

HUIZHOU FORYOU OPTOELECTRONICS TECHNOLOGY CO., LTD

BUILDING 6, B AREA, NO.1 NORTH SHANGXIA ROAD, DONGJIANG HIGH-TECH INDUSTRY PARK
HUIZHOU

Sample Description: 360 FIRERATED DOWNLIGHT

Color: BLACK

Test Style/Item No.: YH25C, YI25C, YF25D, YF25K, YF30K

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Sample Receiving Date: Oct.20, 2020

Test Performing Date: Oct.20, 2020 to Nov.16, 2020

Test Requested:

Fire Resistance Test of the Loadbearing Timber Floor Assembly Sample, Incorporating Five Fire Rated Downlights Fittings, in accordance with BS 476-20:1987+AC:2014 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) and BS 476-21:1987+AC:2014 Fire tests on building materials and structures — Part 21: Methods for determination of the fire resistance of loadbearing elements of construction, Clause 7, Determination of the fire resistance of floors and flat roofs.

Test Results: -- See attached sheet --

Signed for and on behalf of
Shunde Branch
SGS-CSTC Co., Ltd.



scan to see the report



SDFS2010006527FF

Daniel Guan
Approved signatory



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1. Introduction

Determine the fire resistance performance of a loadbearing timber floor assembly protected by a plasterboard ceiling, incorporating five fire rated downlights lighter fittings, when tested in accordance with Clause 7 of BS 476: Part 21: 1987+AC:2014 Fire tests on building materials and structures — Part 21: Methods for determination of the fire resistance of loadbearing elements of construction.

The specified side (under side) of floor sample was exposed to elevated temperatures as dictated by the BS 476-20 time-temperature curve for a period of 91 minutes under loadbearing condition.

The test was conducted on Nov.6, 2020.

2. Summary

The performance of the sample was judged against the criteria for loadbearing capability, integrity and insulation as specified in Clause 10 Performance criteria of BS 476-20: 1987+AC:2014 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), for horizontal construction, and the results obtained were as follows:

Loadbearing capacity	Integrity	Insulation
≥ 90 minutes	≥ 90 minutes	≥ 90 minutes

The test was terminated after a period of 91 minutes as requested by the test sponsor.

3. Test Sample

The timber floor had overall nominal dimensions of 4600 mm long by 4400 mm wide and comprised softwood timber joists at 500 mm centres. The upper surface of the floor comprised one layer nominally 18 mm thick Egger chipboard flooring.

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

One layer of 50mm thick rockwool was filled within the cavity between the floor and the ceiling.

The floor supported an evenly distributed load of 461 N/m².

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The ceiling incorporated three downlight light fittings referenced as follows:

Specimen No.	Model	Description
A	YF30K	Size: Ø 96 mm x 63 mm
B	YH25C	Size: Ø 88 mm x 65 mm
C	YF25D	Size: Ø 88 mm x 40.07 mm
D	YI25C	Size: Ø 88 mm x 86 mm
E	YF25K	Size: Ø 81 mm x 63 mm

Schedule of Components

(Refer to Figures 1 to 6)

Timber floor assembly (items 1 to 4)

1. Floor Joists

- Materials : Softwood Timber Joists
- Over section size : 50 mm thick by 200 mm deep
- Density of Joist : About 600 kg/m³
- Joint centres : 500 mm

2. Floor boards

- Manufacturer : Egger
- Materials : Egger Chipboard, E1
- Thick : 1 layer, 18 mm thick
- Size : About 700 kg/m³
- Fixing method : All board screw fixed to all joists using drywall steel screws 55 mm long by 3.9 mm diameter screws, at 200 mm centres along joints and 150 mm centres align perimeter of floor.

3. Ceiling boards

- Manufacturer : Knauf
- Materials : Gypsum plasterboard
- Thick : 2 layers, each 15mm thick
- Size : About 720 kg/m³



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Fixing method : All board joints staggered with respect to adjacent layer and screw fixed to all joists using drywall steel screws, 35 mm long by 3.9 mm diameter screws for first layer and 55 mm long by 3.9 mm diameter screws for second layer, at 200 mm centres along joints and 150 mm centres align perimeter of ceiling.

4. Rockwool

Materials : Rockwool
 Thick : 50mm
 Size : About 68 kg/m³
 Fixing method : Filled into the cavity between the floor and the ceiling

5. Specimen "A"

Product Name : 360 Firerated downlight
 Model : YF30K
 Overall dimensions and construction : See Figure 2
 Hole size in ceiling boards : 80 mm diameter

6. Specimen "B"

Product Name : 360 Firerated downlight
 Model : YH25C
 Overall dimensions and construction : See Figure 3
 Hole size in ceiling boards : 68 mm diameter



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7. Specimen “C”

Product Name : 360 Firerated downlight
 Model : YF25D
 Overall dimensions and construction : See Figure 4
 Hole size in ceiling boards : 68 mm diameter

8. Specimen “D”

Product Name : 360 Firerated downlight
 Model : YI25C
 Overall dimensions and construction : See Figure 5
 Hole size in ceiling boards : 68 mm diameter

9. Specimen “E”

Product Name : 360 Firerated downlight
 Model : YF25K
 Overall dimensions and construction : See Figure 6
 Hole size in ceiling boards : 68 mm diameter

The preparation of tested assembly took place in the test laboratory over a total combined time of 3 days. Throughout this period of time both the temperature and the humidity of the laboratory were measured and recorded as being within a range of from 25°C to 28°C and 52% to 55% respectively.

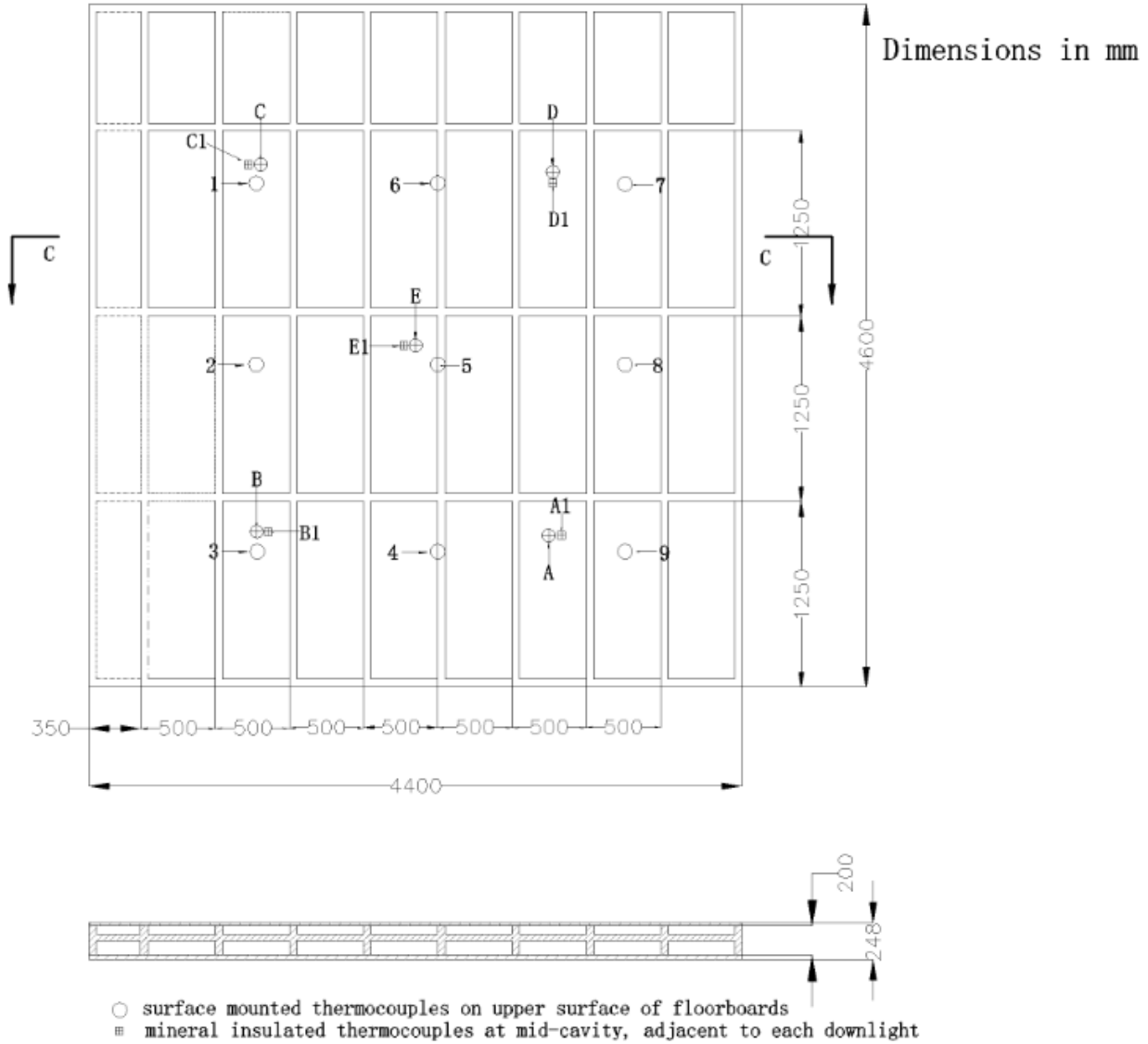
The tested sample was supported on the horizontal furnace with an opening of the 4.0 m by 4.2 m. The all around of the furnace wall was covered by ceramic fibre cotton. The tested sample was asymmetrical. At the request of client, the sample was mounted such that underside (plasterboard ceiling) towards to the heating conditions of the test.

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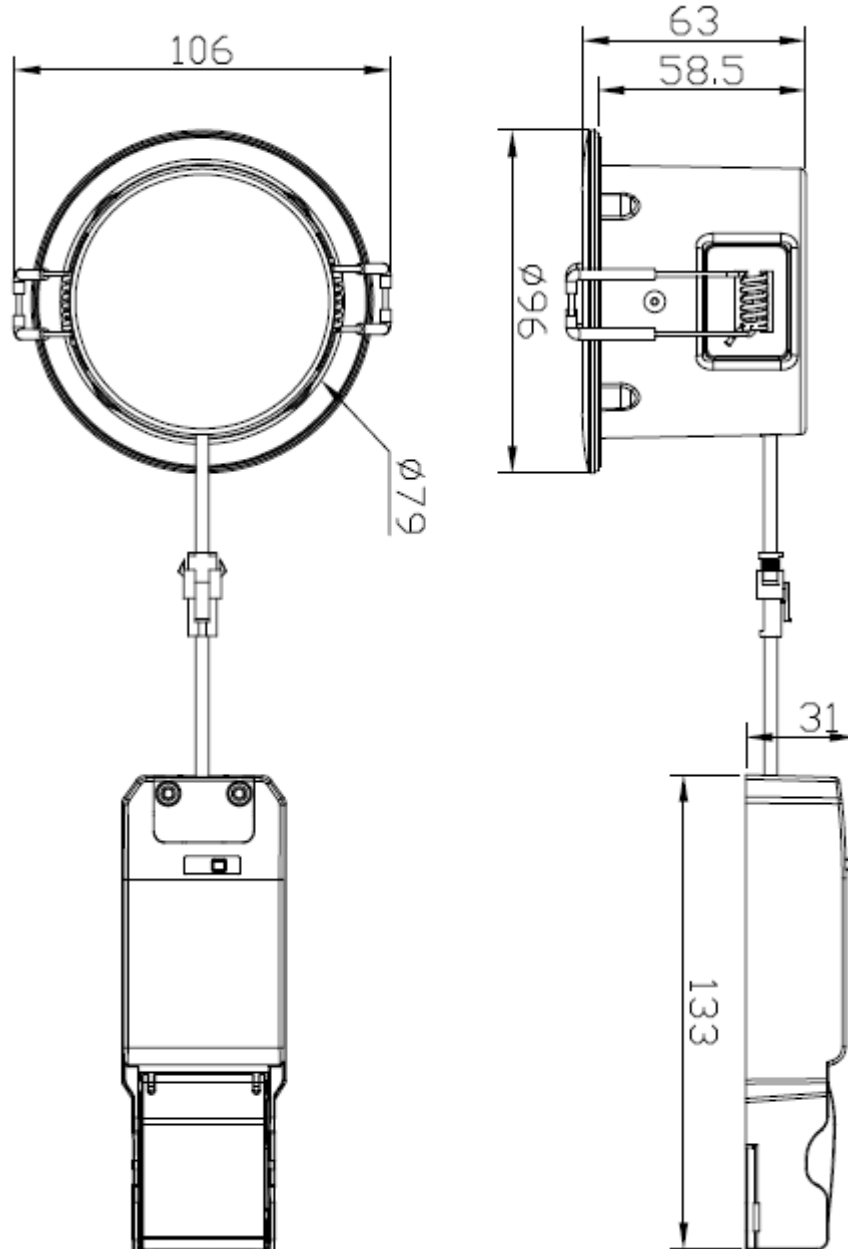
Figure 1 - General Plan of Test Sample from Unexposed Face and Thermocouple Positions



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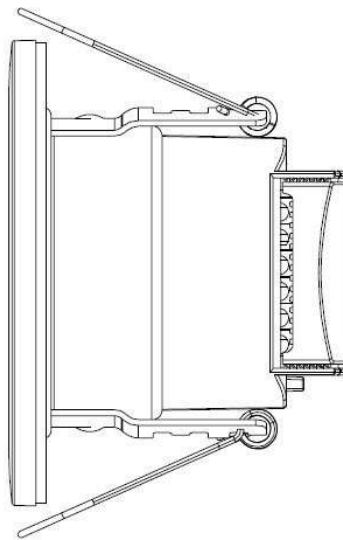
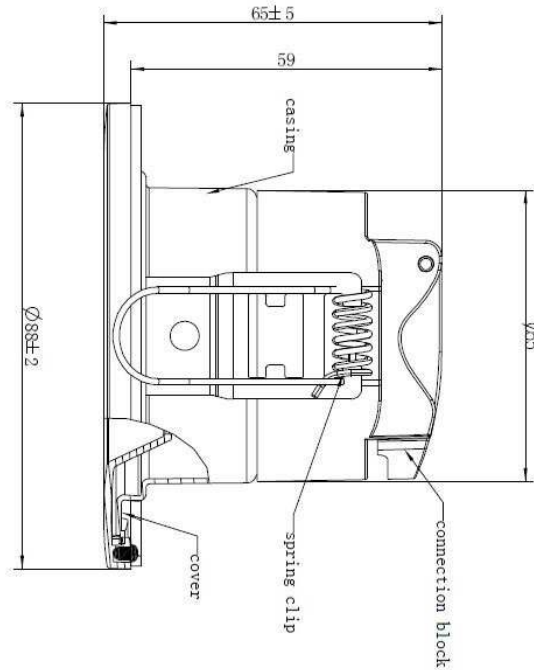
Figure 2 - Details of Specimens 'A' Downlights



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Figure 3 - Details of Specimens 'B' Downlights



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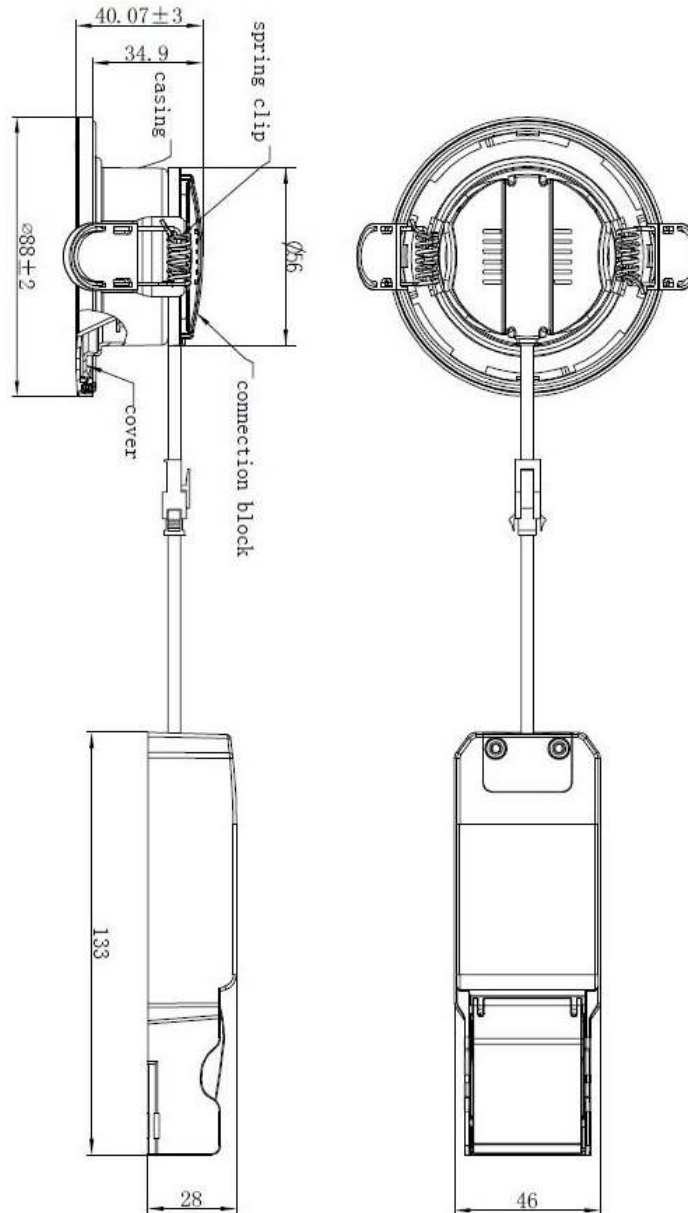
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Figure 4 - Details of Specimens 'C' Downlights

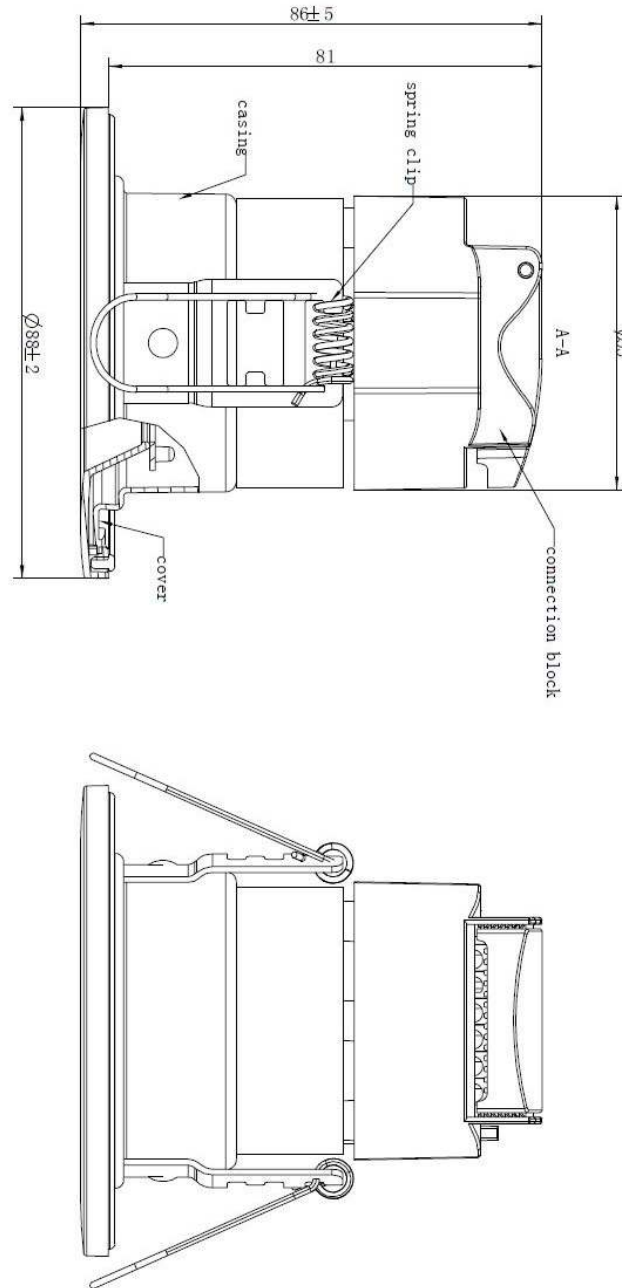


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Figure 5 - Details of Specimens 'D' Downlights



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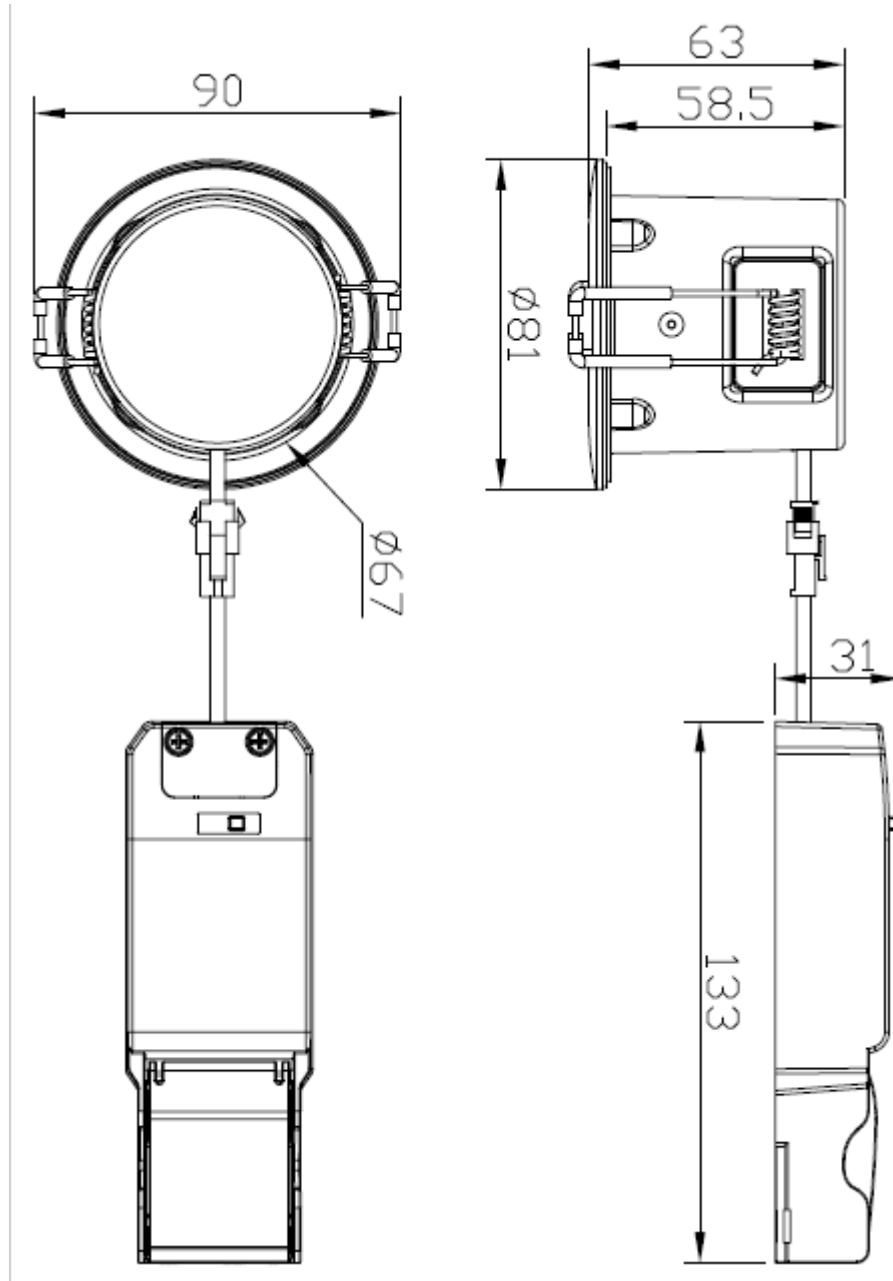
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Figure 6 - Details of Specimens 'E' Downlights



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4. Test Procedure

The timber floor assembly sample was tested under a loadbearing construction. The test was conducted in accordance with Clause 7 of BS 476: Part 21: 1987+AC:2014, Methods for determination of the fire resistance of loadbearing elements of construction. This test report should be read in conjunction with that Standard and with BS 476: Part 20: 1987+AC:2014, Method for determination of the fire resistance of elements of construction (general principles).

The furnace was controlled so that the mean furnace temperature, deviation from the mean furnace temperature and uniformity of temperature distribution complied with the requirement of BS 476: Part 20. 14 furnace thermocouples were used to determine the mean furnace temperature.

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 as follows:

The locations and reference numbers of the various unexposed surface and internal thermocouples are shown in Figure 1.

A roving thermocouple was available to measure temperatures on the unexposed surface of the sample at any position which might appear to be hotter than the temperatures indicated by the fixed thermocouples.

Cotton pads and gap gauges were available to evaluate the compliance with the integrity criterion of the sample to hot gases. The occurrence of sustaining flaming on the unexposed surface was also checked to determine compliance with the integrity criterion.

Based on the requested of client, the floor supported an evenly distributed load of 461N/m².

After the first five minutes of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS 476: Part 20 and the pressure differential relative to the laboratory atmosphere at a position 100 mm below the underside of the assembly was 20(+0,-2) Pa.

The deflection, D, was measured from the commencement of heating by distance meter recorded at least one reading per minute, which placed in the centre of the unexposed surface of the tested sample.

During the test, the temperatures, pressures and deflection were continuously monitored and were recorded at one minute intervals.

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5. Test Results

The following data were recorded during the test:

- a) The actual mean furnace temperature/time curve as well as the standard furnace temperature/time curve, which were shown in Figure 6. The mean temperatures recorded within the furnace were shown in Table 1.
- b) The mean and maximum temperature rise of the unexposed surface of the sample was shown in Figure 7. The individual temperatures recorded on the unexposed surface of the sample were shown in Table 2.
- c) The individual temperatures recorded adjacent to the downlight fittings at the mid-height of the cavity were shown in Table 3.
- d) The deflection of the centre of the unexposed surface of the tested sample was shown in Figure 8. The individual deflections recorded on the unexposed surface of the sample were shown in Table 4.

The ambient air temperature in the vicinity of the test construction was 25°C at the start of the test with variation of +2°C during the test.

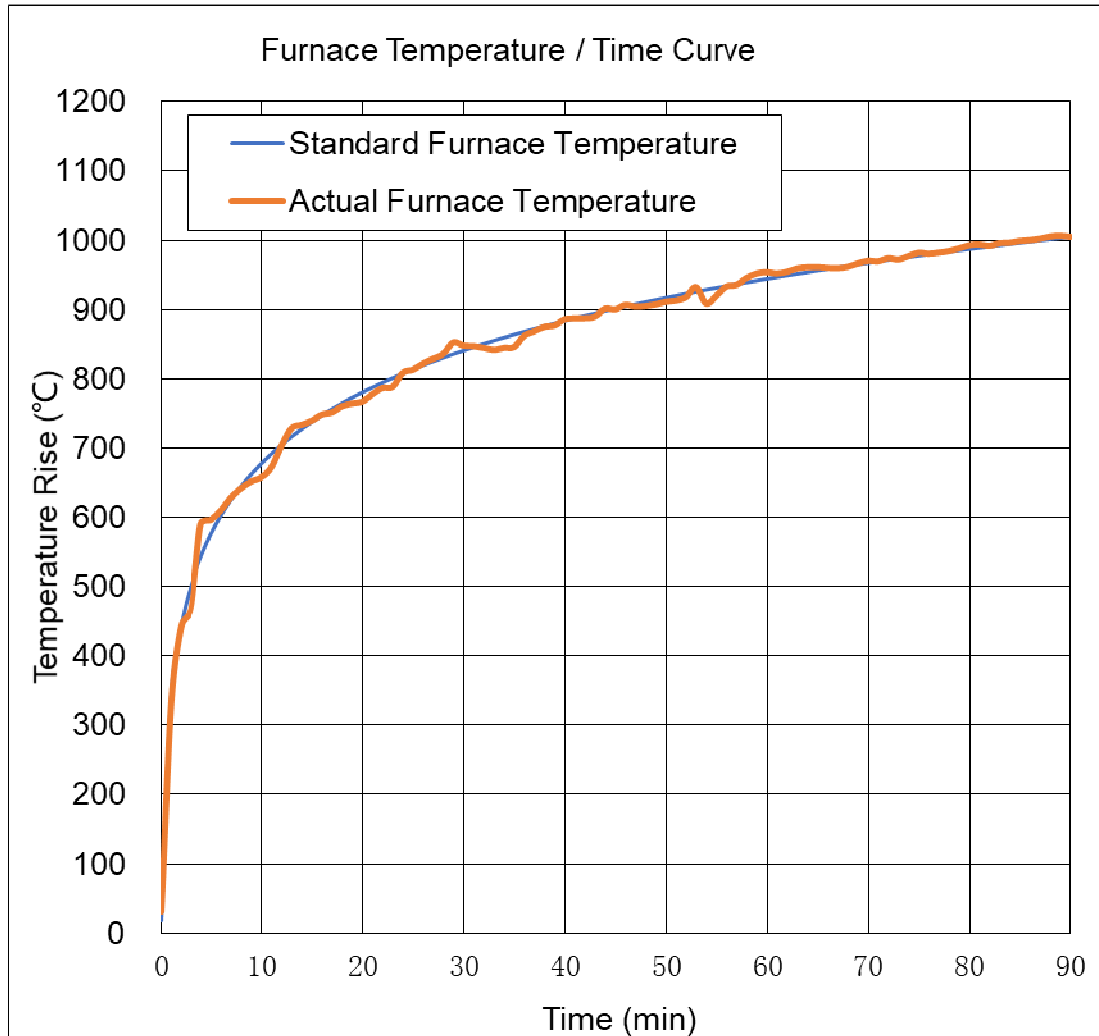
A summary of the observations made on the general behavior of the sample was given in Table 5.



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Figure 6 - Standard and actual Mean Furnace Temperature/Time Curve



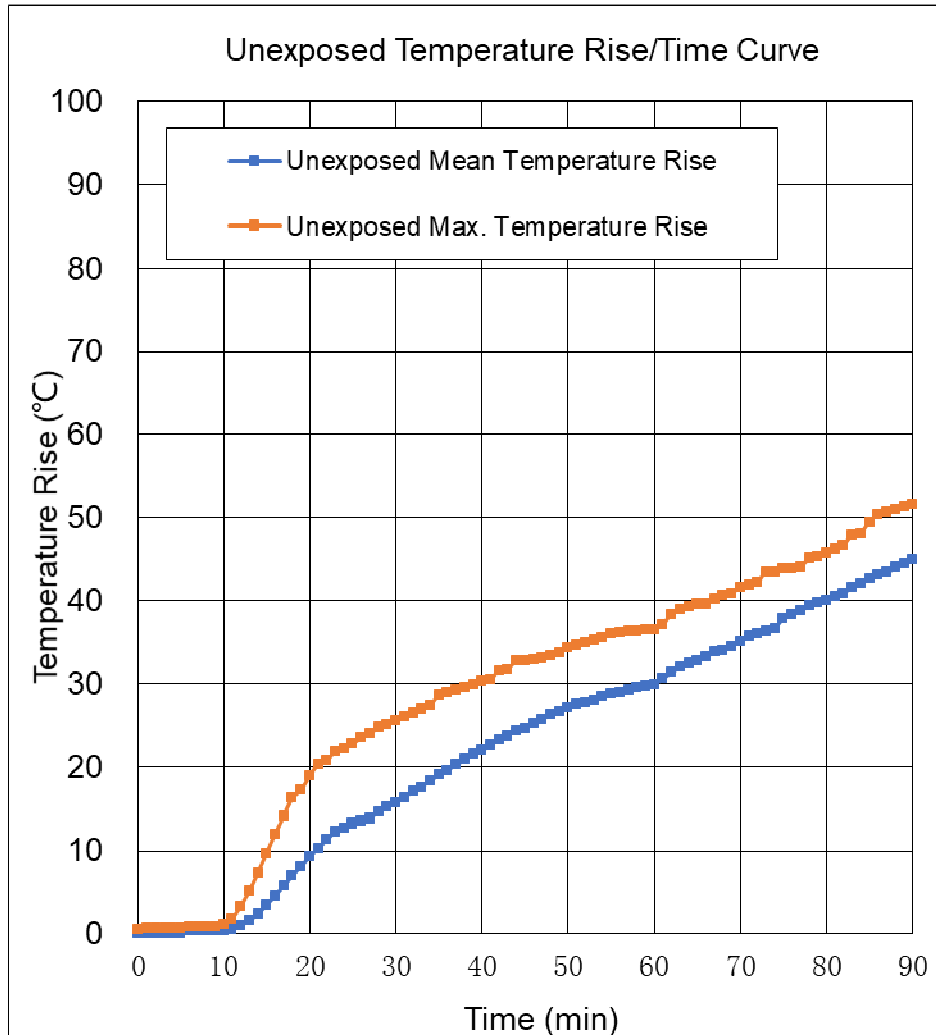
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Figure 7 – Unexposed Surface Mean and Maximum Temperature Rise / Time Curve

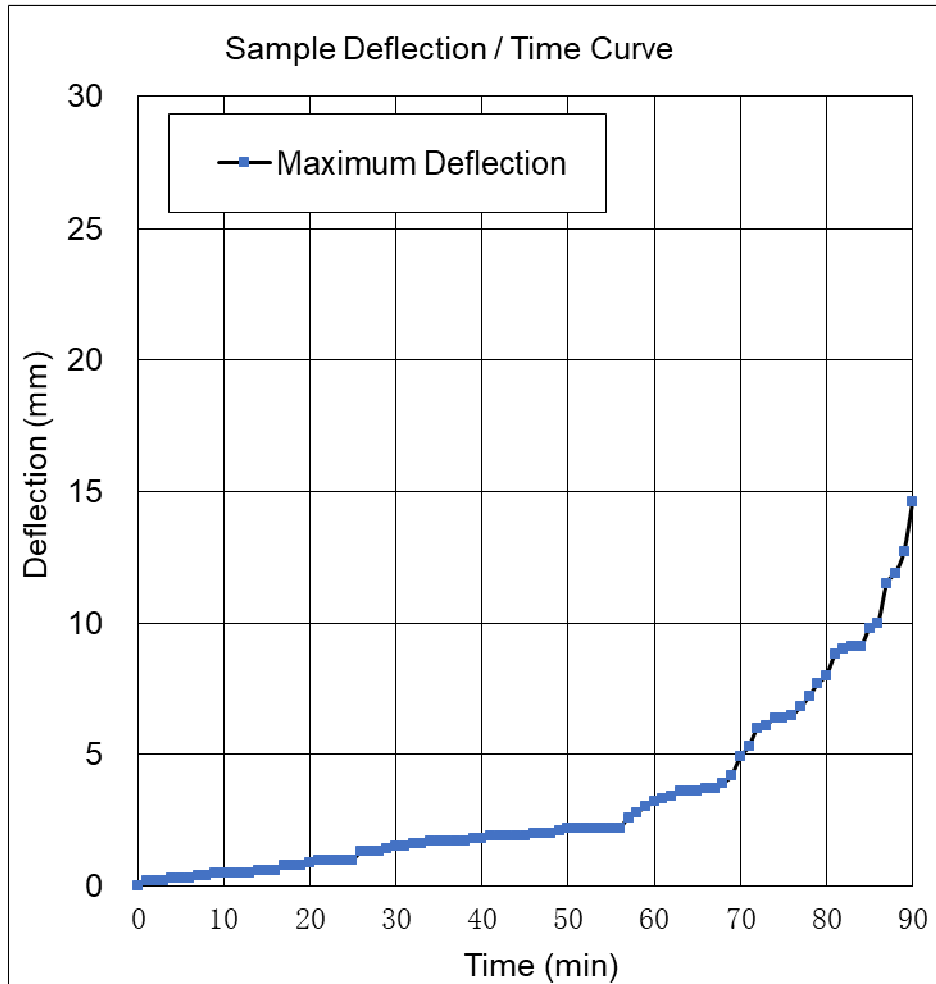


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Figure 8 - Sample Deflection (At the centre of the sample)



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Table 1 Average Temperatures Recorded within the Furnace

Time (min)	BS 476-20 Std Average (°C)	Furnace Average (°C)	Error (%)	Time (min)	BS 476-20 Std Average (°C)	Furnace Average (°C)	Error (%)
0	20.0	32.17	-	31	846.7	847.73	0.1%
1	349.2	336.41	-3.7%	32	851.4	845.21	-0.7%
2	444.5	443.63	-0.2%	33	856.0	842.33	-1.6%
3	502.3	468.77	-6.7%	34	860.5	845.15	-1.8%
4	543.9	590.23	8.5%	35	864.8	846.28	-2.1%
5	576.4	596.44	3.5%	36	869.0	862.55	-0.7%
6	603.1	610.13	1.2%	37	873.1	869.16	-0.5%
7	625.8	628.71	0.5%	38	877.1	875.63	-0.2%
8	645.5	642.06	-0.5%	39	881.0	877.59	-0.4%
9	662.8	652.02	-1.6%	40	884.7	886.45	0.2%
10	678.4	658.18	-3.0%	41	888.4	887.78	-0.1%
11	692.5	672.57	-2.9%	42	892.0	888.1	-0.4%
12	705.4	703.6	-0.3%	43	895.5	890.24	-0.6%
13	717.3	728.97	1.6%	44	899.0	902.17	0.4%
14	728.3	733.89	0.8%	45	902.3	900.73	-0.2%
15	738.6	739.86	0.2%	46	905.6	907.37	0.2%
16	748.2	748.87	0.1%	47	908.8	904.83	-0.4%
17	757.2	751.87	-0.7%	48	912.0	905.76	-0.7%
18	765.7	760.84	-0.6%	49	915.1	908.13	-0.8%
19	773.7	764.74	-1.2%	50	918.1	912	-0.7%
20	781.4	767.39	-1.8%	51	921.0	913.75	-0.8%
21	788.6	778.25	-1.3%	52	923.9	918.6	-0.6%
22	795.6	787.34	-1.0%	53	926.8	933.09	0.7%
23	802.2	789.04	-1.6%	54	929.6	909.38	-2.2%
24	808.5	809.1	0.1%	55	932.3	920.54	-1.3%
25	814.6	813.63	-0.1%	56	935.0	933.89	-0.1%
26	820.5	822.43	0.2%	57	937.7	936.07	-0.2%
27	826.1	829.44	0.4%	58	940.3	946.33	0.6%
28	831.5	836.57	0.6%	59	942.8	952.78	1.1%
29	836.7	853.16	2.0%	60	945.3	954.71	1.0%
30	841.8	848.5	0.8%	61	947.8	952.7	0.5%



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Time (min)	BS 476-20 Std Average (°C)	Furnace Average (°C)	Error (%)
62	950.2	955.1	0.5%
63	952.6	960.1	0.8%
64	955.0	961.8	0.7%
65	957.3	962.0	0.5%
66	959.6	960.9	0.1%
67	961.8	960.5	-0.1%
68	964.1	962.3	-0.2%
69	966.2	967.3	0.1%
70	968.4	971.0	0.3%
71	970.5	970.3	0.0%
72	972.6	975.0	0.2%
73	974.7	973.0	-0.2%
74	976.7	977.8	0.1%
75	978.7	982.7	0.4%
76	980.7	981.4	0.1%
77	982.6	983.1	0.0%
78	984.6	985.2	0.1%
79	986.5	989.0	0.3%
80	988.4	993.6	0.5%
81	990.2	994.7	0.5%
82	992.1	992.9	0.1%
83	993.9	996.6	0.3%
84	995.7	997.3	0.2%
85	997.4	999.8	0.2%
86	999.2	1000.9	0.2%
87	1000.9	1002.9	0.2%
88	1002.6	1006.2	0.4%
89	1004.3	1007.3	0.3%
90	1006.0	1005.8	0.0%



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Table 2 Individual Temperatures on the Unexposed Surface of the Sample

Time (min)	Thermocouples temperatures (°C)								
	1#	2#	3#	4#	5#	6#	7#	8#	9#
0	30.4	30.7	30.1	30.0	29.8	30.0	30.0	30.5	29.9
1	30.5	30.7	30.2	30.1	29.8	30.0	30.1	30.6	30.0
2	30.5	30.8	30.2	30.1	29.9	30.0	30.1	30.5	29.9
3	30.5	30.7	30.1	30.0	29.8	30.0	30.0	30.5	30.0
4	30.5	30.8	30.1	30.0	29.8	30.0	30.1	30.6	29.9
5	30.5	30.7	30.1	30.0	29.8	30.0	30.0	30.5	30.0
6	30.7	31.0	30.4	30.3	30.0	30.2	30.3	30.8	30.2
7	30.7	31.0	30.3	30.3	30.0	30.2	30.3	30.8	30.2
8	30.7	30.9	30.3	30.3	30.1	30.2	30.5	30.8	30.2
9	30.6	30.9	30.2	30.2	30.1	30.1	30.8	30.9	30.1
10	30.5	30.8	30.2	30.1	30.3	30.0	31.3	31.2	29.9
11	30.4	30.6	30.0	30.0	30.8	29.8	31.9	31.9	29.8
12	30.5	30.6	30.3	30.2	31.9	29.9	32.9	33.4	29.9
13	30.6	30.7	30.6	30.5	33.4	30.0	34.1	35.3	30.0
14	30.7	30.8	31.3	30.9	35.3	30.2	35.4	37.4	30.5
15	30.9	31.1	32.3	31.6	37.6	30.6	36.8	39.8	31.1
16	31.2	31.3	33.8	32.6	39.9	31.2	38.1	42.1	31.7
17	31.4	31.7	35.3	33.7	42.3	31.9	39.4	44.2	32.5
18	31.8	32.1	37.1	35.0	44.6	32.8	40.6	46.3	33.3
19	32.2	32.5	38.9	36.3	46.7	33.8	41.9	47.3	34.2
20	32.6	33.0	40.5	37.4	48.7	34.9	43.1	48.9	35.1
21	33.0	33.6	42.1	39.0	50.3	36.1	44.1	49.3	36.0
22	33.5	34.0	43.8	40.3	50.8	37.3	45.1	50.8	36.8
23	34.0	34.6	45.1	42.0	51.7	38.4	46.1	52.0	37.7
24	34.5	35.1	46.0	43.1	49.4	39.7	47.0	52.2	38.5
25	34.9	35.7	46.9	44.5	46.6	40.8	47.8	52.9	39.3
26	35.3	36.3	47.5	45.3	43.6	41.9	48.6	53.5	40.0
27	35.5	36.6	47.5	46.7	42.3	42.7	49.1	54.1	40.9
28	36.0	37.3	47.9	47.9	42.4	43.6	49.9	54.8	41.8
29	36.6	37.9	48.3	48.4	43.0	44.5	50.7	55.2	42.5
30	37.2	38.6	48.7	49.6	42.5	45.4	51.4	55.6	43.4



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Time (min)	Thermocouples temperatures (°C)								
	1#	2#	3#	4#	5#	6#	7#	8#	9#
31	37.5	39.3	49.1	50.4	42.7	46.2	51.9	56.0	44.5
32	38.0	40.3	49.4	51.0	43.4	47.2	52.6	56.6	45.2
33	38.7	41.1	49.8	51.5	43.4	48.0	53.2	57.0	46.1
34	39.3	42.1	50.4	52.4	43.9	49.0	54.0	57.4	46.8
35	39.9	43.1	50.5	53.2	43.6	49.8	54.9	58.7	48.0
36	40.6	44.1	50.5	54.0	43.7	50.7	55.7	59.0	48.8
37	41.3	45.1	50.7	54.1	44.1	51.7	56.4	59.4	50.0
38	42.0	46.2	50.7	55.2	44.2	52.5	57.3	59.6	50.7
39	42.9	47.3	50.7	56.0	44.9	53.4	58.1	59.9	51.6
40	43.3	48.4	50.8	56.2	44.8	53.9	58.7	60.4	52.2
41	44.3	49.5	50.8	56.8	44.7	54.7	59.4	60.5	53.1
42	45.0	50.5	51.0	57.2	44.8	55.3	60.2	61.7	53.9
43	45.9	51.5	50.6	58.3	45.0	55.9	60.6	61.8	54.6
44	46.5	52.5	51.2	58.5	45.0	56.5	61.2	62.9	55.3
45	46.5	53.6	51.3	58.5	44.9	56.7	61.9	62.9	55.8
46	47.5	54.6	52.0	59.1	45.3	57.4	62.6	63.1	56.7
47	48.3	55.6	52.4	59.9	44.9	58.0	62.9	63.1	57.3
48	49.0	56.5	52.6	60.1	45.6	58.5	63.5	63.3	57.9
49	49.6	57.3	53.0	60.4	45.7	58.7	63.9	63.5	58.5
50	50.3	58.1	53.1	60.7	45.9	59.3	64.4	63.2	59.1
51	51.5	59.0	53.8	60.8	45.9	59.7	64.8	63.7	59.5
52	51.2	59.8	54.2	60.9	45.3	59.7	65.0	63.7	59.9
53	52.1	60.3	54.7	60.9	45.7	60.3	65.3	63.6	60.4
54	52.7	61.1	54.8	61.1	45.8	60.5	65.6	63.8	60.8
55	53.4	61.3	55.3	62.1	46.2	60.6	66.2	63.6	61.1
56	53.3	61.8	54.8	62.4	46.1	60.8	66.2	63.6	61.6
57	54.2	62.6	55.2	63.1	46.0	61.3	66.4	63.8	61.6
58	54.6	62.9	55.4	63.6	46.4	61.5	66.4	63.6	61.9
59	55.0	63.3	55.3	64.0	46.6	61.9	66.6	63.5	62.4
60	55.8	63.5	55.1	64.2	46.7	62.1	66.6	63.2	62.8



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Time (min)	Thermocouples temperatures (°C)								
	1#	2#	3#	4#	5#	6#	7#	8#	9#
61	56.3	64.4	56.4	64.9	47.3	62.7	67.2	63.5	63.3
62	56.4	65.2	56.5	65.9	47.7	63.1	68.5	64.5	64.9
63	57.2	65.7	57.3	66.3	49.4	63.4	69.0	64.7	65.4
64	57.0	66.3	57.2	67.2	50.6	63.7	69.4	65.5	65.8
65	57.8	66.7	58.5	66.9	51.4	64.0	69.6	65.4	66.0
66	57.6	67.5	59.3	67.9	52.0	64.9	69.7	65.3	65.4
67	58.3	67.3	59.9	68.8	52.5	65.8	70.3	66.3	66.2
68	58.5	67.0	60.4	68.7	53.4	65.9	70.8	66.4	66.1
69	59.1	68.2	60.8	69.5	54.2	65.9	70.9	66.5	66.4
70	58.8	69.2	61.1	70.2	55.0	66.0	71.6	67.5	67.0
71	59.1	69.8	62.0	71.0	55.1	66.6	71.9	68.3	67.6
72	58.8	71.7	62.5	71.4	56.2	66.2	72.2	68.5	67.6
73	58.5	72.8	62.4	71.1	57.0	67.1	73.6	68.4	67.1
74	59.0	72.7	63.0	71.6	57.2	67.4	73.5	68.8	67.2
75	58.7	73.7	64.2	72.5	63.9	68.0	74.0	69.1	67.7
76	59.0	73.7	64.5	72.9	63.7	67.8	74.0	69.0	70.9
77	58.9	73.4	65.0	73.3	64.0	68.5	74.1	70.3	72.0
78	59.0	74.2	66.0	73.5	64.9	69.0	75.1	70.8	72.9
79	59.4	74.1	65.4	74.4	64.8	69.4	75.4	71.7	73.9
80	58.6	74.3	65.8	75.2	64.9	69.3	75.7	71.9	75.1
81	58.5	75.0	66.4	75.3	65.4	70.2	76.0	72.0	76.3
82	58.9	75.4	66.9	75.8	65.5	70.6	76.2	72.5	76.7
83	60.2	76.0	66.7	75.9	66.6	71.2	78.0	73.3	77.9
84	61.0	76.7	67.0	76.5	66.2	71.9	78.1	73.6	78.2
85	61.7	77.1	67.5	76.3	67.1	71.9	79.0	74.0	79.6
86	62.5	77.8	67.4	77.4	67.4	71.7	79.4	74.2	80.4
87	62.8	77.5	68.2	77.8	67.0	72.5	79.4	75.1	80.7
88	62.9	78.0	68.5	78.5	68.3	72.6	80.3	76.5	81.1
89	63.3	78.0	68.9	79.3	69.7	73.5	80.6	77.0	81.4
90	65.8	78.0	69.9	79.4	69.0	74.0	80.7	76.9	81.6



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Table 3 Individual Temperatures Recorded Adjacent to the Downlight Fittings at Mid-height of the Cavity

Time (min)	Thermocouples temperatures (°C)				
	A1	B1	C1	D1	E1
0	36.8	37.0	37.7	37.4	36.0
1	36.7	85.9	38.3	37.9	36.0
2	36.9	102.1	38.3	38.2	37.9
3	37.4	117.7	38.7	39.6	47.5
4	39.0	107.5	41.0	44.0	80.4
5	44.4	116.2	51.7	64.7	86.8
6	53.8	138.4	68.4	84.3	90.2
7	63.2	121.2	80.8	105.9	102.2
8	71.7	116.2	91.9	121.6	110.7
9	78.2	115.9	111.8	125.7	115.0
10	83.7	119.3	120.8	126.7	120.0
11	88.5	121.3	121.6	127.2	122.6
12	91.7	120.3	115.9	125.3	126.1
13	93.9	119.4	119.8	127.0	129.8
14	95.7	121.8	124.8	130.1	133.4
15	97.8	131.3	127.8	132.6	139.7
16	100.1	123.2	129.9	135.2	146.8
17	101.1	138.8	131.0	138.8	155.8
18	103.1	134.8	135.1	142.4	166.7
19	106.3	126.1	135.7	148.1	176.5
20	112.7	118.0	137.1	153.6	186.1
21	113.9	116.9	143.1	152.0	195.5
22	111.5	119.6	137.6	147.0	205.4
23	111.5	116.1	136.2	152.0	218.3
24	111.6	116.0	167.9	159.7	230.0
25	113.3	114.2	167.4	162.7	241.6
26	116.1	116.9	155.7	163.3	254.8
27	120.0	117.9	144.6	171.4	269.7
28	124.0	118.1	134.3	173.7	280.5
29	127.2	118.1	136.0	183.6	286.7
30	129.6	123.0	177.8	190.0	291.9



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Time (min)	Thermocouples temperatures (°C)				
	A1	B1	C1	D1	E1
31	132.1	124.5	207.8	197.1	296.6
32	134.2	124.3	215.9	193.3	299.2
33	135.7	133.0	195.6	180.0	301.0
34	137.1	133.0	209.4	183.5	308.8
35	138.2	128.0	206.2	188.5	315.3
36	138.9	130.8	187.5	198.5	320.6
37	139.2	138.9	180.5	208.8	327.4
38	139.7	149.5	212.9	193.1	330.3
39	140.5	155.8	212.7	186.4	334.1
40	141.0	165.8	210.3	182.6	335.8
41	141.7	172.0	208.6	178.9	339.9
42	142.3	206.1	211.8	182.6	343.9
43	143.8	216.6	207.6	184.7	346.1
44	144.6	206.6	207.9	190.0	347.9
45	145.4	192.1	208.8	193.8	350.6
46	146.7	177.6	217.2	199.9	351.1
47	148.2	179.3	216.2	204.6	353.4
48	149.8	185.6	215.6	214.0	357.2
49	151.9	184.6	217.3	218.2	360.8
50	154.5	172.2	218.7	219.3	365.6
51	157.7	168.4	228.4	220.6	370.9
52	161.8	169.7	247.9	225.8	377.5
53	167.0	175.4	266.0	229.7	387.1
54	173.5	181.2	303.1	235.9	396.3
55	182.4	190.6	307.9	239.1	418.4
56	193.3	203.1	333.0	240.6	421.8
57	208.9	215.5	370.6	249.5	440.9
58	224.6	227.9	400.2	250.3	422.7
59	243.2	242.0	403.3	253.6	411.1
60	265.3	259.7	409.9	267.2	429.5



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Time (min)	Thermocouples temperatures (°C)				
	A1	B1	C1	D1	E1
61	285.7	282.8	415.2	269.2	433.8
62	310.7	306.8	419.9	278.2	438.0
63	328.0	332.7	422.9	280.2	446.7
64	344.8	354.8	433.2	283.2	458.9
65	359.3	373.6	434.1	290.1	462.8
66	369.5	385.7	433.9	295.1	466.0
67	377.7	393.7	445.4	299.9	435.2
68	384.7	399.5	449.5	282.8	448.8
69	388.5	399.5	450.9	306.8	437.2
70	390.0	396.9	460.9	332.7	446.7
71	391.7	394.7	466.9	345.7	458.9
72	395.0	392.2	477.9	349.5	462.8
73	396.6	390.0	478.2	355.1	477.2
74	397.2	387.6	476.6	359.3	466.9
75	397.7	385.1	476.7	366.4	455.9
76	396.7	382.7	474.9	370.5	466.0
77	395.1	380.5	471.4	374.5	435.2
78	392.9	404.2	470.9	379.5	448.8
79	391.0	407.3	470.9	380.1	437.2
80	388.9	409.3	467.6	383.5	448.2
81	386.8	410.4	466.6	388.6	443.8
82	384.7	410.7	463.7	397.7	449.9
83	382.2	410.4	462.0	389.5	450.6
84	380.3	409.6	461.4	380.8	459.0
85	378.1	407.9	460.4	374.9	461.2
86	376.1	406.2	459.2	366.1	448.5
87	373.9	404.4	459.7	356.2	449.6
88	372.0	402.1	461.8	350.8	455.2
89	370.2	404.2	468.5	344.5	466.0
90	368.7	407.3	480.9	357.5	454.6



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Table 4 Deflection Recorded on the Unexposed Surface of the Sample

Time (mins)	Deflection (mm)	Rate of Deflection (mm/min)	Time (mins)	Deflection (mm)	Rate of Deflection (mm/min)
0	0	-	31	1.5	0.0
1	0.2	0.2	32	1.6	0.1
2	0.2	0.0	33	1.6	0.0
3	0.2	0.0	34	1.7	0.1
4	0.3	0.1	35	1.7	0.0
5	0.3	0.0	36	1.7	0.0
6	0.3	0.0	37	1.7	0.0
7	0.4	0.1	38	1.7	0.0
8	0.4	0.0	39	1.8	0.1
9	0.5	0.1	40	1.8	0.0
10	0.5	0.0	41	1.9	0.1
11	0.5	0.0	42	1.9	0.0
12	0.5	0.0	43	1.9	0.0
13	0.5	0.0	44	1.9	0.0
14	0.6	0.1	45	1.9	0.0
15	0.6	0.0	46	2.0	0.1
16	0.6	0.0	47	2.0	0.0
17	0.8	0.2	48	2.0	0.0
18	0.8	0.0	49	2.1	0.1
19	0.8	0.0	50	2.2	0.1
20	0.9	0.1	51	2.2	0.0
21	1.0	0.1	52	2.2	0.0
22	1.0	0.0	53	2.2	0.0
23	1.0	0.0	54	2.2	0.0
24	1.0	0.0	55	2.2	0.0
25	1.0	0.0	56	2.2	0.0
26	1.3	0.3	57	2.6	0.4
27	1.3	0.0	58	2.8	0.2
28	1.3	0.0	59	3.0	0.2
29	1.4	0.1	60	3.2	0.2
30	1.5	0.1	61	3.3	0.1



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Time (mins)	Deflection (mm)	Rate of Deflection (mm/min)	Time (mins)	Deflection (mm)	Rate of Deflection (mm/min)
62	3.4	0.1	77	6.8	0.3
63	3.6	0.2	78	7.2	0.4
64	3.6	0.0	79	7.7	0.5
65	3.6	0.0	80	8.0	0.3
66	3.7	0.1	81	8.8	0.8
67	3.7	0.0	82	9.0	0.2
68	3.9	0.2	83	9.1	0.1
69	4.2	0.3	84	9.1	0.0
70	4.9	0.7	85	9.8	0.7
71	5.3	0.4	86	10.0	0.2
72	6.0	0.7	87	11.5	1.5
73	6.1	0.1	88	11.9	0.4
74	6.4	0.3	89	12.7	0.8
75	6.4	0.0	90	14.6	1.9
76	6.5	0.1	/	/	/



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Table 5 Observations Made during the Test

Time (min:sec)	Observations
00:00	Furnace Fired.
20:30	Some small cracks appeared on the outer layer plasterboards.
30:05	Slight smoke release from the joints between the joists and flooring.
40:00	The cracks became larger gradually.
50:00	Smoke release increases around the unexposed perimeter of the floor assembly, between the joists and flooring.
52:00	The outer layer plasterboard began to fall off.
80:00	Smoke release continues to increase on the unexposed face of the floor assembly.
90:00	The sample maintained the loadbearing capacity and kept integrity and insulation.
91:00	Test was terminated as per client requirement.

6. Performance Criteria

The performance of the sample was judged against the criteria for loadbearing capability, integrity and insulation as specified in Clause 10 Performance criteria of BS 476-20: 1987+AC:2014 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). The performance criteria for failure were given as follows,

Loadbearing:

Failure to support the load is deemed to have occurred when either of the following criteria have been exceeded, whichever is exceeded first.

Limiting deflection, $=L/20 = 210 \text{ mm}$,

And,

Limiting rate of deflection, $=L^2/9000d = 7.90 \text{ mm/min}$,

Where,

L is the clear span of the test sample, in millimetres; $L=4200 \text{ mm}$

d is the distance from the extreme fibre of the design compression zone to the extreme fibre of the design tensile zone of the structural section, in millimetres. $d=248 \text{ mm}$

Note: Since relatively rapid deflections can occur until stable conditions are reached, the rate of deflection criteria is not applied until a deflection of $L/30$ has been exceeded.



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Integrity: Failure is deemed to occur:

- a) When collapse occurs; or
- b) When sustained flaming for not less than 10s on the unexposed surface occurs; or
- c) For situations where the cotton pad is suitable, when flames and/or hot gases cause flaming or glowing of the cotton fibre pad; or
- d) For situations where the cotton pad is not suitable, when either:
 - i) 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
 - ii) the 25 mm diameter gap gauge can penetrate a through gap such that the end of the gauge projects into the furnace.

Insulation: Failure is deemed to occur:

- a) When the mean unexposed face temperature increases by more than 140 °C above its initial value; or
- b) When the temperature recorded at any position on the unexposed face, either by a fixed thermocouple or by the roving thermocouple subject to the following provisions is in excess of 180 °C above the initial mean unexposed face temperature, or
- c) When integrity failure occurs.

7. Conclusion

The timber floor assembly protected by a plasterboard ceiling, incorporating five fire rated downlights lighter fittings, was tested in accordance with Clause 7 of BS 476: Part 21: 1987+AC:2014 Fire tests on building materials and structures — Part 21: Methods for determination of the fire resistance of loadbearing elements of construction.

During the heating period of 90 minutes, the maximum deflection was 14.6 mm and the maximum rate of deflection was 1.9 mm/min. No collapse and sustained flaming were occurred. The mean temperature rise of unexposed surface was 44.9°C and the maximum temperature rise was 51.5°C.

The performance of the sample was judged against the criteria for loadbearing capability, integrity and insulation as specified in chapter 6 of this report (Clause 10 of BS 476-20), for horizontal construction, and the sample satisfied the performance requirements for the following period:

Loadbearing capacity	Integrity	Insulation
≥ 90 minutes	≥ 90 minutes	≥ 90 minutes

The test was terminated after a period of 91 minutes.



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8. Limitation

The results only relate to the behaviour of the sample of the element of construction under the particular conditions of the test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use nor do they reflect the actual behaviour in fires.

The test results relate only to the sample tested. The fire resistance performance of sample of this design may change if different dimensions, different gaps, incorporating different components, or mounted within different wall construction.

Appendix A of BS 476: Part 20: 1987+AC:2014 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.

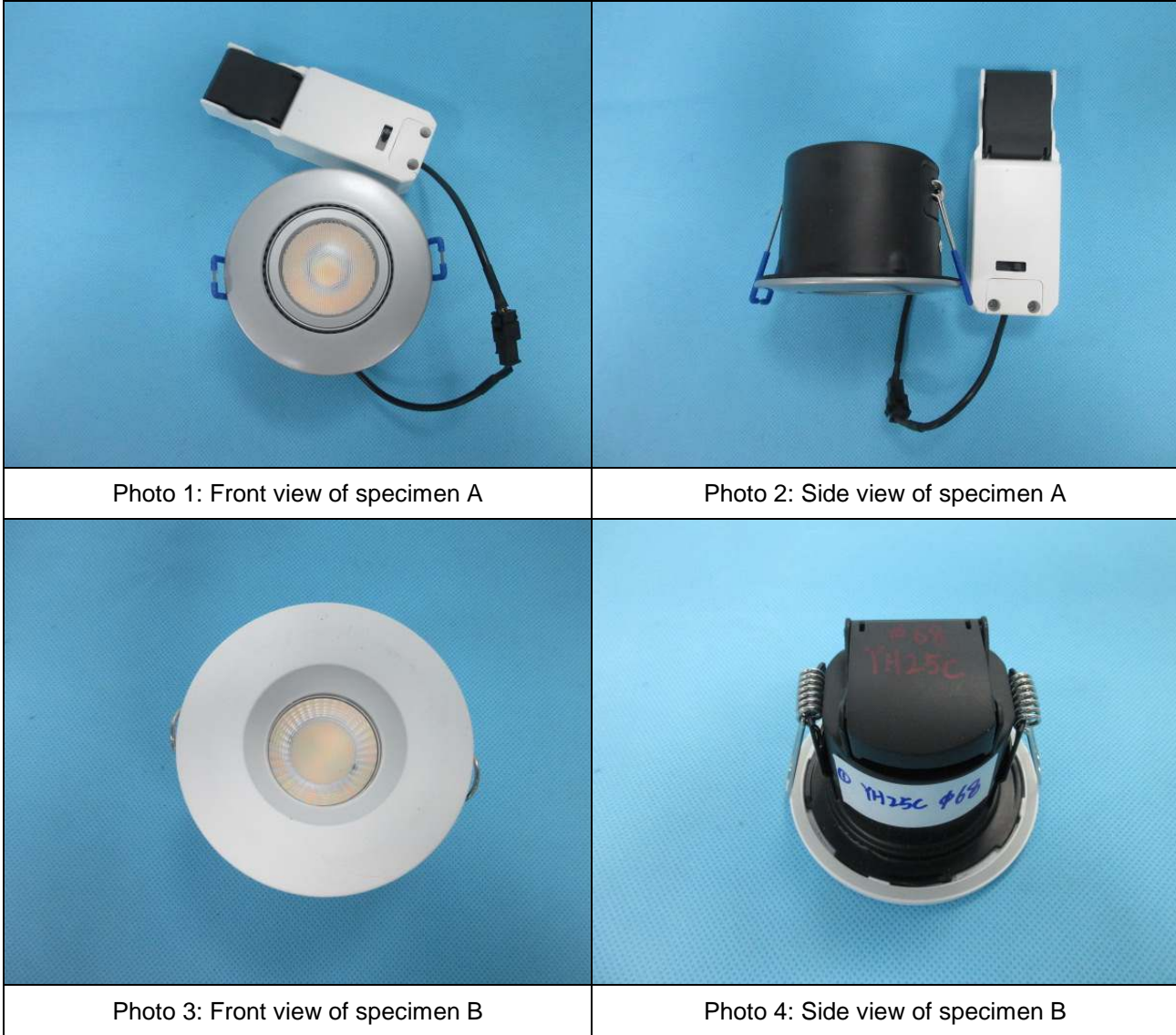
The sample was asymmetrical and was tested such that the specified surface towards the heating conditions of the test. The test result may not be appropriate to situation other side towards the heating conditions.



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Appendix - Photographs



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Photo 5: Front view of specimen C



Photo 6: Side view of specimen C

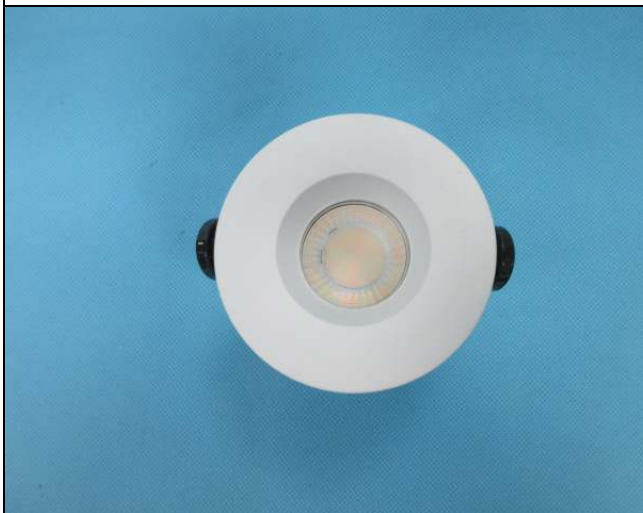


Photo 7: Front view of specimen D



Photo 8: Side view of specimen D



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Photo 9: Front view of specimen E



Photo 10: Side view of specimen E



Photo 11: The unexposed face before the test



Photo 12: The exposed face before the test



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Photo 13: The unexposed face before the test
(Distribution of the weights)



Photo 14: The unexposed face of sample
(After test duration of 50 minutes)

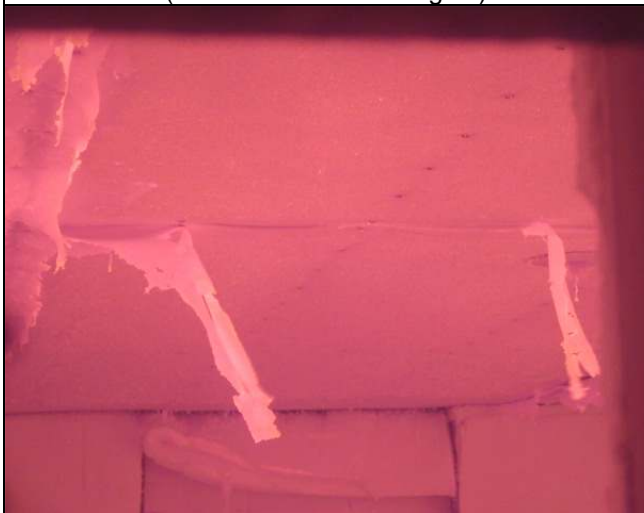


Photo 15: The exposed face of sample
(After test duration of 52 minutes)



Photo 16: The unexposed face of sample
(After test duration of 90 minutes)

SGS authenticate the photo on original report only

End of Report



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