



TEST REPORT

No. : XMCCM151101286

Date : Nov.24, 2015

Page: 1 of 29

FOSHAN RAYVEN LIGHTING CO., LTD.

A1 NEW LIGHTING SOURCE INDUSTRY ZONE, LUOCUN, NANHAI DISTRICT, FOSHAN, GUANGDONG,
CHINA 528200

The following sample(s) was/ were submitted and identified on behalf of the client as:

Sample Name : FIRE RATED LED DOWNLIGHT

Type No. : 1) RAV10FHE21; 2) RAV8FHB20; 3) RAV8FHB29;
4) RAV8FHC24; 5) RAV8FHB21; 6) RAV10FHE29;
7) RAV8FHD21; 8) RAV8FHB24.

Test Item : Fire Resistance Test

Test Requested : BS 476-20:1987 Incorporating Amendment No.1. Fire tests on building materials
and structures-Part 20: Method for determination of the fire resistance of
elements of construction (general principles)

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

Date of Receipt : Nov.09, 2015

Test Period : Nov.09, 2015 to Nov.19, 2015

Test Results : For further details, please refer to the following page(s)
***** To be continued *****

Signed for
SGS-CSTC Standards Technical
Services Co., Ltd. XM Branch Testing Center

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Xiamen Branch Testing Center

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Test Summary

To determine the fire resistance of a timber floor assembly protected by a plasterboard ceiling designed to provide 90 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".

Performance Criteria	Test Results
Loadbearing Capacity	91min (No failure)
Integrity	91min (No failure)
Insulation	91min (No failure)

Note: According to customer requirements, the test was discontinued after a period of 91 minutes.

Sample details and conditioning

The ceiling incorporated eight downlight fittings referenced as follows:

Test Ref.	Model Ref.	Description
A	RAV10FHE21	Size: $\Phi 85\text{mm} \times 61.5\text{mm}$ Round
B	RAV8FHB20	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round
C	RAV8FHB29	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round
D	RAV8FHC24	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round
E	RAV8FHB21	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round
F	RAV10FHE29	Size: $\Phi 85\text{mm} \times 61.5\text{mm}$ Round
G	RAV8FHD21	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round
H	RAV8FHB24	Size: $\Phi 85\text{mm} \times 56.5\text{mm}$ Round

The floor assembly had overall nominal dimensions of 4696mm long by 3200mm wide. The unexposed surface of the floor comprised 1 layer of 18mm thick Egger Chipboard, the layers was screw fixed to the upside of the floor joists.

The floor assembly was protected on its underside by a direct fixed ceiling, formed from two layers of 15mm thick plasterboard. Both layers were screw fixed to the underside of the floor joists.

One layers of 50mm thick rockwool was filled into the cavity between the floor and the ceiling.

The floor supported an evenly distributed load of 387.2N/m^2 .

***** To be continued *****

Test procedure

The ambient temperature at the beginning of the test was 27 °C.

The furnace temperature was measured by means of nine thermocouples distributed evenly in the furnace, with their measuring junctions 100 mm ± 10 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.

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.

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 1.

Test data and information

Details of the specimen structure are shown in Figure 2 to 9. The photographs of the downlights are shown in Photo 1 to 16.

Photographs of the test are shown in Photos 17 to 28. A summary of the observations made on the general behavior of the specimen is given in Appendix 6.

The mean furnace temperature records are shown in Appendix 7, and the actual time-temperature curve of furnace in relation to the specified time-temperature curve is shown in Appendix 3.

The unexposed surface temperature records are shown in Appendix 8, and the individual temperatures recorded adjacent to the downlight fittings at mid-height of the cavity are shown in Appendix 9. The unexposed surface maximum and mean temperature curve are shown in Appendix 4.

The vertical deflection at the centre of the floor assembly was continuously measured during the test, and the data records are given in Appendix 10. The deflection curve is shown in Appendix 5.

The Load Calculations is given in Appendix 1

Performance criteria

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

***** To be continued*****

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 $L/20$; 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:

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

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).

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 fibre 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.

***** To be continued*****

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 91 minutes, the maximum deflection was 86.5mm, the maximum rate of deflection was 6.7mm/min. As The loadbearing capacity was satisfied. At the heating period of 91 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 91 minutes, the mean temperature rise of the unexposed face was 36.7°C, the maximum temperature rise of the unexposed face was 68.6 °C. The insulation requirement was satisfied.

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

Performance Criteria	Test Results
Loadbearing Capacity	91min (No failure)
Integrity	91min (No failure)
Insulation	91min (No failure)

Note: According to customer requirements, the test was discontinued after a period of 91 minutes.

Remark:

1. The test results relate only to the specimen tested. Appendix A of BS 476-20 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the result to assemblies of different dimensions or supported in other manners or incorporating different components should be the subject of a design appraisal.
2. The test was carried out by the accredited laboratory.

***** To be continued*****

Appendix 1: Schedule of components

Floor assembly (items 1 to 4)

1. Floor Joists

Material : Softwood timber joists
Overall section size : 45 mm thick x 190 mm deep
Density of Joist : 600 kg/m³

2. Floorboards

Manufacturer : Egger
Material : Egger Chipboard, E1
Thickness : 1 no. layer, 18mm thick
Density : 700 kg/m³
Fixing method : All board joints staggered with respect to adjacent layer and screw fixed to all joists using drywall steel screws, 35 mm long x 3.9 mm diameter screws for first layer and 55 mm long x 3.9 mm diameter screws for second layer, at 200 mm centres along joists and 150 mm centres along perimeter of floor.

3. Ceiling boards

Manufacturer : Knauf
Material : Gypsum plasterboard
Thickness : 2 no. layers, each 15mm thick
Density : 727 kg/m³
Fixing method : All board joints staggered with respect to adjacent layer and screw fixed to all joists using drywall steel screws, 35 mm long x 3.9 mm diameter screws for first layer and 55 mm long x 3.9 mm diameter screws for second layer, at 200 mm centres along joists and 150 mm centres along perimeter of ceiling.

4. Rockwool

Manufacturer : ROCKWOOL
Thickness : 50mm
Density : 80 kg/m³
Fixing method : filled into the cavity between the floor and the ceiling

***** To be continued *****

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TEST REPORT

No. : XMCCM151101286

Date : Nov.24, 2015

Page: 7 of 29

5. Specimen 'A'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV8FHB24
Type : Round, fix down light
Overall dimensions and construction : See figure 2
Hole size in ceiling boards : $\Phi 72 - \Phi 75\text{mm}$
Materials :
i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material :
i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material :
i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

6. Specimen 'B'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV8FHB20
Type : Round, fix down light
Overall dimensions and construction : See figure 3
Hole size in ceiling boards : $\Phi 72 - \Phi 75\text{mm}$
Materials :
i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material :
i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material :
i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

***** To be continued*****



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TEST REPORT

No. : XMCCM151101286

Date : Nov.24, 2015

Page: 8 of 29

7. Specimen 'C'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV8FHB29
Type : Round, fix down light
Overall dimensions and construction : See figure 4
Hole size in ceiling boards : Φ 72- Φ 75mm
Materials : i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material : i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material : i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

8. Specimen 'D'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV8FHC24
Type : Round, fix down light
Overall dimensions and construction : See figure 5
Hole size in ceiling boards : Φ 72- Φ 75mm
Materials : i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material : i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material : i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

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TEST REPORT

No. : XMCCM151101286

Date : Nov.24, 2015

Page: 9 of 29

9. Specimen 'E'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV8FHB21
Type : Round, fix down light
Overall dimensions and construction : See figure 6
Hole size in ceiling boards : Φ 72- Φ 75mm
Materials :
i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material :
i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material :
i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

10. Specimen 'F'

Product Name : Fire Rated Led Downlight
Manufacturer : Foshan Rayven Lighting Co.,Ltd
Type No. : RAV10FHE29
Type : Round, fix down light
Overall dimensions and construction : See figure 7
Hole size in ceiling boards : Φ 72- Φ 75mm
Materials :
i: Casing: die-casting Aluminum
ii: Cover: die-casting Aluminum
iii: Spring clip: carbon steel
iv: iron hoop: cold-rolled sheet
Details of fireproof material :
i: Type: 90minutes fire resistance
ii: Thickness: 1.0mm
iii: Location: Inner side of the heat sink
Details of expanding material :
i: Type: 90minutes fire resistance
ii: Material: graphite
iii: Thickness: 1.0mm
iv: Location: inner side of the heat sink

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TEST REPORT

No. : XMCCM151101286

Date : Nov.24, 2015

Page: 10 of 29

11. Specimen 'G'

Product Name : Fire Rated Led Downlight
 Manufacturer : Foshan Rayven Lighting Co.,Ltd
 Type No. : RAV8FHD21
 Type : Round, fix down light
 Overall dimensions and construction : See figure 8
 Hole size in ceiling boards : Φ 72- Φ 75mm
 Materials :
 i: Casing: die-casting Aluminum
 ii: Cover: die-casting Aluminum
 iii: Spring clip: carbon steel
 iv: iron hoop: cold-rolled sheet
 Details of fireproof material :
 i: Type: 90minutes fire resistance
 ii: Thickness: 1.0mm
 iii: Location: Inner side of the heat sink
 Details of expanding material :
 i: Type: 90minutes fire resistance
 ii: Material: graphite
 iii: Thickness: 1.0mm
 iv: Location: inner side of the heat sink

12. Specimen 'H'

Product Name : Fire Rated Led Downlight
 Manufacturer : Foshan Rayven Lighting Co.,Ltd
 Type No. : RAV8FHB24
 Type : Round, fix down light
 Overall dimensions and construction : See figure 9
 Hole size in ceiling boards : Φ 72- Φ 75mm
 Materials :
 i: Casing: die-casting Aluminum
 ii: Cover: die-casting Aluminum
 iii: Spring clip: carbon steel
 iv: iron hoop: cold-rolled sheet
 Details of fireproof material :
 i: Type: 90minutes fire resistance
 ii: Thickness: 1.0mm
 iii: Location: Inner side of the heat sink
 Details of expanding material :
 i: Type: 90minutes fire resistance
 ii: Material: graphite
 iii: Thickness: 1.0mm
 iv: Location: inner side of the heat sink

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 中国·福建·厦门·火炬(翔安)产业区翔虹路31号 邮编:361101 t (86-592) 5761588 f (86-592) 5765380 e sgs.china@sgs.com

Load Calculations

1. Physical Parameters of Timber Joists

Measured Joist dimensions	: 190 mm deep by 45 mm thick
Mean spacing	: 640 mm
Effective span	: 4500 mm
Density of Joist	: 600 kg/m ³

2. Physical Parameters of Rockwool

Thickness	: 50 mm
Density	: 80 kg/m ³

3. Physical Parameters of Floorboards

Thickness	: 1 layers, 18 mm thick
Density	: 700 kg/m ³

4. Physical Parameters of Ceiling boards

Thickness	: 2 layers, each 15 mm thick
Density	: 727 kg/m ³

5. Weight of Actual Timber Joists

Actual volume of Joist	: 0.286 m ³
Actual weight of Joist	: 171.6 kg

6. Weight of Actual Rockwool

Actual volume of Rockwool	: 0.615 m ³
Actual weight of Rockwool	: 49.2 kg

7. Weight of Actual Floorboards

Actual volume of Floorboards	: 0.243 m ³
Actual weight of Floorboards	: 170.1 kg

8. Weight of Actual Ceiling boards

Actual volume of Floorboards	: 0.405 m ³
Actual weight of Floorboards	: 294.4 kg

9. Actual Dead Weight

Actual Dead Weight of overall specimen	: 685.3 kg
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10. Actual Dead Load

Actual Dead Load per metre square	: (685.3×9.81)/(4.5×3.0) 498.0 N/m ² ; 50.8 kg/m ²
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11. Imposed Load

Imposed Load per metre square	: (532.9×9.81)/(4.5×3.0) 387.2 N/m ² ; 39.5 kg/m ²
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Remark:

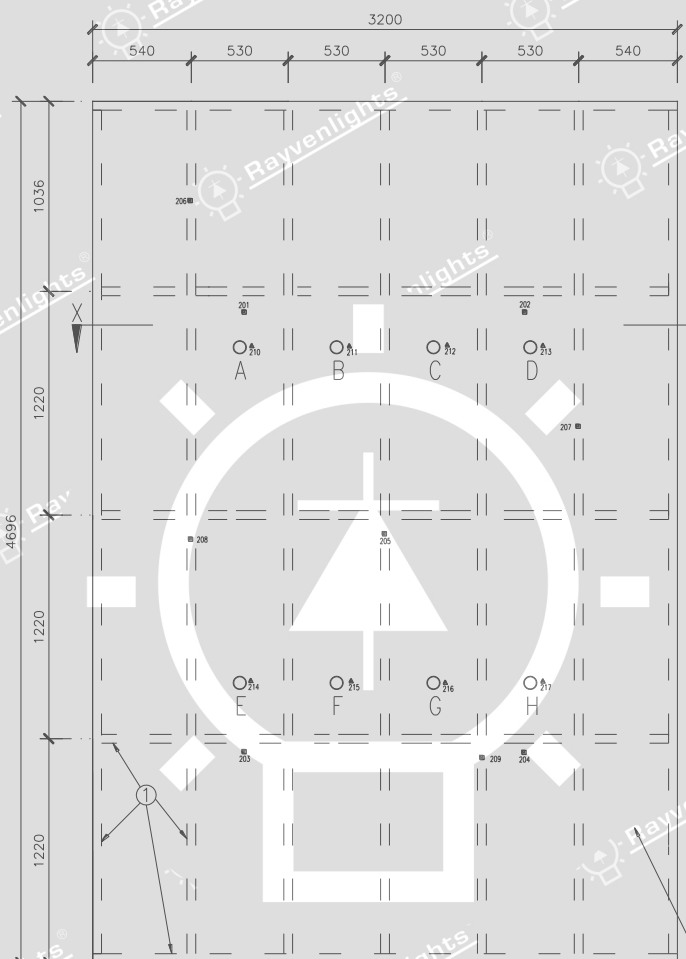
1. All values are nominal unless stated otherwise
2. All other details are as stated by the customer
3. All the specimens and floor assembly provided and install by customer

***** To be continued *****

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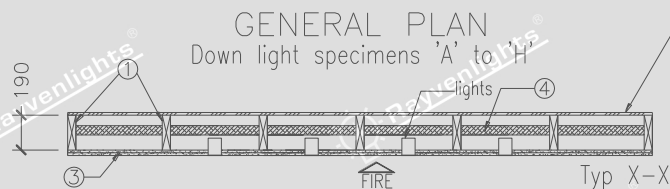
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Appendix 2: Details of test specimen



Positions of thermocouples

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



Do not scale. All dimensions are in mm.

Figure 1 - Specimen General Plan

***** To be continued*****

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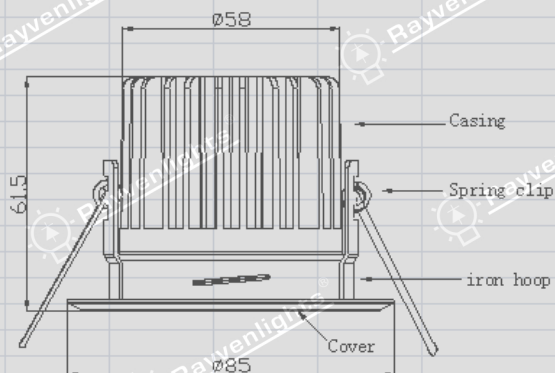


Figure 2 – Details of type No.: RAV10FHE21

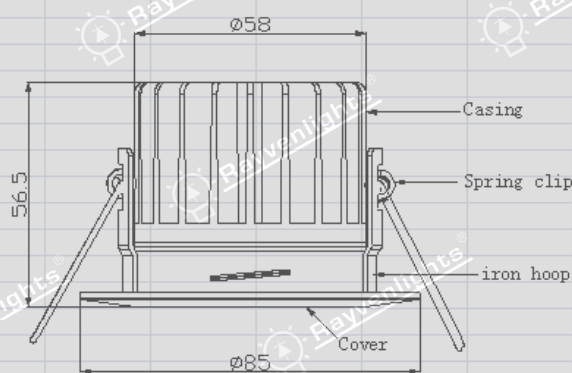


Figure 3 – Details of type No.: RAV8FHB20

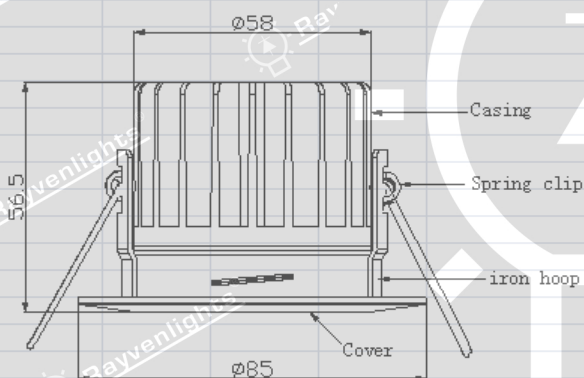


Figure 4 – Details of type No.: RAV8FHB29

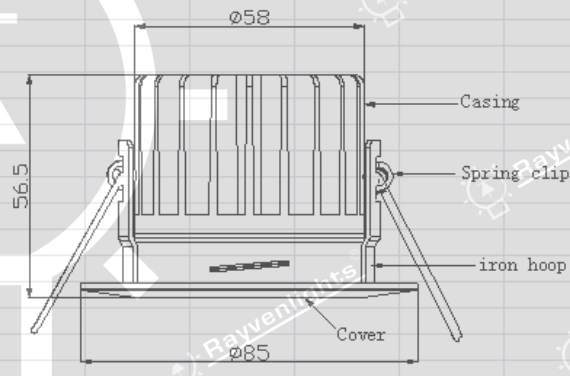


Figure 5 – Details of type No.: RAV8FHC24

***** To be continued *****

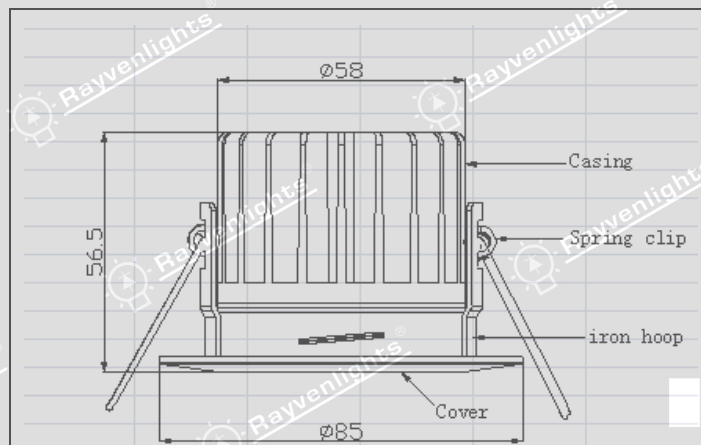


Figure 6 – Details of type No.: RAV8FHB21

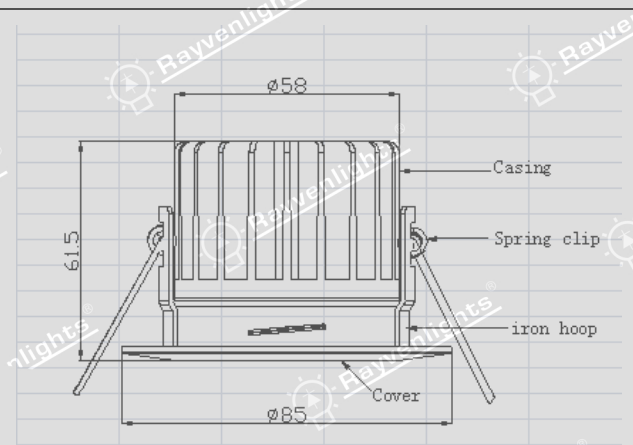


Figure 7 – Details of type No.: RAV10FHE29

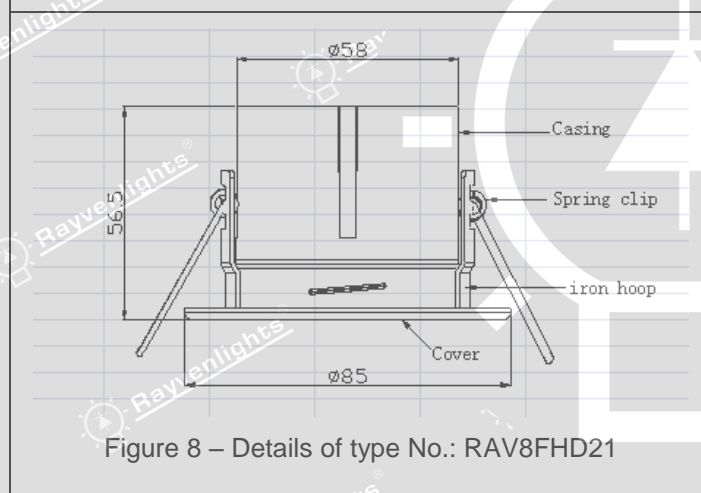


Figure 8 – Details of type No.: RAV8FHD21

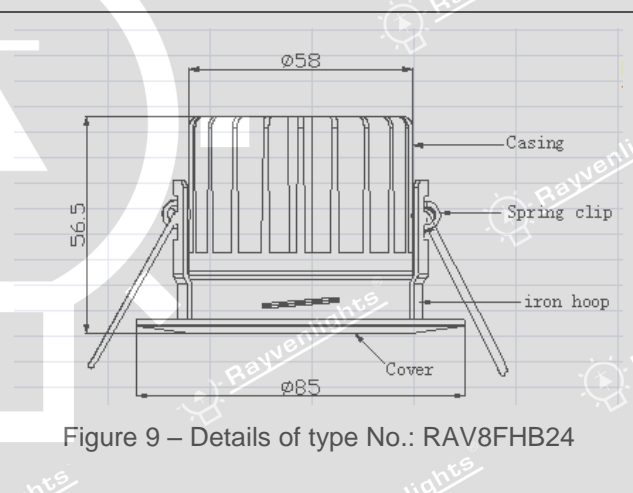
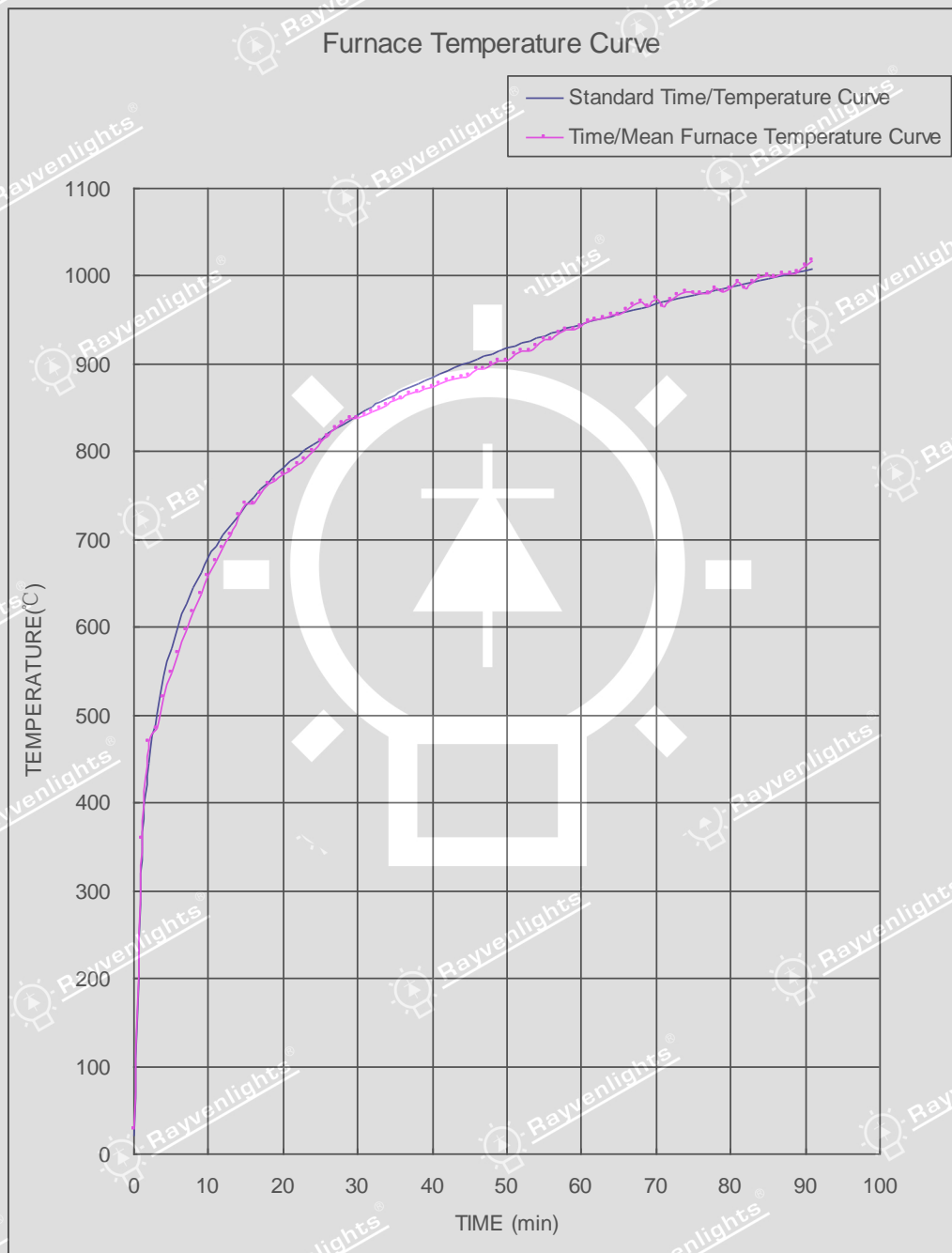


Figure 9 – Details of type No.: RAV8FHB24

Note: the specimen details provided by the customer

***** To be continued*****

Appendix 3 - Furnace Temperature Curve



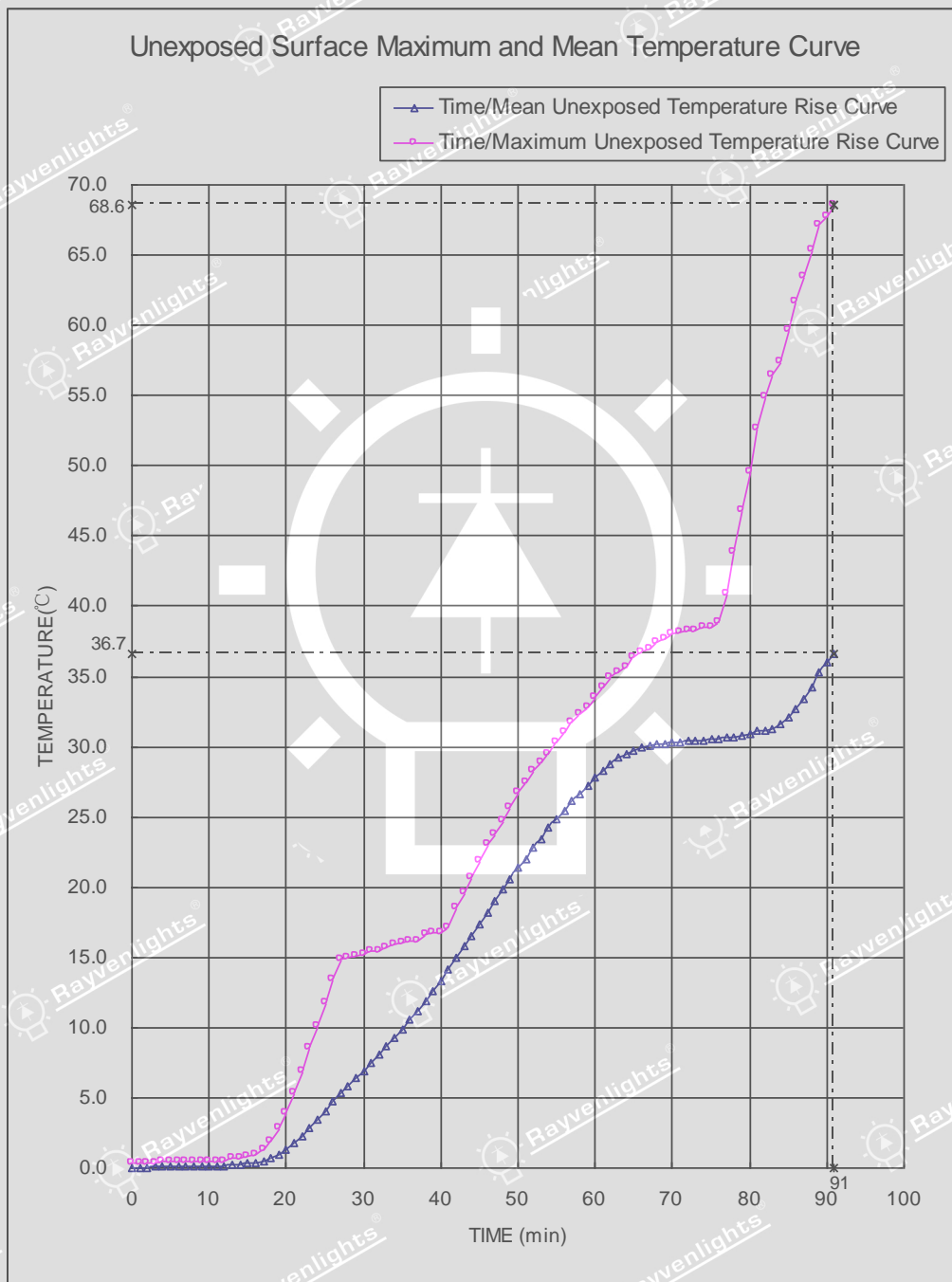
***** To be continued *****

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Appendix 4 - Unexposed Face Mean and Maximum Temperature Curve

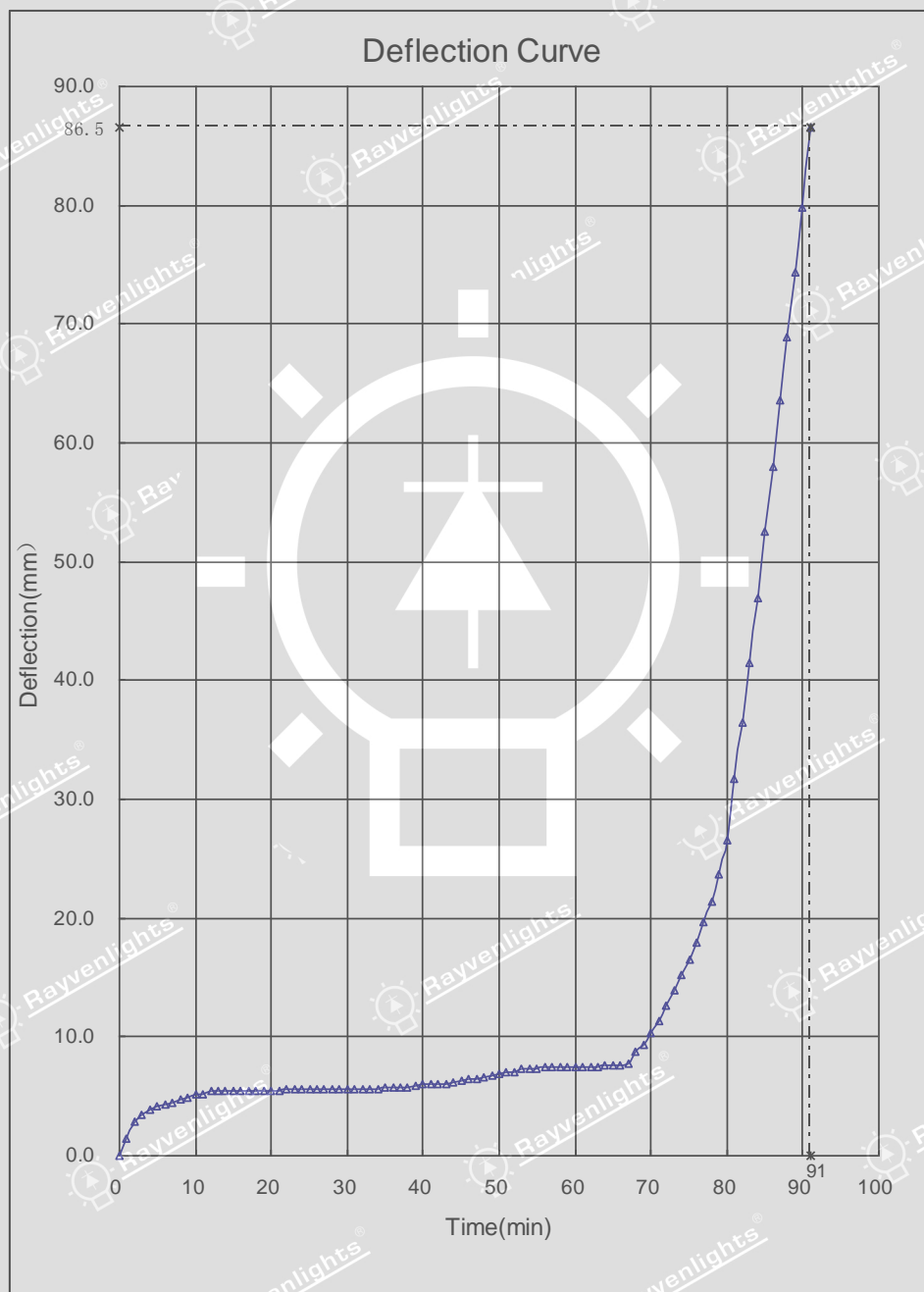


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Appendix 5 - Deflection Curve



***** To be continued *****

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Appendix 6 –Test Observations

Time (min)	Observation (All observations are from the exposed face unless noted otherwise)
0	Test started.
15	Coating of the plasterboard ceiling started to fall away.
25	Specimen 'C' and 'G' fused.
40	The first layer of plasterboard ceiling started to sag slightly and joints began to open.
41	The first layer of plasterboard ceiling sagged seriously.
48	The first layer of plasterboard ceiling nearby specimen 'E' fell away.
58	More first layer of plasterboard ceiling fell away.
65	Lots of smoke release increased inside the furnace, resulting the observation from the exposed side discontinued.
91	Test terminated at sponsor's request.

***** To be continued *****

Appendix 7 – Furnace Temperature Records

Time min	Specified Furnace Temperature °C	Actual Furnace Mean Temperature °C
0	20	28
5	576	548
10	678	659
15	739	741
20	781	775
25	815	811
30	842	838
35	865	858
40	885	874
45	902	888
50	918	904
55	932	927
60	945	957
65	957	957
70	968	975
75	979	981
80	988	985
85	997	1001
90	1006	1011
91	1008	1017

***** To be continued *****

Appendix 8 –Unexposed Surface Temperature Records

Time min	TC No.201 ℃	TC No.202 ℃	TC No.203 ℃	TC No.204 ℃	TC No.205 ℃	TC No.206 ℃	TC No.207 ℃	TC No.208 ℃	TC No.209 ℃	Mean Temp ℃	Mean Temp Rise ℃	Max Temp Rise ℃
0	27.2	26.9	26.7	26.7	26.5	26.6	26.5	26.3	26.2	26.8	0.0	0.4
5	27.3	27.0	26.9	26.8	26.6	26.7	26.6	26.4	26.2	26.9	0.1	0.5
10	27.3	27.0	26.9	26.9	26.6	26.7	26.6	26.7	26.3	26.9	0.1	0.5
15	27.6	27.2	27.2	26.9	26.7	26.8	26.6	27.1	26.3	27.1	0.3	0.8
20	30.7	27.5	27.8	27.1	27.2	26.9	27.4	27.5	26.6	28.1	1.3	3.9
25	38.6	28.9	29.7	28.3	29.0	27.5	29.1	29.0	27.4	30.9	4.1	11.8
30	42.0	31.7	32.6	30.6	31.7	28.8	31.7	32.4	29.4	33.7	6.9	15.2
35	42.8	35.6	36.2	34.4	34.5	30.8	34.6	37.8	32.2	36.7	9.9	16.0
40	43.6	40.2	39.9	39.3	37.5	34.0	38.7	42.9	40.7	40.1	13.3	16.8
45	44.6	45.8	44.7	44.7	40.9	38.2	44.3	48.7	44.5	44.1	17.3	21.9
50	45.1	51.2	50.0	50.3	44.2	42.5	50.2	53.5	47.8	48.2	21.4	26.7
55	45.2	55.7	55.0	55.5	47.0	46.6	52.6	57.1	51.2	51.7	24.9	30.3
60	45.5	58.9	59.4	59.6	49.4	47.5	55.8	60.3	55.5	54.6	27.8	33.5
65	45.6	61.2	62.9	62.3	50.7	47.7	58.4	63.2	58.1	56.5	29.7	36.4
70	45.8	61.8	64.3	62.7	50.9	48.5	61.0	64.8	60.0	57.1	30.3	38.0
75	46.0	62.0	64.4	62.8	51.4	49.0	64.4	65.3	60.4	57.3	30.5	38.5
80	46.7	62.3	64.7	63.0	51.8	49.8	76.3	65.3	61.0	57.7	30.9	49.5
85	48.3	62.5	65.1	64.6	53.7	51.5	86.5	65.8	61.6	58.8	32.0	59.7
90	50.9	64.2	66.5	68.9	63.3	52.4	94.5	66.9	66.7	62.8	36.0	67.7
91	51.4	64.8	66.9	69.3	64.9	52.4	95.4	67.5	68.0	63.5	36.7	68.6

***** To be continued *****

Appendix 9 – Individual Temperatures Recorded Adjacent to the Downlight Fittings at Mid-height of the Cavity

Time min	TC No.210 ℃	TC No.211 ℃	TC No.212 ℃	TC No.213 ℃	TC No.214 ℃	TC No.215 ℃	TC No.216 ℃	TC No.217 ℃
0	26.1	25.9	26.1	26.5	26.4	26.4	26.5	26.4
5	26.6	27.1	26.5	27.0	27.5	26.9	26.9	27.1
10	44.4	55.4	32.1	41.6	40.1	44.9	32.6	35.7
15	74.8	75.4	58.0	66.8	66.3	70.7	59.9	51.6
20	82.1	81.6	68.0	73.0	83.9	77.1	70.9	70.2
25	84.2	83.7	71.6	76.3	85.6	81.5	76.2	81.4
30	87.3	86.5	75.2	79.6	86.2	83.6	81.3	87.3
35	90.4	89.1	83.3	85.2	89.7	86.8	84.4	91.6
40	92.9	102.6	85.9	90.3	92.9	90.1	87.1	93.4
45	95.1	122.0	88.5	94.9	96.1	93.9	89.7	94.9
50	95.6	131.3	90.1	96.7	98.9	101.3	91.6	95.8
55	96.1	133.1	91.6	97.8	101.1	103.5	93.4	96.1
60	96.6	135.0	93.1	106.2	102.9	105.2	94.2	96.5
65	100.1	151.3	93.7	108.2	107.4	110.2	94.5	97.5
70	110.5	200.6	94.0	111.3	178.4	175.6	95.0	101.2
75	218.2	236.6	97.2	175.8	285.0	222.9	190.7	154.4
80	260.6	246.7	126.7	301.8	292.0	263.2	197.4	203.3
85	273.0	323.3	170.3	339.5	296.2	348.1	201.7	232.5
90	352.7	427.1	230.0	382.2	338.2	481.1	278.4	305.1
91	394.5	451.7	253.8	399.0	349.7	520.7	309.7	323.8

***** To be continued *****

Appendix 10 - Deflection of the floor assembly during the test

Time min	Central Vertical Deflection mm	Rate of Deflection mm/min
0	0.0	0.0
5	4.1	0.2
10	5.2	0.3
15	5.4	0.0
20	5.5	0.0
25	5.6	0.0
30	5.6	0.0
35	5.7	0.1
40	6.0	0.1
45	6.3	0.1
50	6.9	0.1
55	7.3	0.0
60	7.5	0.1
65	7.6	0.0
70	10.3	0.9
75	10.3	0.9
80	26.6	2.9
85	52.5	5.5
90	79.8	5.5
91	86.5	6.7

Note:

1. A positive value indicates deflection towards to the furnace
2. The limiting deflection is 225mm, and the limiting rate of deflection is 9.6mm/min.

***** To be continued*****

Photo Appendix:



Photo 1: Front view of RAV10FHE21



Photo 2: Side view of RAV10FHE21

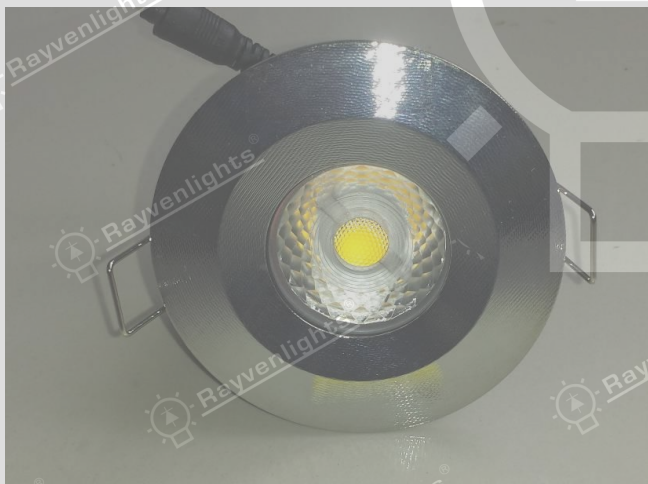


Photo 3: Front view of RAV8FHB20



Photo 4: Side view of RAV8FHB20

***** To be continued*****



Photo 5: Front view of RAV8FHB29



Photo 6: Side view of RAV8FHB29



Photo 7: Front view of RAV8FHC24



Photo 8: Side view of RAV8FHC24

***** To be continued *****



Photo 9: Front view of RAV8FHB21



Photo 10: Side view of RAV8FHB21



Photo 11: Front view of RAV10FHE29



Photo 12: Side view of RAV10FHE29

***** To be continued *****

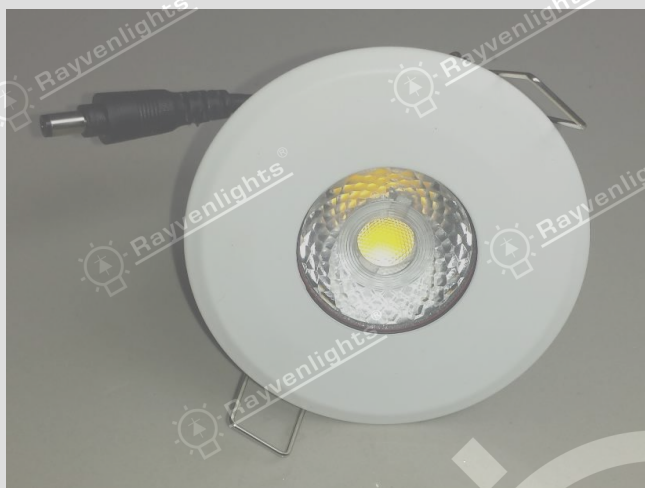


Photo 13: Front view of RAV8FHD21



Photo 14: Side view of RAV8FHD21

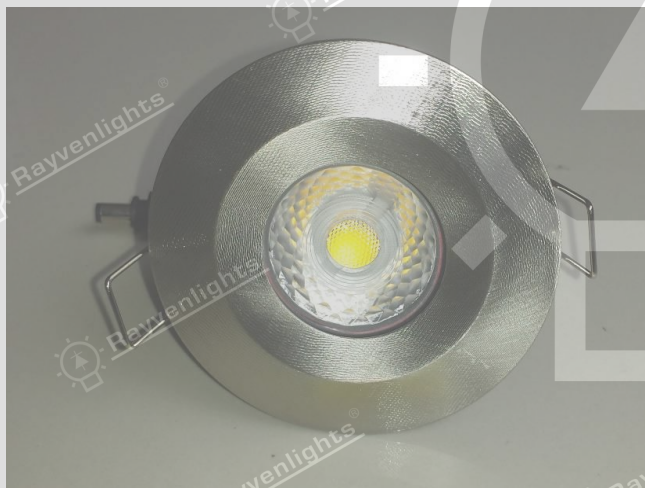


Photo 15: Front view of RAV8FHB24



Photo 16: Side view of RAV8FHB24

***** To be continued *****



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



Photo 18: The unexposed surface of the specimen before the test. (Without load).



Photo 19: The unexposed surface of the specimen before the test. (Already load).



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

***** To be continued *****

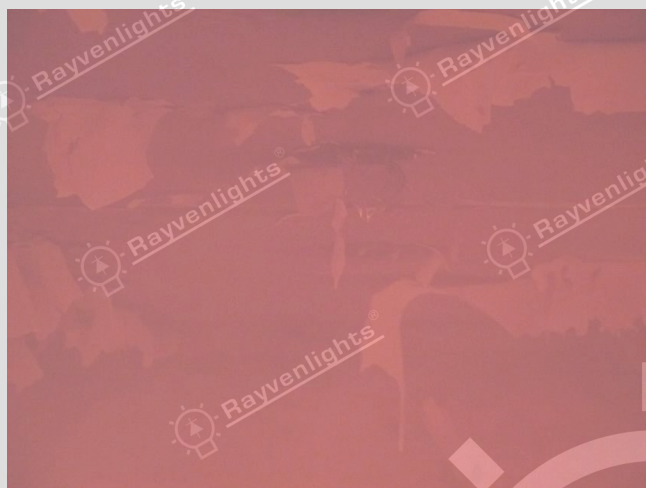


Photo 21: The exposed surface of the specimen after a test duration of 27 minutes, showing the specimen 'G' fused.



Photo 22: The unexposed surface of the specimen after a test duration of 30 minutes.

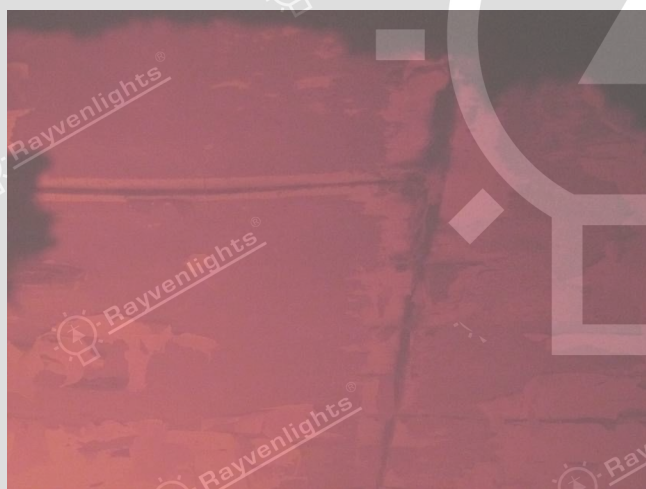


Photo 23: The exposed surface of the specimen after a test duration of 37 minutes, showing the first layer of plasterboard ceiling started to sag and joints began to open.



Photo 24: The unexposed surface of the specimen after a test duration of 45 minutes.

***** To be continued *****



Photo 25: The exposed surface of the specimen after a test duration of 50 minutes, showing the first layer of plasterboard ceiling fell away.



Photo 26: The unexposed surface of the specimen after a test duration of 60 minutes.



Photo 27: The unexposed surface of the specimen after a test duration of 75 minutes.



Photo 28: The unexposed surface of the specimen after the test.

SGS authenticate the photo on original report only

***** End of report *****