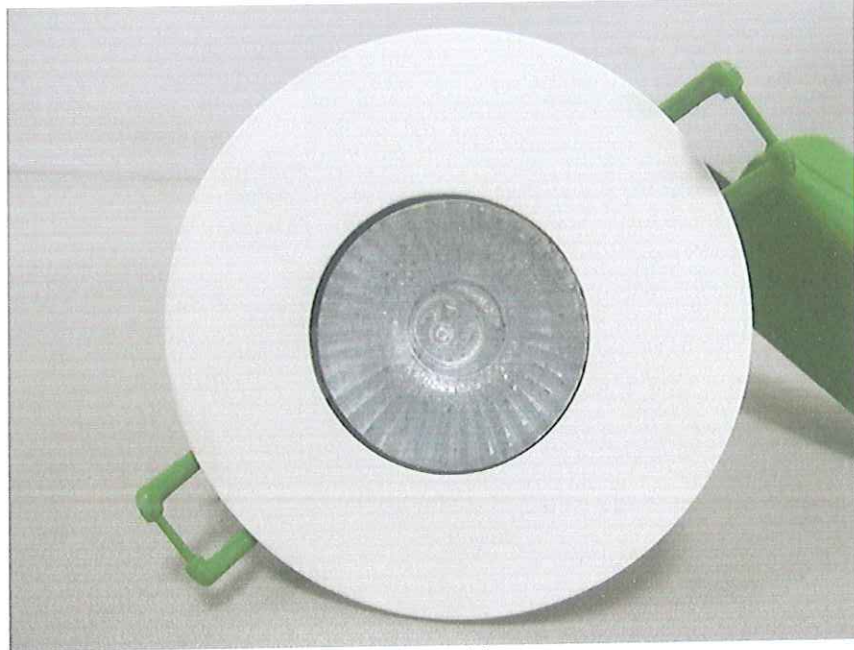


Photo 11



Photo 12

Photo 11: Front view of specimen 'F'
Photo 12: Side view of specimen 'F'

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Photo 13



Photo 14

Photo 13: Front view of specimen 'G'
Photo 14: Side view of specimen 'G'

GML



Photo 15



Photo 16

Photo 15: Front view of specimen 'H'

Photo 16: Side view of specimen 'H'

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Photo 17



Photo 18

Photo 17: The exposed surface of the specimen before the test

Photo 18: The unexposed surface of the specimen before the test.

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Photo 19



Photo 20

Photo 19: The exposed surface of the specimen after test duration of 4 minutes, showing the lens of specimen was fusing.

Photo 20: The unexposed surface of the specimen after test duration of 15 minutes.



Photo 21

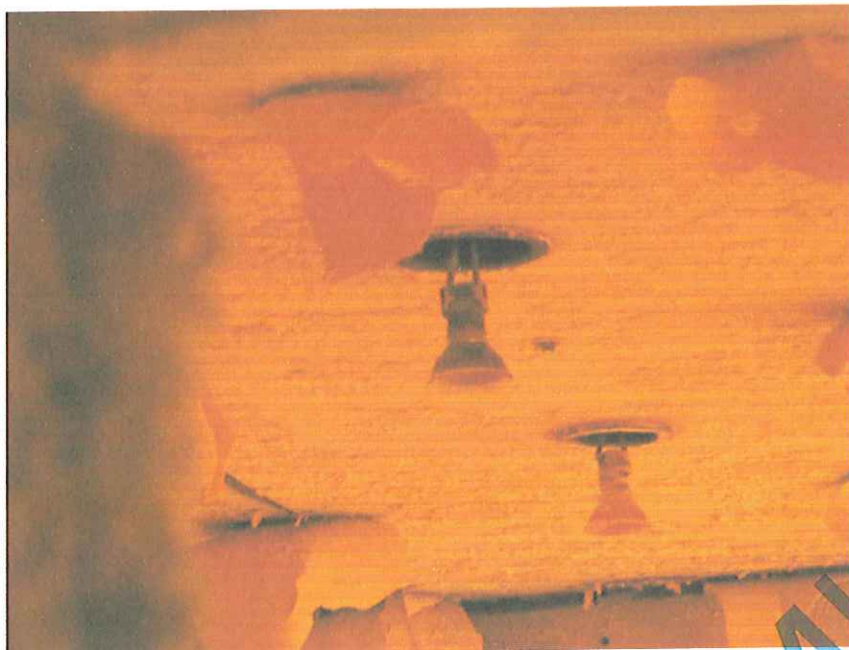


Photo 22

Photo 21: The exposed surface of the specimen after test duration of 17 minutes, showing the bezel of specimen fell away.

Photo 22: The exposed surface of the specimen after test duration of 26 minutes, showing the lamp cups of specimen fell out from the light can.

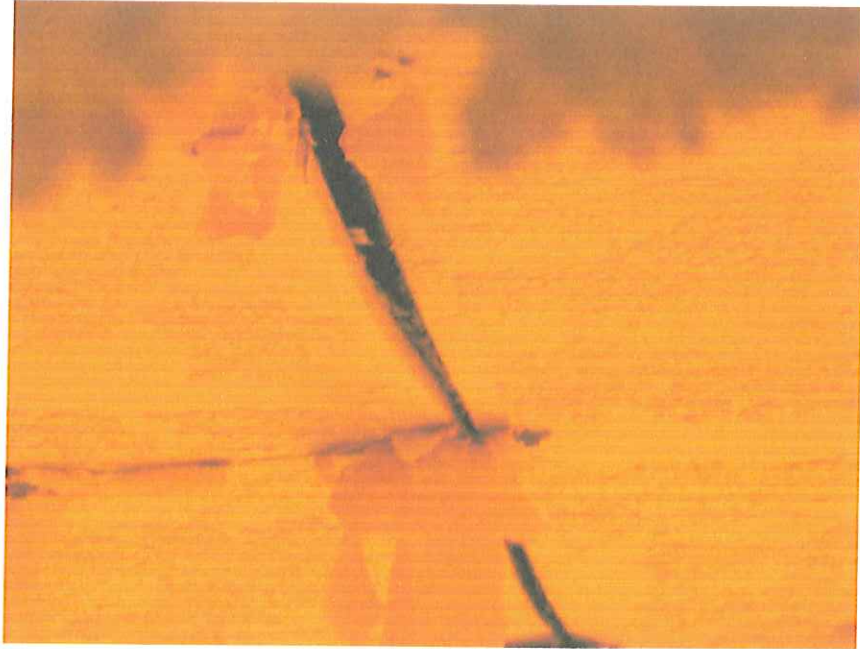


Photo 23



Photo 24

Photo 23: The exposed surface of the specimen after test duration of 29 minutes, the first layer plasterboard ceiling started to sag slightly and joints began to open.

Photo 24: The unexposed surface of the specimen after test duration of 30 minutes.



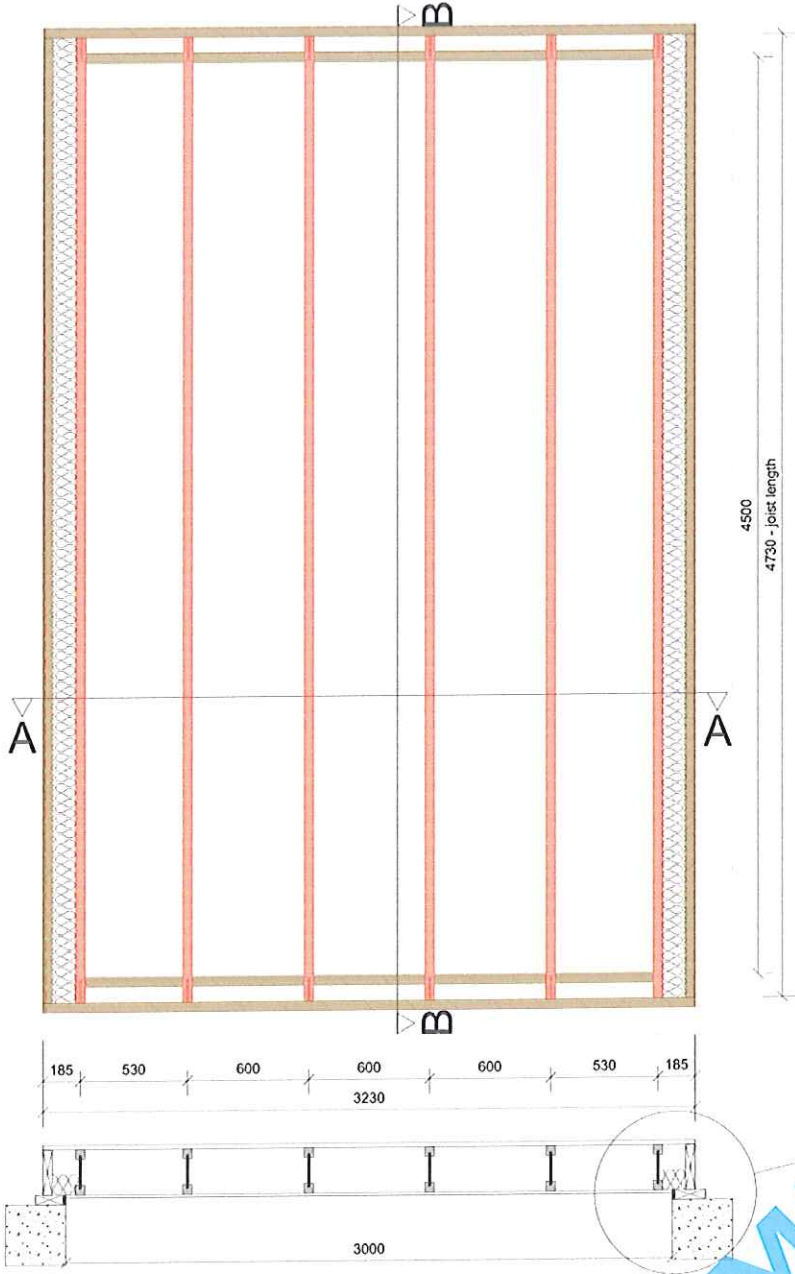
Photo 25



Photo 26

Photo 25: The exposed surface of the specimen after the test.
Photo 26: The unexposed surface of the specimen after the test.

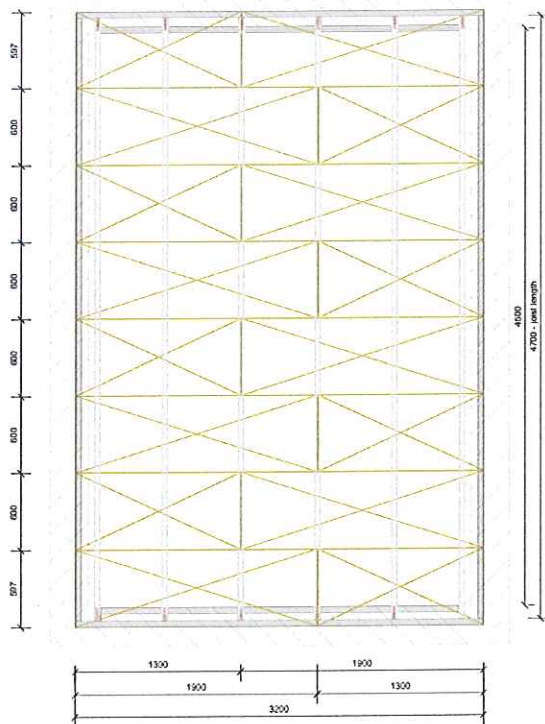
DETAILS OF TEST SPECIMEN



Section A - A

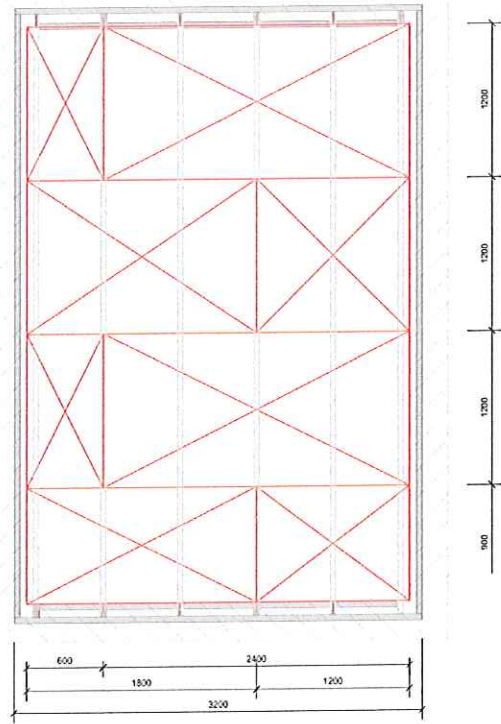
Figure 1 - Specimen Structural Drawing

Note: the specimen details provided by the sponsor



Chipboard glued between tongue and groove, and to joists with D4 adhesive and fixed with 2.8Ø x 51mm long nails through tongues at max 600mm c/c generally, and at max. 300mm at perimeter.

Chipboard Layout



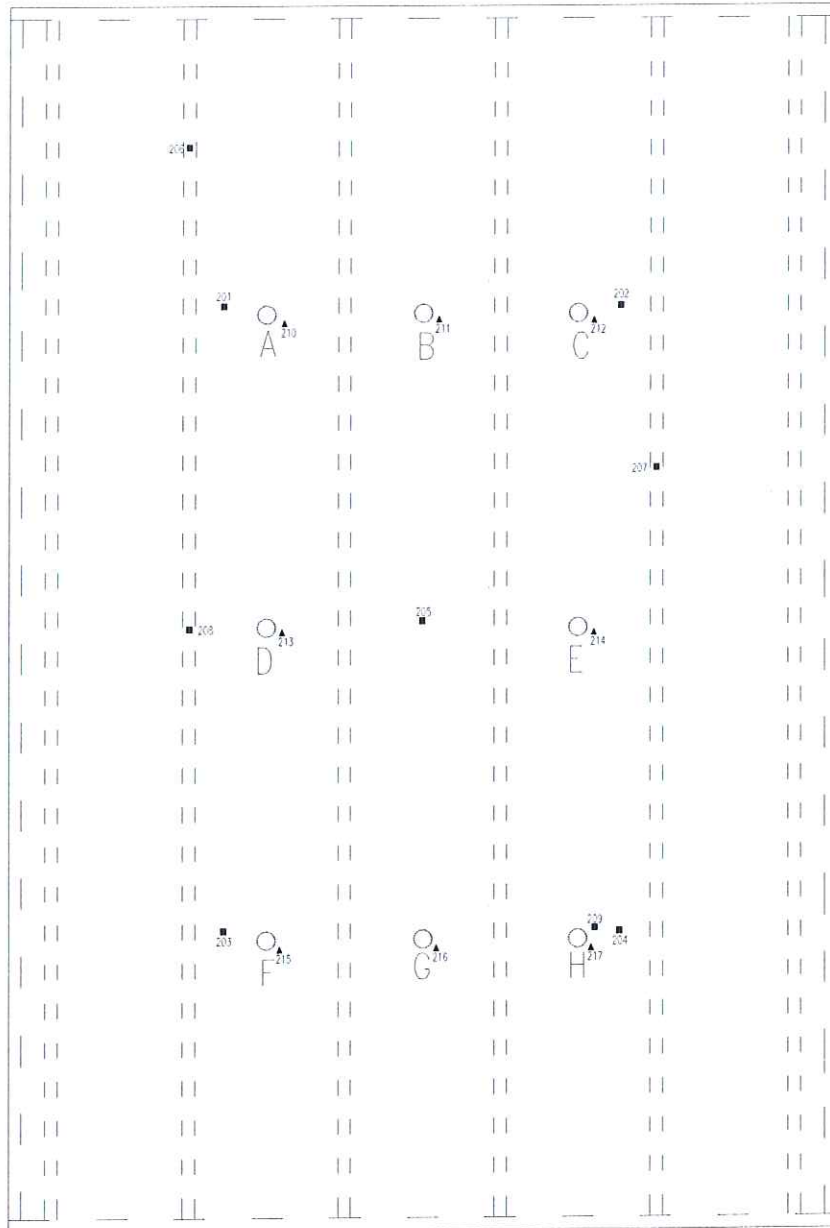
Plasterboard fixed to joists with 3.5Ø x 38mm Drywall screws at max. 230mm c/c. All joints filled only (no tape) using Gyproc joint filler and screw heads covered with filler.

Plasterboard Layout

Figure 2 - Specimen Structural Drawing

Note: the specimen details provided by the sponsor





Positions of thermocouples

- surface mounted thermocouples on upper surface of floorboards
- ▲ mineral insulated (MI) thermocouples at mid-cavity, adjacent to each downlight

GENERAL PLAN
Down light specimens 'A' to 'H'

Figure 3 - Positions for Thermocouples Plan

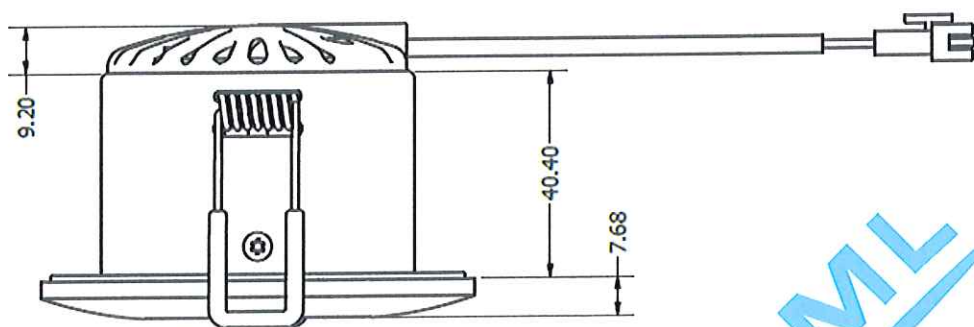
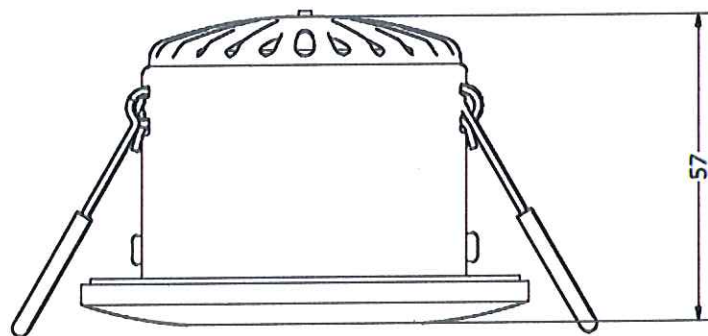
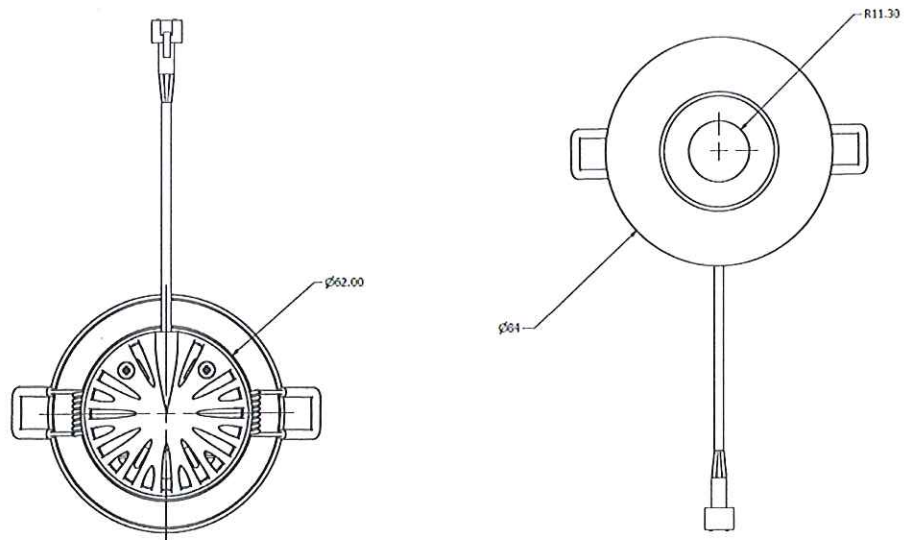


Figure 4 – Details of specimen 'A'

Note: the specimen details provided by the sponsor



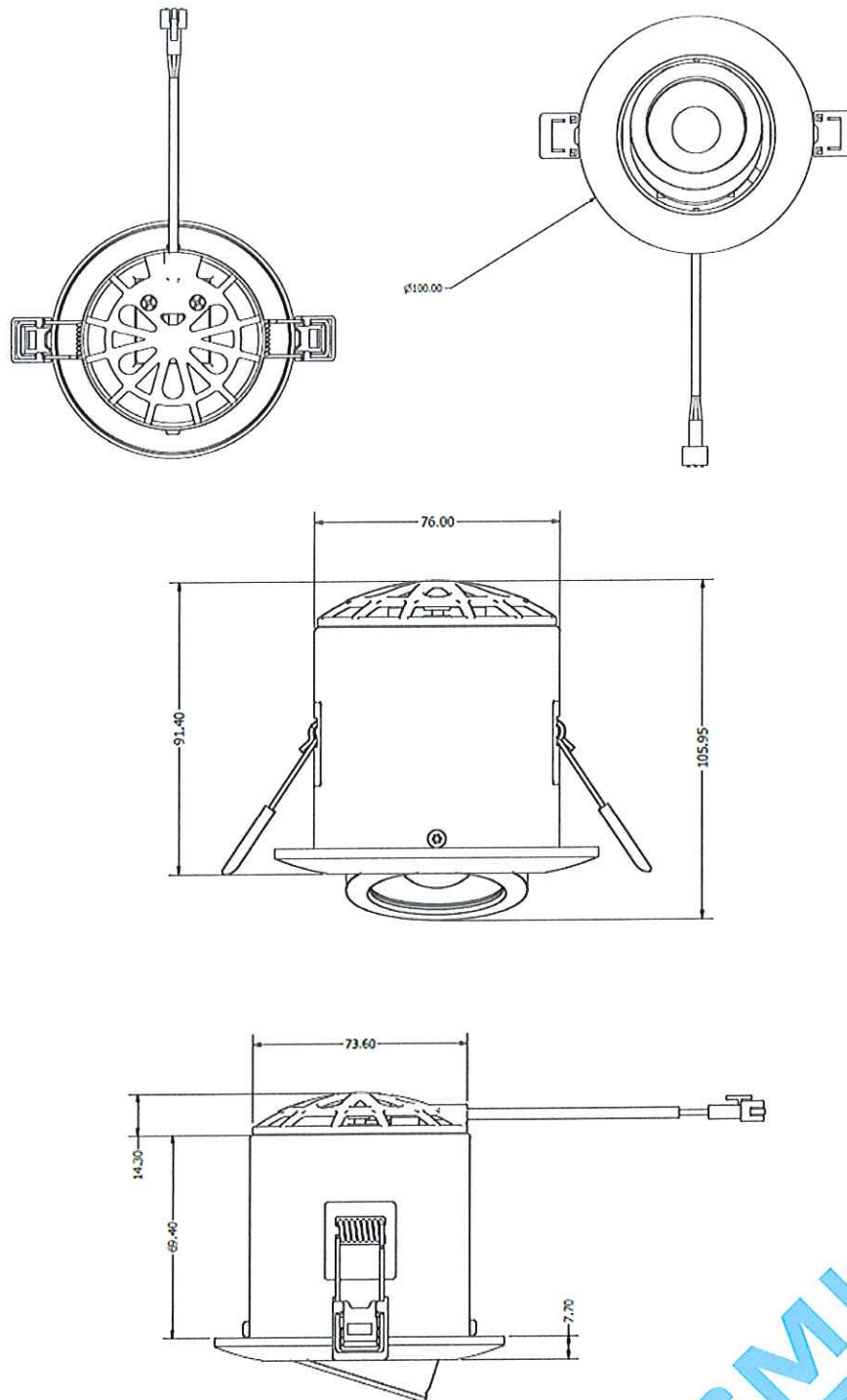


Figure 5 –Details of specimen 'B'

Note: the specimen details provided by the sponsor



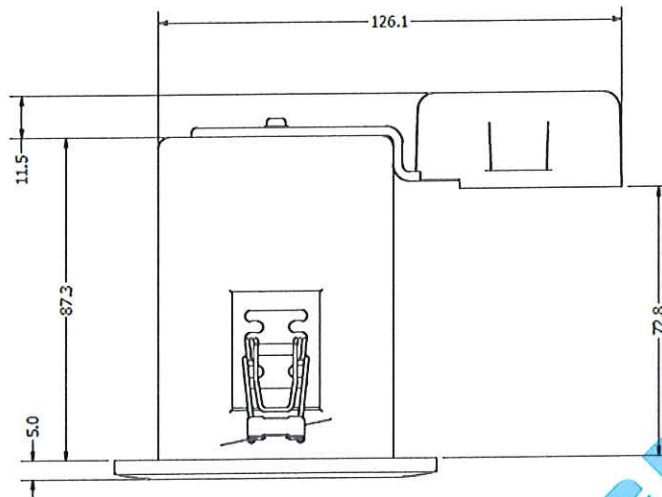
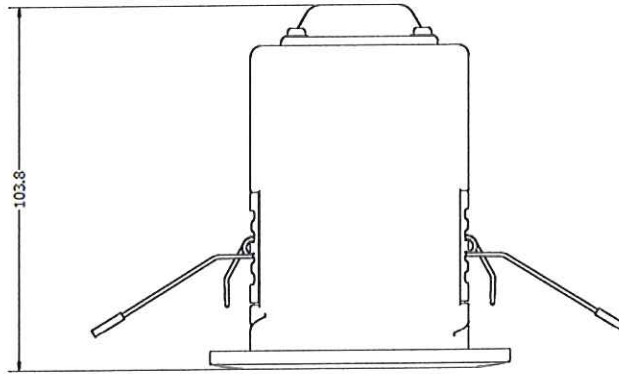
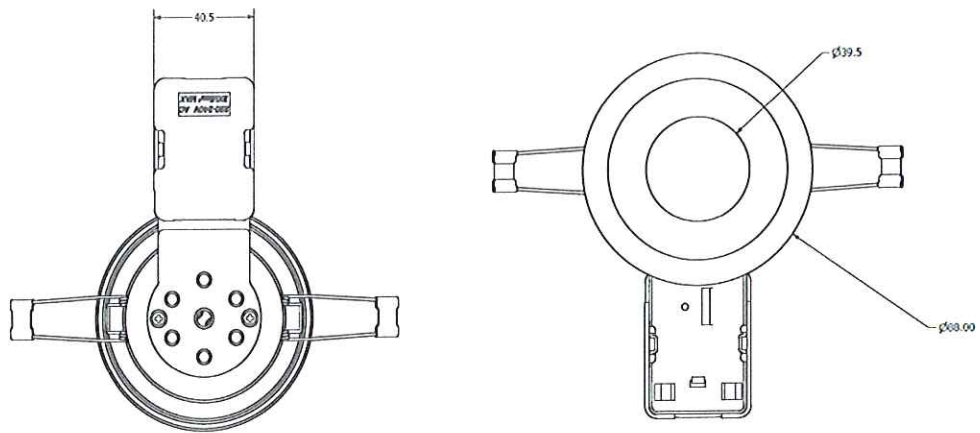


Figure 6 –Details of specimen 'C'

Note: the specimen details provided by the sponsor



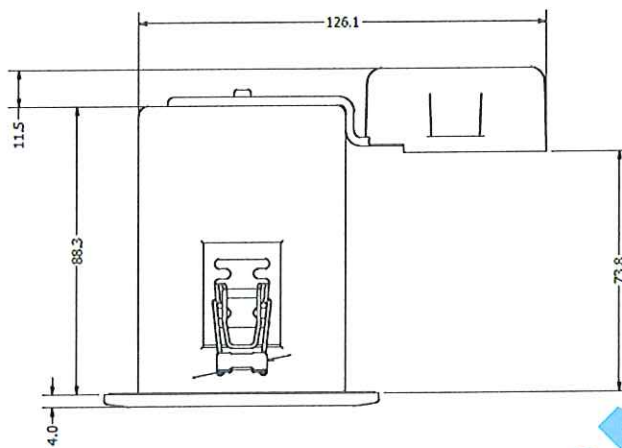
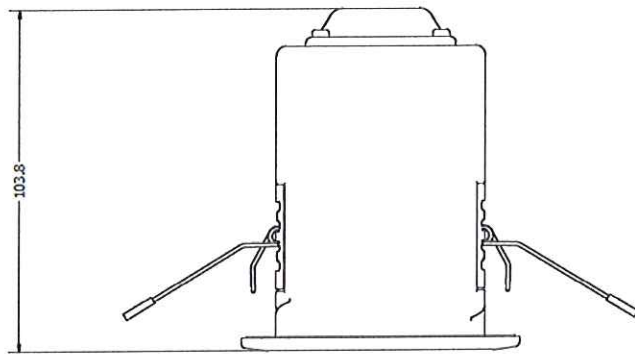
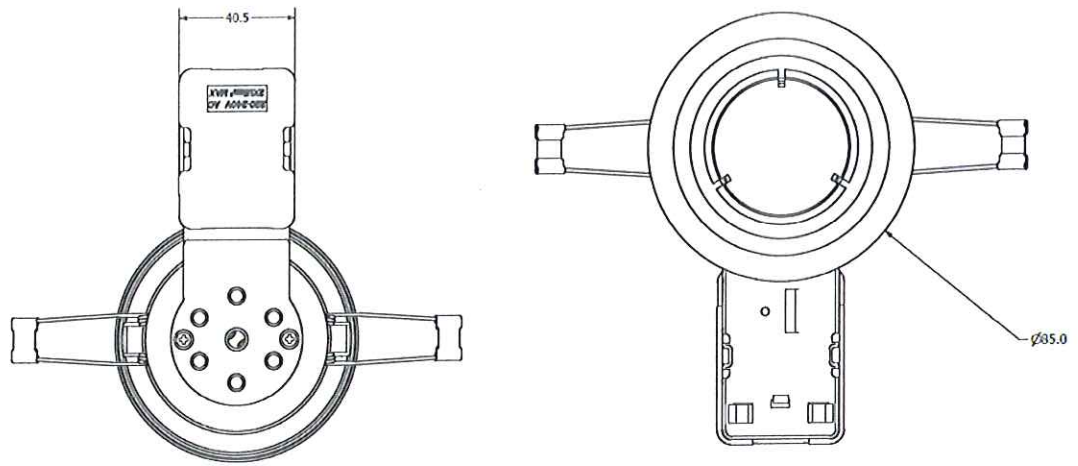


Figure 7 –Details of specimen 'D'

Note: the specimen details provided by the sponsor



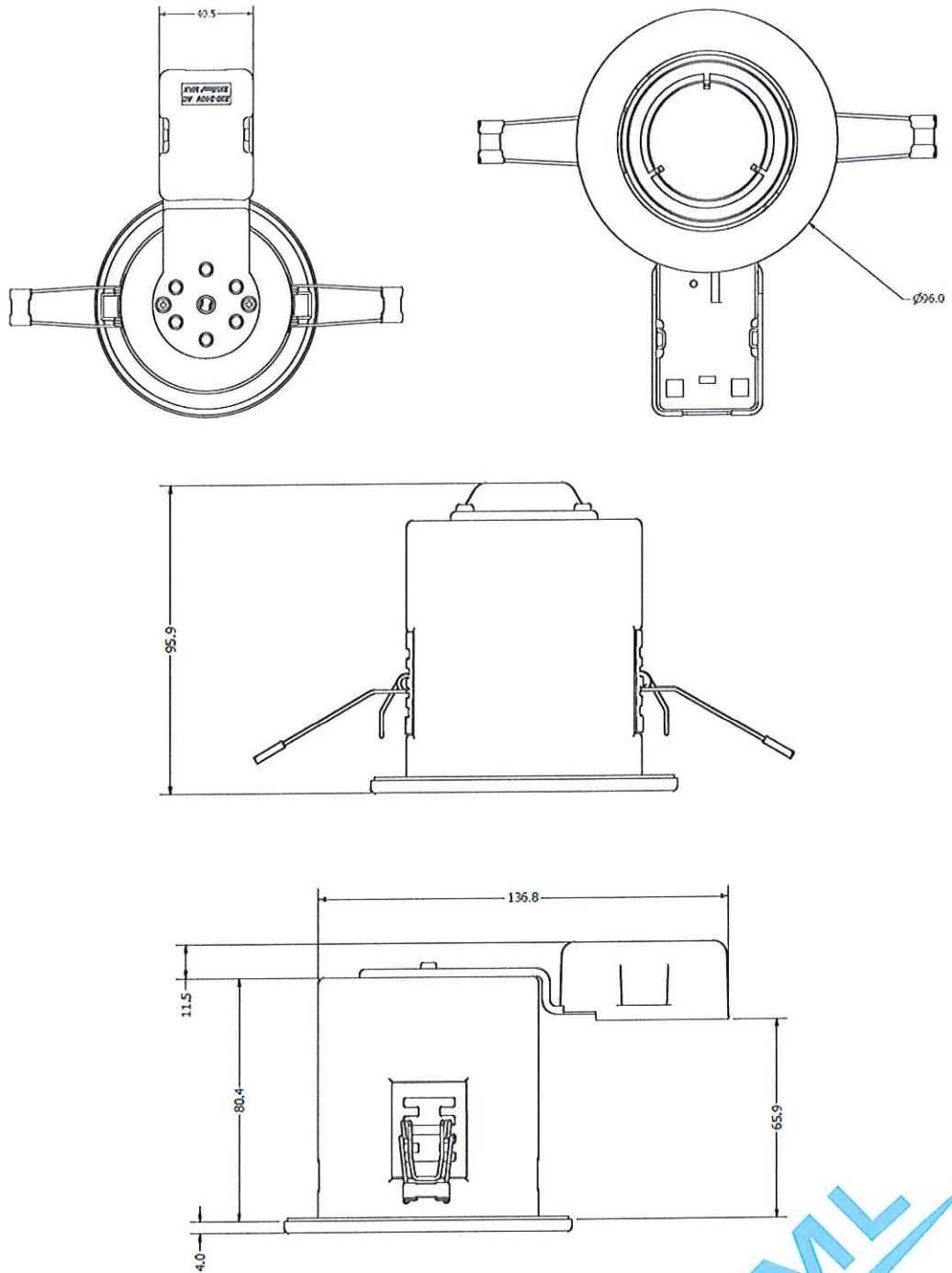


Figure 8 –Details of specimen 'E'

Note: the specimen details provided by the sponsor



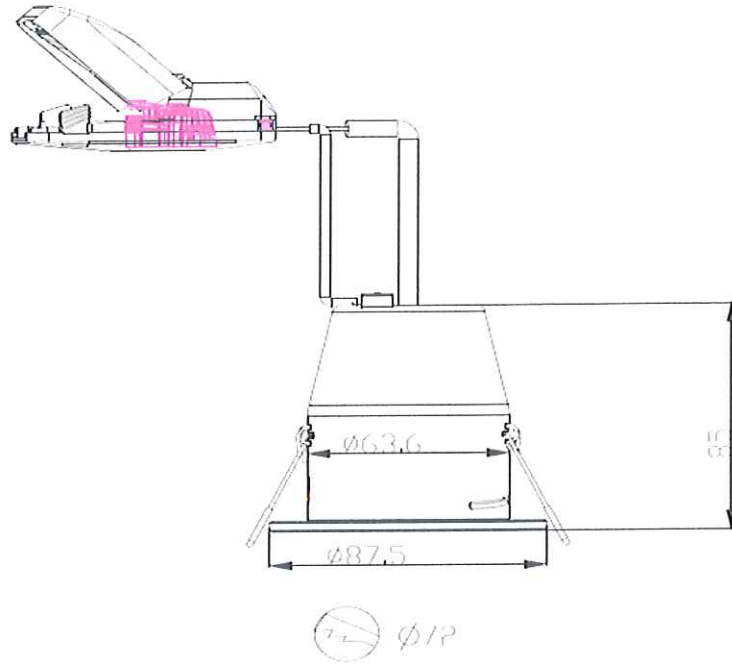


Figure 9 –Details of specimen 'F'

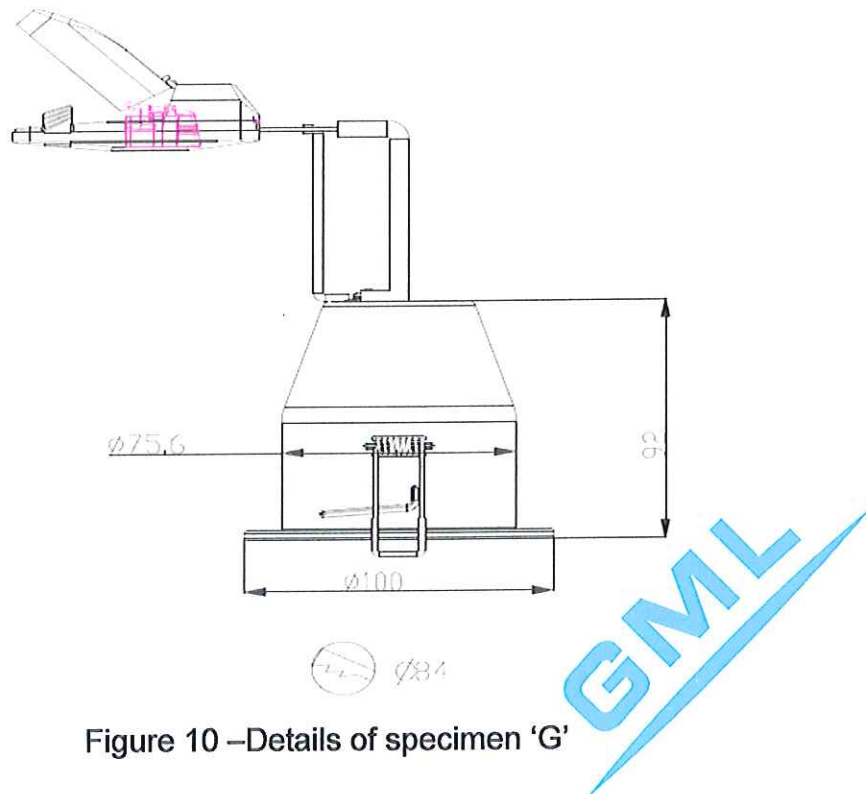


Figure 10 –Details of specimen 'G'

Note: the specimen details provided by the sponsor

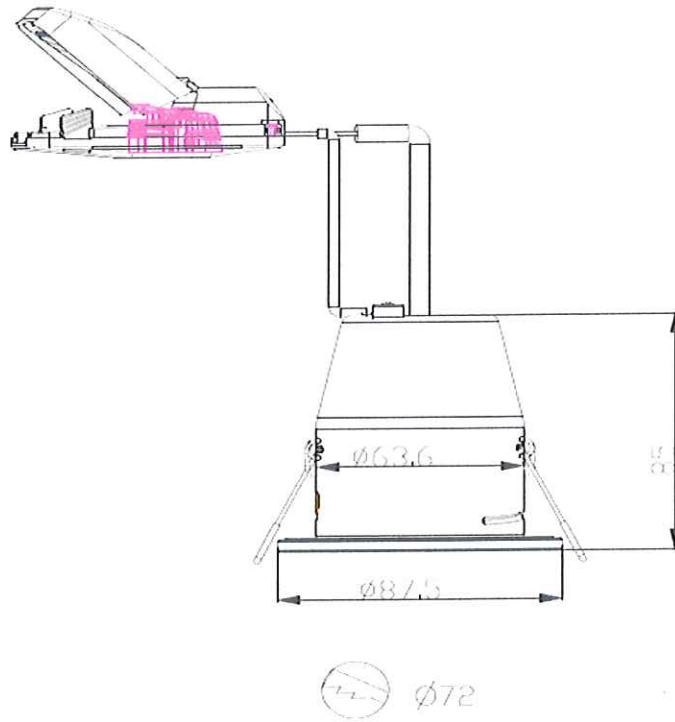


Figure 11 –Details of specimen 'H'

Note: the specimen details provided by the sponsor

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TEMPERATURE CURVES

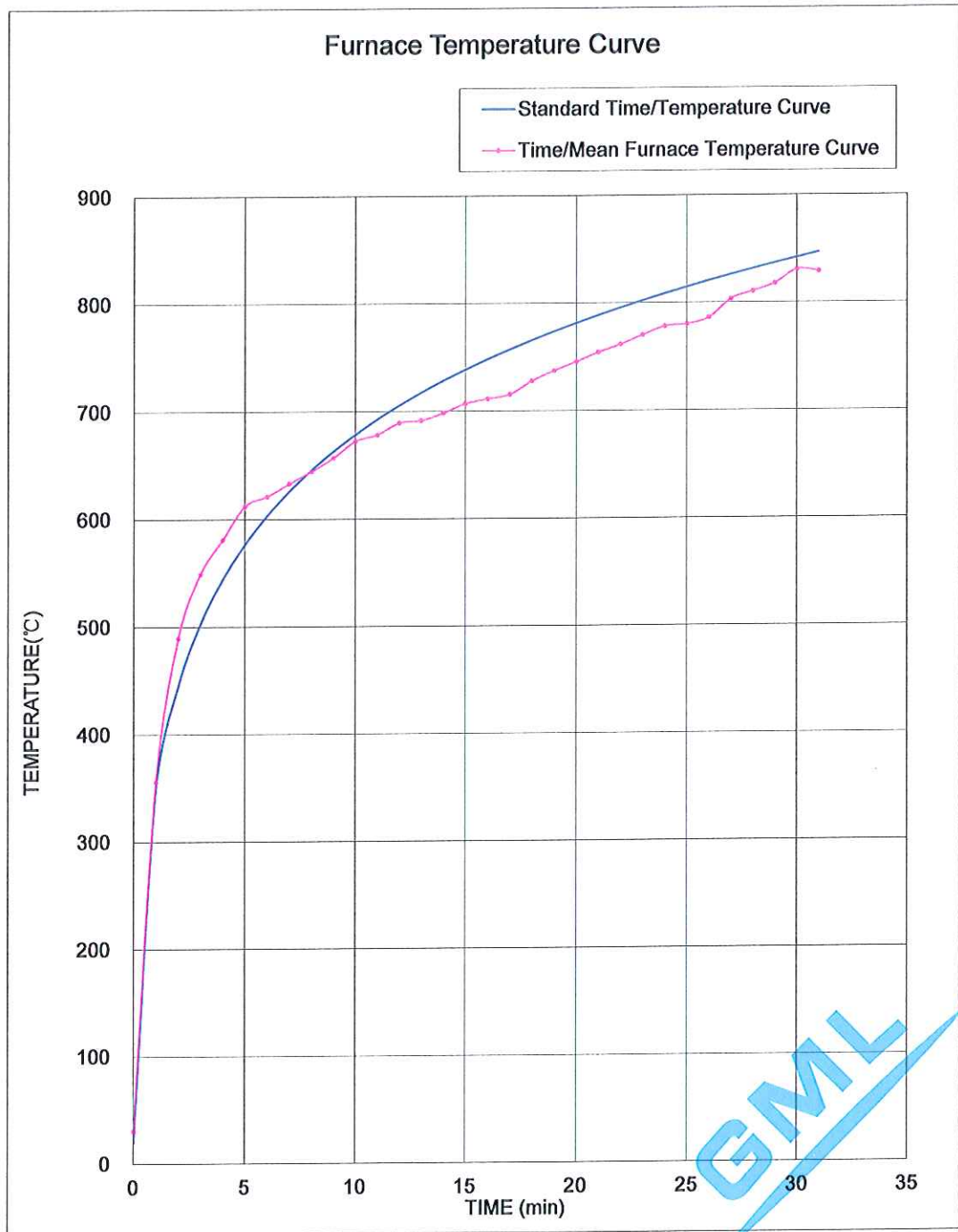


Figure 12 - Furnace Temperature Curve

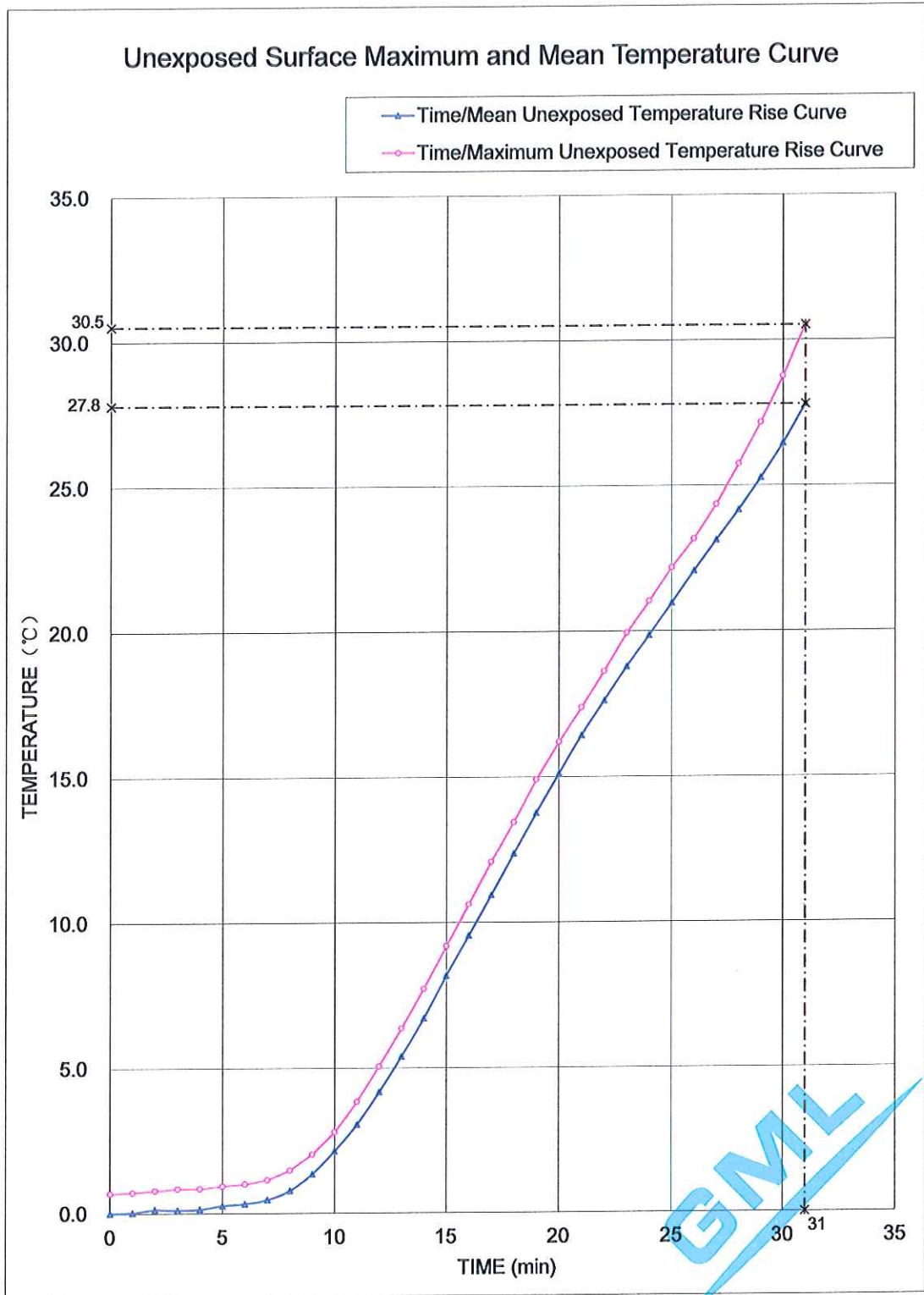


Figure 13 - Unexposed Face Mean and Maximum Temperature Curve

DEFLECTION CURVES

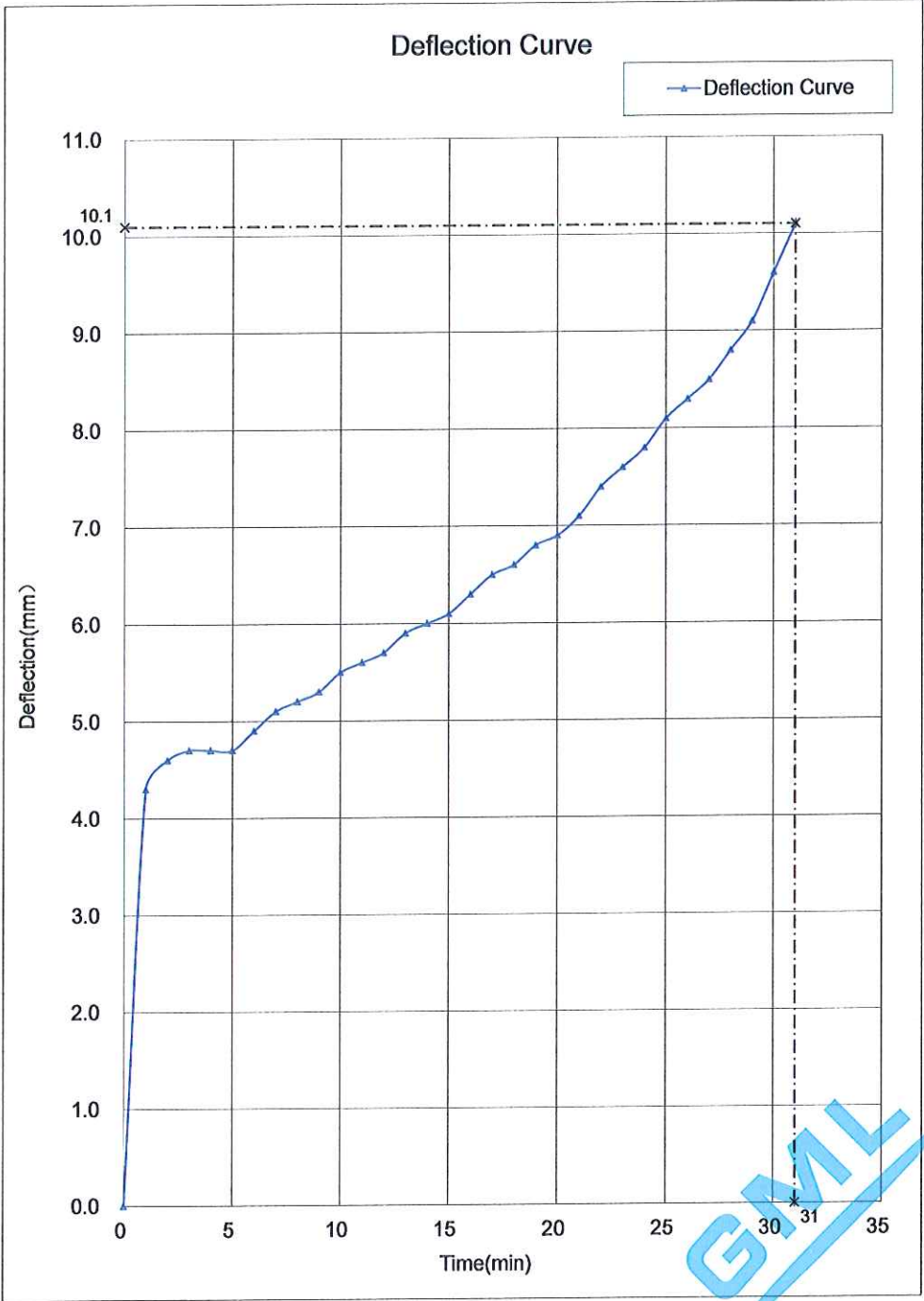


Figure 14 - Deflection Curve

TEST OBSERVATIONS

Time (min)	Observation (All observations are from the exposed face unless noted otherwise)
0	Test started.
4	The lens of specimen 'A' fused.
5	The lens of specimen 'B' fused.
7	The lens of specimen 'D' fused, and the bezels of specimen 'C', 'D', 'E', 'H' and 'G' turned black.
9	The bezels of specimen 'F' turned black.
10	Coating of the plasterboard ceiling fell away.
17	The bezel of specimen 'C' fell away.
23	The lamp cup of specimen 'A' fell out from the light can.
26	The lamp cups of specimen 'F' and 'G' fell out from the light can.
28	The first layer plasterboard ceiling started to sag slightly and joints began to open.
31	Test terminated at sponsor's request.

Appendix 1 – Test Observations



TEMPERATURE RECORDS

Time min	Specified Furnace Temperature °C	Actual Furnace Mean Temperature °C
0	20	31
5	576	612
10	678	672
15	739	707
20	781	746
25	815	780
30	842	830
31	847	829

Appendix 2 – Furnace Temperature Records



Time min	TC No.201 °C	TC No.202 °C	TC No.203 °C	TC No.204 °C	TC No.205 °C	TC No.206 °C	TC No.207 °C	TC No.208 °C	TC No.209 °C	Mean Temp °C	Mean Temp Rise °C	Max Temp Rise °C
0	21.0	20.9	21.2	20.8	21.4	21.1	21.7	21.4	21.4	21.1	0.0	0.7
5	21.2	21.2	21.5	21.1	21.7	21.4	22.0	21.6	21.6	21.3	0.3	0.9
10	22.8	23.0	23.8	22.7	23.7	22.3	23.9	23.4	23.8	23.2	2.1	2.8
15	28.8	29.2	30.0	28.2	30.0	26.8	29.8	28.4	30.2	29.2	8.2	9.2
20	35.7	36.5	37.2	34.5	36.9	33.0	36.5	32.3	37.3	36.2	15.1	16.2
25	41.5	42.7	42.9	39.9	43.0	39.1	42.5	35.6	43.2	42.0	21.0	22.2
30	46.3	48.1	49.8	44.8	48.7	44.4	47.8	38.8	48.7	47.5	26.5	28.8
31	47.2	49.2	51.6	45.8	50.6	45.3	49.0	40.5	50.4	48.9	27.8	30.5

Appendix 3 – Unexposed Surface Temperature Records



Time min	TC No.210 °C	TC No.211 °C	TC No.212 °C	TC No.213 °C	TC No.214 °C	TC No.215 °C	TC No.216 °C	TC No.217 °C
0	23.5	24.0	24.4	25.0	23.5	28.4	24.2	25.0
5	74.3	86.6	73.9	87.5	71.3	93.1	76.5	82.3
10	84.0	93.3	90.5	96.5	84.2	99.6	89.2	91.1
15	97.4	100.0	109.0	111.2	100.0	106.7	111.3	99.0
20	104.7	107.9	118.0	119.9	108.9	123.8	122.0	106.3
25	148.9	163.1	185.6	183.7	159.6	210.3	202.7	155.1
30	206.1	223.6	231.4	267.4	221.5	282.1	272.8	218.3
31	216.0	229.5	240.3	276.5	224.2	289.5	280.0	226.2

**Appendix 4 – Individual Temperatures Recorded Adjacent to the Spotlight
Fittings at Mid-height of the Cavity**



DEFORMATION RECORDS

Time min	Central Vertical Deflection mm	Rate of Deflection mm/min
0	0.0	0.0
5	4.7	0.0
10	5.5	0.2
15	6.1	0.1
20	6.9	0.1
25	8.1	0.3
30	9.6	0.5
31	10.1	0.5

Note:

1. A positive value indicates deflection towards to the furnace

Appendix 5 – Deflection of the floor assembly during the test

* * * End * * *

The logo for GML, consisting of the letters 'GML' in a bold, blue, sans-serif font, slanted upwards to the right. A blue diagonal line runs from the bottom left to the top right, passing behind the letters.

注 意 事 项

Notice

1. 检验检测报告未加盖本机构“检验检测专用章”无效；
Inspection Test Report is Invalid without the Seal of "Special Stamp of Inspection Test Report" of the Institution.
2. 检验检测报告无主检、无审核、无批准人签名无效；
No Inspection Test Report is Valid without the Signature of Persons for Test, Check and Certification.
3. 检验检测报告涂改无效；
Inspection Test Report is Invalid if Altered.
4. 未经本机构书面批准，不得部分复制检验检测报告（完整复制除外），复印检验检测报告未重新加盖“检验检测专用章”无效；
Inspection Test Report shall not be Reproduced except in Full, without the Written Approval of Our Institution. Reproduced Report is Invalid without the Seal of "Special Stamp of Inspection Test Report" of the Institution.
5. 对检验检测报告若有异议应于收到检验检测报告之日起十五日内向本机构提出；
Any Objection against to the Inspection Test Report Should be Put forward to the Institution Within 15 days from the Day Receiving the Inspection Test Report.
6. 除见证检验外，委托检验仅对来样负责。
Except Sampling by Witness, the Inspection Test Report for the Samples Delivered by Client is Valid only for the Samples Tested.

The logo for GML (Guangdong Metrology Laboratory) is located in the bottom right corner. It consists of the letters "GML" in a bold, blue, sans-serif font, slanted upwards to the right. A blue diagonal line runs from the bottom left to the top right, passing behind the letters.