TEST REPORT

No. : XMCCM150100122
Date : Mar.11, 2015

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

Sample Name	:	FIRE RATE DOWNLIGHT
Type No.	:	1) FR1137W; 2) FR1175W; 3) FR1185W; 4) FR1193W; 5) FR1001W; 6) FR1003W; 7) FR1009W; 8) FR1011W
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	:	Jan 28, 2015
Test Period	:	Jan 28, 2015 to Feb.12, 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

Civi Huang
Authorized Signatory

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Xiamen Branch Testing Center Materials Laboratory
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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 six 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
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	FR1137W	Size: Φ90.0mm×71.3mm Round
B	FR1175W	Size: Φ97.0mm×69.0mm Round
C	FR1185W	Size: Φ90.0mm×71.3mm Round
D	FR1193W	Size: Φ97.0mm×69.0mm Round
E	FR1001W	Size: Φ84.0mm×46.5mm Round
F	FR1003W	Size: Φ92.0mm×46.5mm Round
G	FR1009W	Size: Φ84.0mm×46.5mm Round
H	FR1011W	Size: Φ92.0mm×46.5mm Round

The floor assembly had overall nominal dimensions of 4696 mm long by 3200 mm wide. The unexposed surface of the floor comprised two layers of 15mm thick plasterboards, and both layers were screw fixed to the upside 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.

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

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Test procedure

The ambient temperature at the beginning of the test was 16 ºC.

The furnace temperature was measured by means of eight 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 eight 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 Down lights 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 behaviour of the specimen is given in Appendix 5.

The mean furnace temperature records are shown in Appendix 6, 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 7, and the individual temperatures recorded adjacent to the downlight fittings at mid-height of the cavity are shown in Appendix 8. 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 is given in Appendix 9

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:

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.

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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 140ºC above its initial value;

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

c) When integrity failure occurs

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 external laboratory assessed as competent.

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

Appendix 1: Schedule of components

Floor assembly (items 1 to 4)

1. Floor Joists

Material	: Softwood timber joists
Overall section size	: 45mm thickness×190mm deep
Density of Joist	: 600kg/m^3

2.Floorboards

Manufacturer	: Knauf
Material	: Gypsum plasterboard
Thickness	: 2 layers, each 15mm thickness
Density	:727kg/m^3
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 layers, each 15mm thick
Density	:727kg/m^3
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	: Knauf
Thickness	: 50mm
Density	: 60kg/m^3
Fixing method	: filled into the cavity between the floor and the ceiling

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5.Specimen 'A'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1137W
Type	: Round, fix down light
Overall dimensions and construction	: See figure 2
Hole size in ceiling boards	: 70mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.35kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

6. Specimen 'B'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1175W
Type	: Round, adjustable down light
Overall dimensions and construction	: See figure 3
Hole size in ceiling boards	: 83mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.36kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

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7. Specimen 'C'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1185W
Type	: Round, fix down light
Overall dimensions and construction	: See figure 4
Hole size in ceiling boards	: 70mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.35kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

8. Specimen 'D'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1193W
Type	: Round, adjustable down light
Overall dimensions and construction	: See figure 5
Hole size in ceiling boards	: 83mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.36kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

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9. Specimen 'E'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1001W
Type	: Round, fix down light
Overall dimensions and construction	: See figure 6
Hole size in ceiling boards	: 70mm
Materials	i: cover: Die cast aluminium
	ii: shrapnel: Stainless steel
Approx weight	: 0.2kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

10. Specimen 'F'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1003W
Type	: Round, adjustable down light
Overall dimensions and construction	: See figure 7
Hole size in ceiling boards	: 83mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.21kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

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11. Specimen 'G'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1009W
Type	: Round, fix down light
Overall dimensions and construction	: See figure 8
Hole size in ceiling boards	: 70mm
Materials	i: cover: Die cast aluminium
	ii: shrapnel: Stainless steel
Approx weight	: 0.2kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90 minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

12. Specimen 'H'

Product Name	: Fire rate Downlight
Manufacturer	
Type No.	: FR1011W
Type	: Round, adjustable down light
Overall dimensions and construction	: See figure 9
Hole size in ceiling boards	: 83mm
Materials	i: cover: Die cast aluminium
	ii: spring clip: Spring steel wire, nickel plated
Approx weight	: 0.21kg
Details of fireproof material	i: Manufacturer: Dongguan Fumei electronic materials Co., Ltd.
	ii: Type: 90 minutes fire resistance
	iii:Thickness:1.5mm
	iv: Location: Strip fitted external around flange of cover

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

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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	: 60 kg/m^3

3. **Physical Parameters of Floorboards**

Thickness	: 2 layers, each 15 mm thick
Density	: 727 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	: 36.9 kg

7. **Weight of Actual Floorboards**

Actual volume of Floorboards	: 0.405 m^3
Actual weight of Floorboards	: 294.4 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	: 797.3 kg

10. Actual Dead Load

Actual Dead Load per metre square	: (797.3×9.81)/(4.5×3.0) 579.4 N/m^2 59.1 kg/m^2

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

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

Appendix 2: Details of test specimen

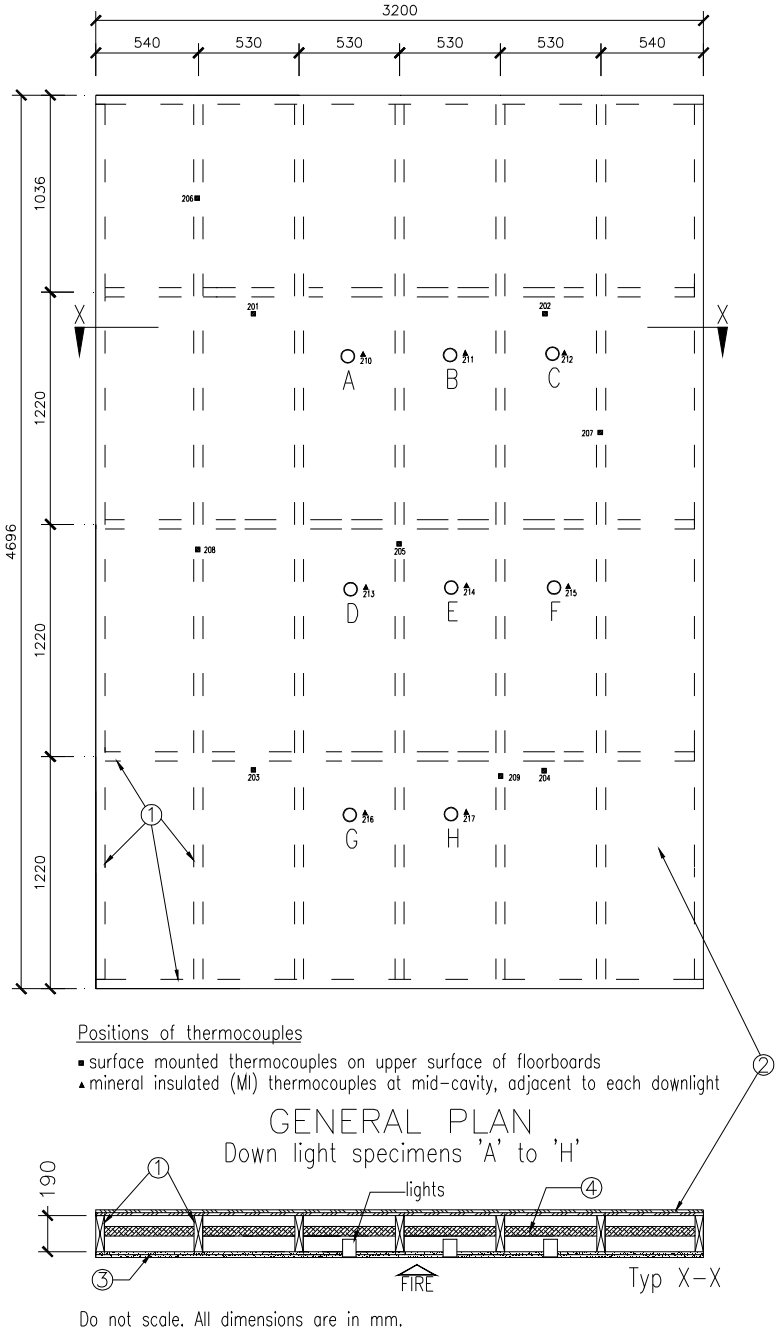

Figure 1 - Specimen General Plan

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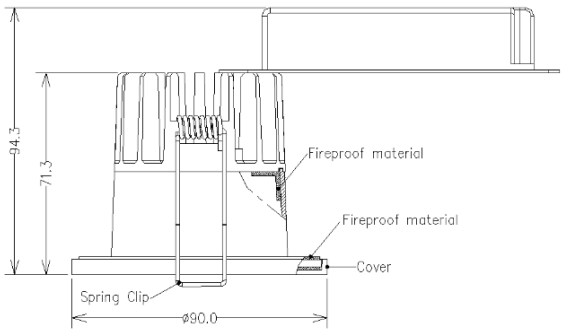

Figure 2 – Details of type No.: FR1137W

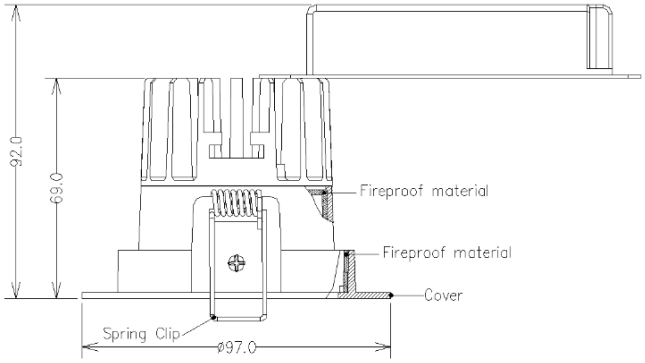

Figure 3 – Details of type No.: FR1175W

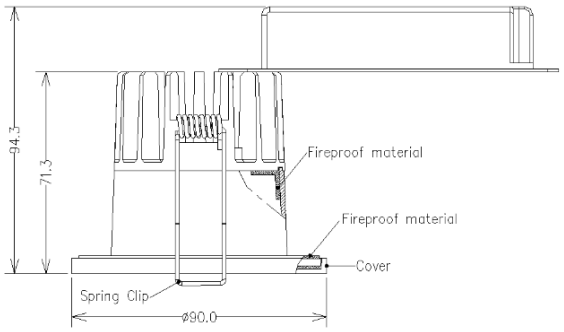

Figure 4 – Details of type No.: FR1185W

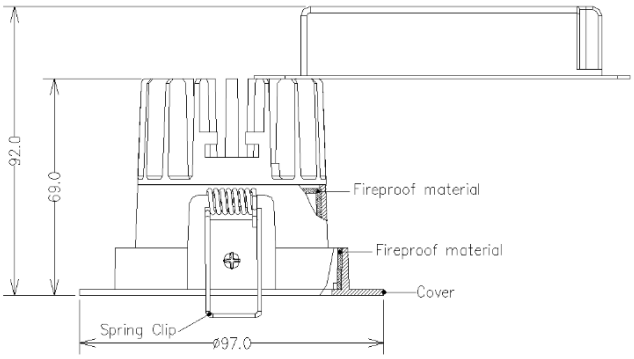

Figure 5 – Details of type No.: FR1193W

Note: the specimen details provided by the customer

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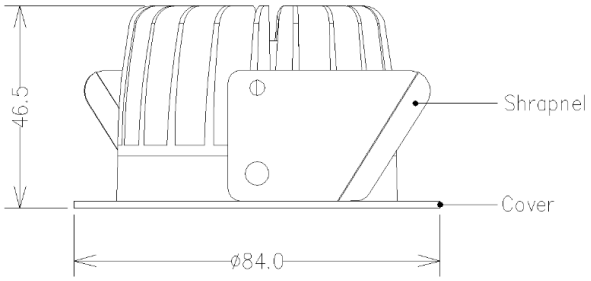

Figure 6 – Details of type No.: FR1001W

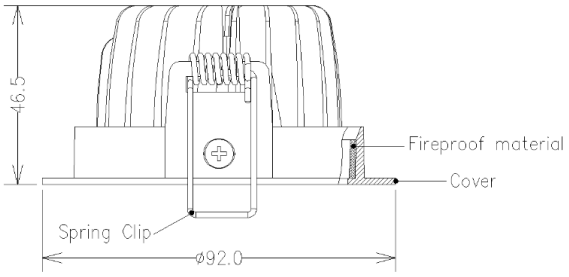

Figure 7 – Details of type No.: FR1003W

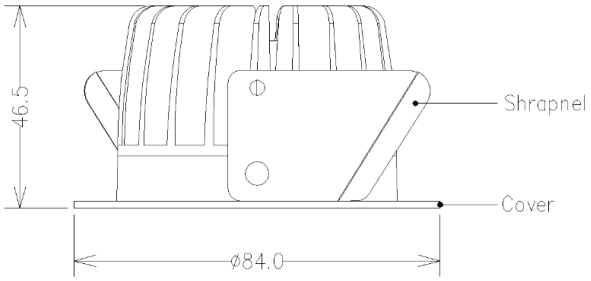

Figure 8 – Details of type No.: FR1009W

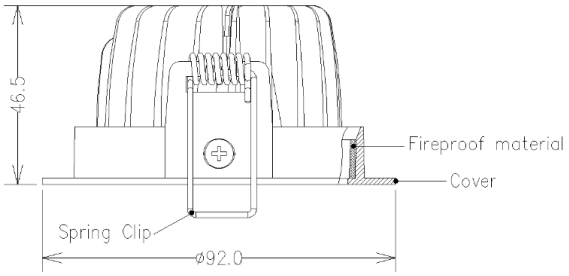

Figure 9 – Details of type No.: FR1011W

Note: the specimen details provided by the customer

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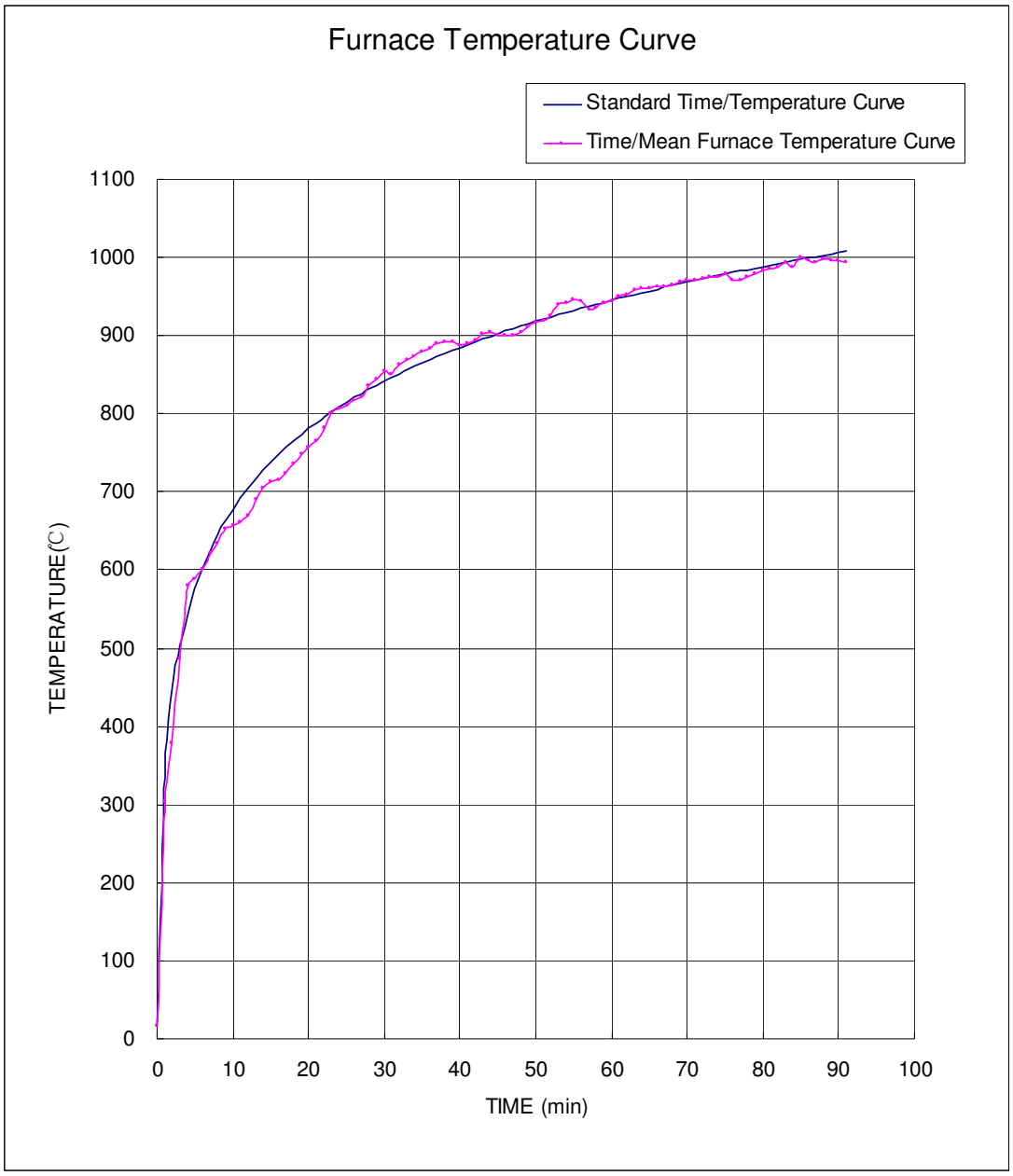
Appendix 3 - Furnace Temperature Curve



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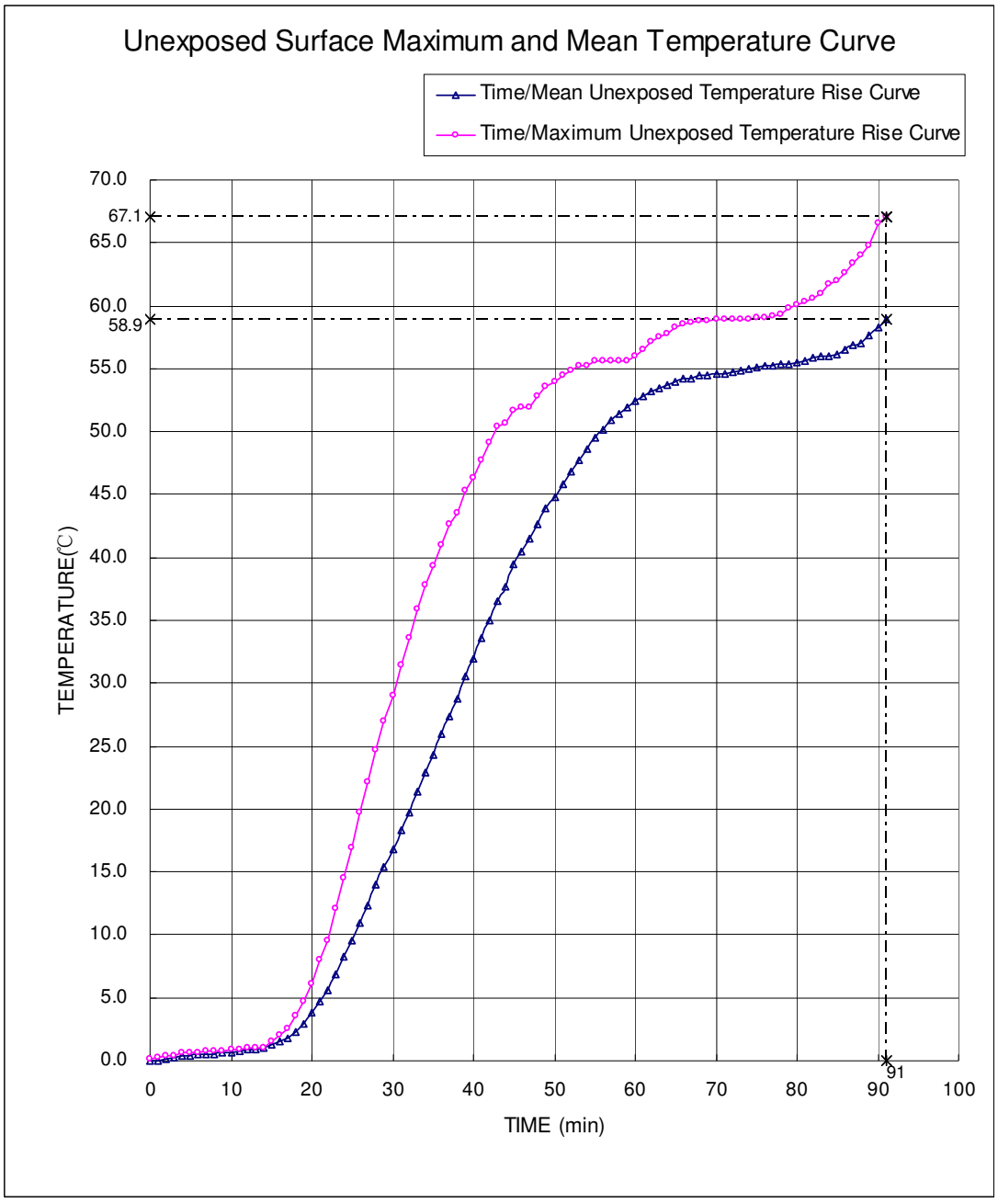
Appendix 4 - Unexposed Face Mean and Maximum Temperature Curve



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Appendix 5 –Test Observations

Time （min）	Observation (All observations are from the exposed face unless noted otherwise)
0	Test started.
12	Coating of the plasterboard ceiling started to fall away.
24	Specimen ‘A’ fused.
40	The first layer of plasterboard ceiling started to sag slightly and joints began to open.
48	Specimen ‘D’ and ‘E’ fell away.
50	The first layer of plasterboard ceiling nearby specimen ‘D’ sagged seriously.
52	Specimen ‘B’, ‘C’ and ‘H’ fell away.
54	The first layer of plasterboard ceiling between specimen ‘H’ and ‘F’ fell away, and the specimen ‘F’ fell away at the same time.
58	Specimen ‘G’ fell away.
61	Specimen ‘A’ fell away.
65	Most of the first layer of plasterboard ceiling already fell away.
68	Some cracks appeared on second layer of plasterboard ceiling.
75	The second layer of plasterboard ceiling between specimen ‘G’ and ‘H’ fell away.
78	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********

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Appendix 6 – Furnace Temperature Records

Time min	Specified Furnace Temperature ℃	Actual Furnace Mean Temperature ℃
0	20	16
5	576	589
10	678	657
15	739	713
20	781	756
25	815	811
30	842	855
35	865	880
40	885	888
45	902	901
50	918	917
55	932	946
60	945	945
65	957	960
70	968	972
75	979	980
80	988	984
85	997	1000
90	1006	995
91	1008	993

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

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Appendix 7 –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	14.1	13.9	13.9	13.9	13.8	14.0	13.9	13.8	13.7	13.9	0.0	0.2
5	14.5	14.3	14.3	14.4	14.2	14.5	14.3	14.3	14.2	14.3	0.4	0.6
10	14.8	14.6	14.5	14.7	14.4	14.6	14.6	14.5	14.4	14.6	0.7	0.9
15	15.1	15.5	15.0	15.1	15.1	15.4	15.1	14.9	15.0	15.2	1.2	1.6
20	16.2	20.0	16.1	16.5	19.7	17.8	18.1	15.6	16.7	17.7	3.8	6.1
25	18.8	29.2	18.7	19.6	30.9	23.3	25.5	17.6	20.7	23.4	9.5	17.0
30	23.2	39.6	23.5	24.1	42.9	28.0	34.9	20.6	26.5	30.7	16.7	29.0
35	29.2	49.2	30.3	29.4	53.3	33.7	46.0	25.0	34.4	38.3	24.4	39.4
40	36.6	57.1	39.1	36.0	60.3	40.1	56.2	32.9	42.4	45.8	31.9	46.4
45	45.8	62.8	49.7	43.2	65.6	46.7	63.5	39.1	50.6	53.4	39.5	51.7
50	56.0	66.6	55.1	50.2	66.0	52.9	67.9	48.3	56.6	58.8	44.9	54.0
55	64.4	69.5	60.2	56.6	66.2	59.1	69.1	55.8	59.4	63.4	49.5	55.6
60	69.6	69.9	63.6	62.0	66.6	63.8	69.2	61.0	61.4	66.3	52.4	56.0
65	72.2	70.2	65.1	65.2	66.9	67.7	69.3	64.8	64.1	67.9	54.0	58.3
70	72.9	70.4	65.5	66.5	67.0	70.4	69.5	66.9	65.7	68.5	54.5	59.0
75	73.0	70.6	65.9	68.3	67.3	72.5	69.7	67.6	66.0	69.0	55.1	59.1
80	73.1	70.7	66.7	69.1	67.7	74.0	69.9	68.8	66.3	69.5	55.5	60.1
85	73.3	70.9	67.6	70.6	68.0	75.9	70.0	69.2	67.3	70.1	56.2	62.0
90	74.7	71.3	69.5	73.8	71.7	80.5	71.5	71.0	70.1	72.2	58.3	66.6
91	75.0	71.4	69.9	74.9	73.0	81.0	72.2	72.3	71.9	72.8	58.9	67.1

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

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Appendix 8 – 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 ℃
0	14.3	14.2	14.0	14.8	14.6	14.5
5	14.7	16.8	14.8	18.0	16.0	19.2
10	24.9	19.9	40.8	38.8	30.2	26.8
15	63.7	40.3	65.9	58.8	69.8	62.0
20	84.2	63.1	74.9	69.4	85.4	80.3
25	88.1	74.0	80.8	75.8	88.6	84.7
30	89.8	77.9	83.2	83.3	92.8	90.1
35	93.2	84.5	86.3	93.5	95.5	100.1
40	96.7	90.3	106.4	99.5	98.4	103.4
45	98.3	94.7	114.6	100.3	101.5	104.5
50	99.0	94.9	116.0	101.8	103.0	105.9
55	99.4	95.4	117.2	102.4	104.0	107.5
60	99.9	97.9	118.5	102.9	104.9	110.4
65	100.1	102.4	119.4	103.4	109.7	111.3
70	101.7	110.1	120.9	104.0	123.4	114.2
75	116.9	135.3	155.2	111.1	159.0	146.1
80	161.3	163.3	205.6	136.0	190.0	175.1
85	286.5	180.1	219.4	151.0	309.1	258.9
90	324.7	242.0	265.2	211.7	345.1	295.8
91	339.5	258.3	295.5	245.9	350.7	311.2

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

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Appendix 9 - Deflection of the floor assembly during the test

Time min	Central Vertical Deflection mm
0	0.0
5	5.0
10	6.3
15	6.0
20	4.9
25	4.5
30	4.7
35	4.6
40	4.7
45	4.6
50	4.9
55	5.5
60	6.1
65	6.2
70	5.9
75	5.8
80	6.4
85	8.3
90	11.7
91	12.3

Note: A negative value indicates deflection away from the furnace

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

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Photo Appendix:

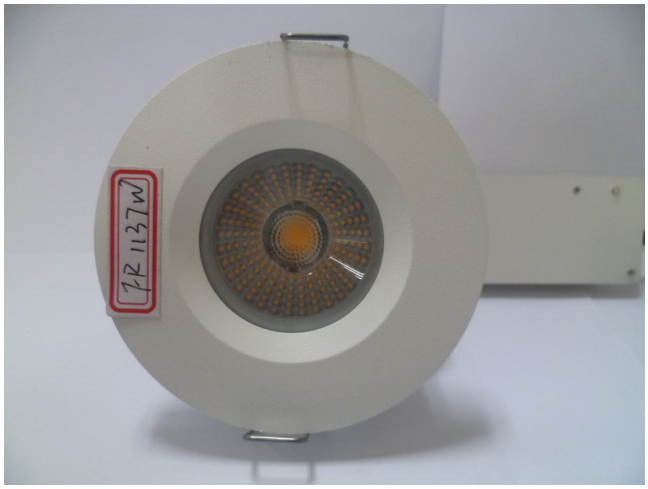

Photo 1: Front view of FR1137W

Photo 2: Side view of FR1137W

Photo 3: Front view of FR1175W

Photo 4: Side view of FR1175W

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

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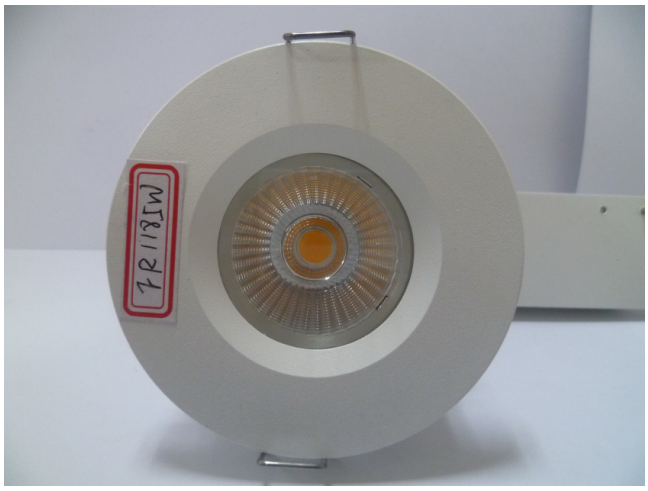
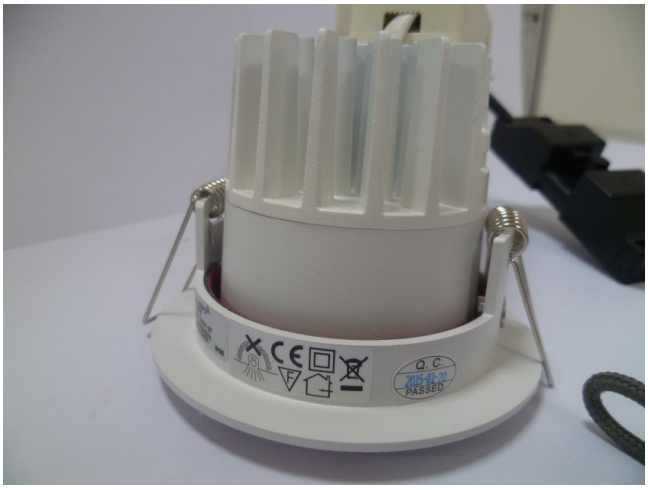


Photo 5: Front view of FR1185W	Photo 6: Side view of FR1185W
	
Photo 7: Front view of FR1193W	Photo 8: Side view of FR1193W

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

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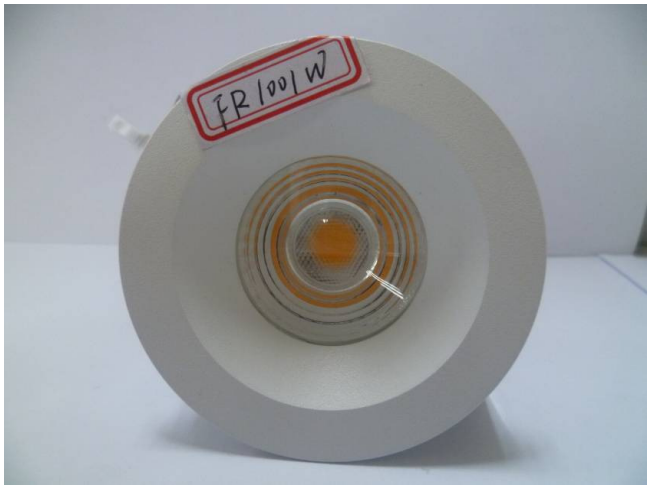

Photo 9: Front view of FR1001W

Photo 10: Side view of FR1001W

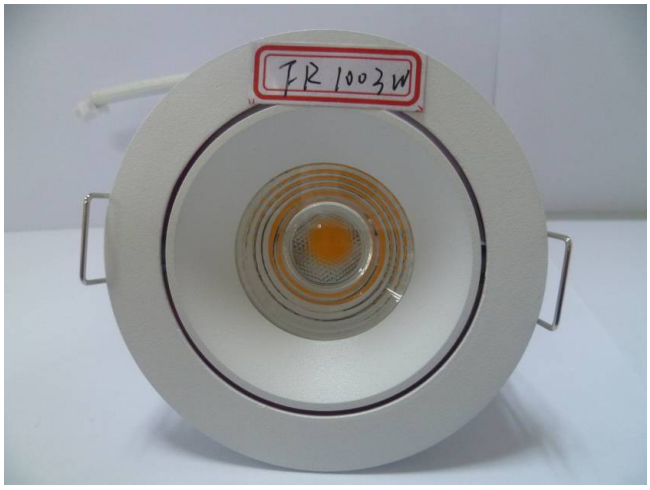

Photo 11: Front view of FR1003W

Photo 12: Side view of FR1003W

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

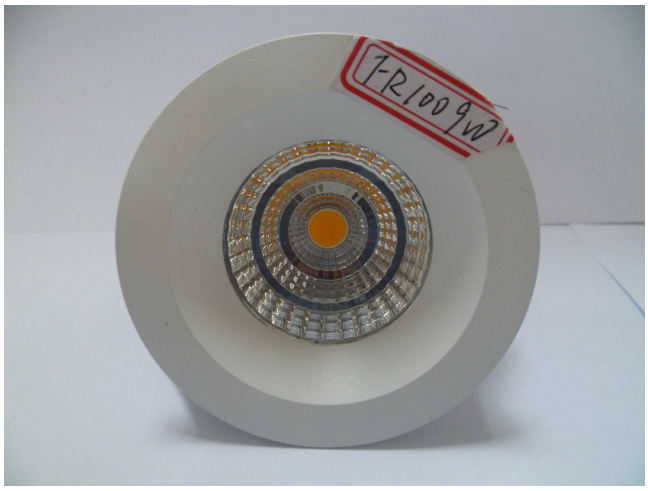

Photo 13: Front view of FR1009W

Photo 14: Side view of FR1009W

Photo 15: Front view of FR1011W

Photo 16: Side view of FR1011W

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

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

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

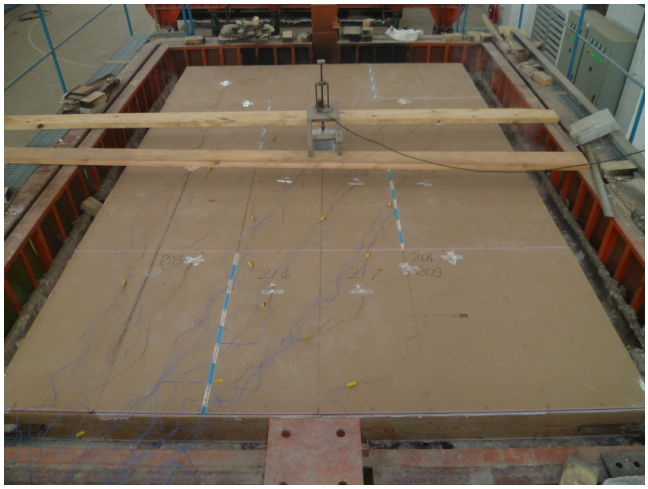

Photo 19: The unexposed surface of the specimen after a test duration of 15 minutes.

Photo 20: The exposed surface of the specimen after a test duration of 24 minutes, showing the specimen 'A' fused.

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

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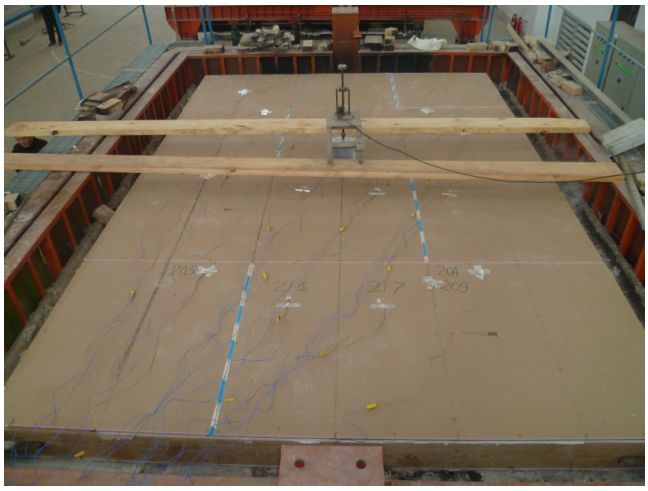

Photo 21: The unexposed surface of the specimen after a test duration of 30 minutes.

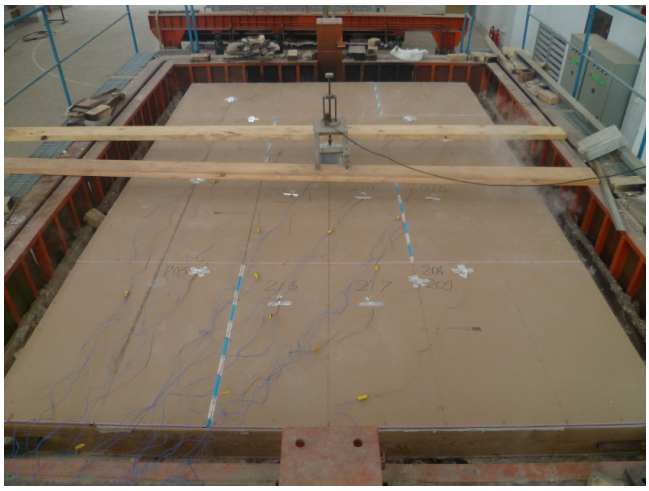

Photo 22: The unexposed surface of the specimen after a test duration of 45 minutes.

Photo 23: The exposed surface of the specimen after a test duration of 48 minutes, showing the specimen 'D' and 'E' fell away and the nearby first layer of plasterboard ceiling started to sag slightly and joints began to open.

Photo 24: The exposed surface of the specimen after a test duration of 54 minutes, showing the specimen 'B' and 'C' fell away and a part of first layer of plasterboard ceiling fell away.

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

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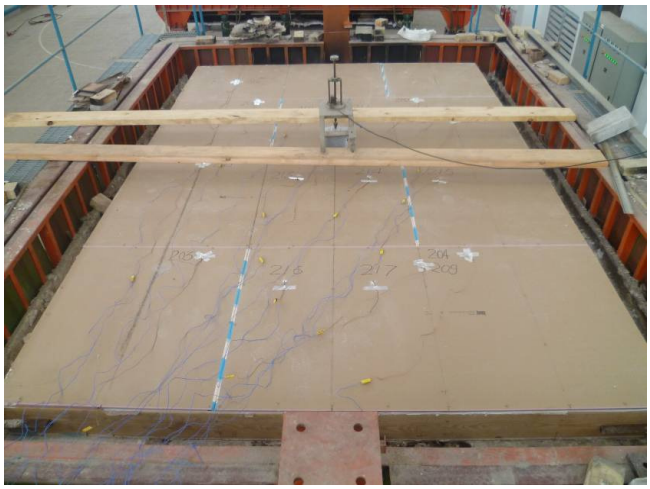

Photo 25: The unexposed surface of the specimen after a test duration of 60 minutes.

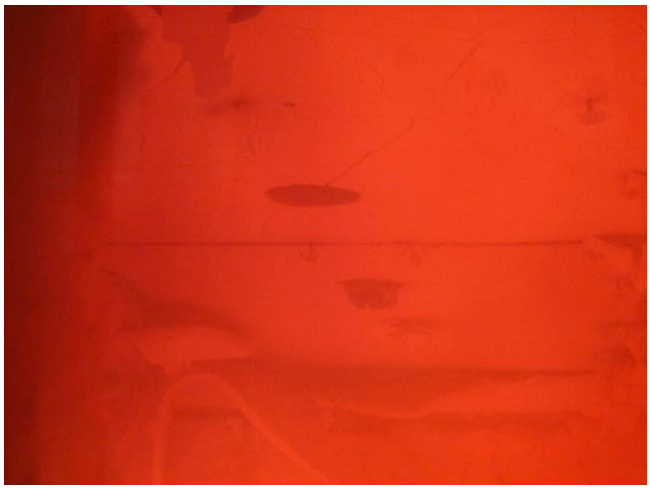

Photo 26: The exposed surface of the specimen after a test duration of 68 minutes, showing cracks appeared on second layer of plasterboard ceiling.

Photo 27: The unexposed surface of the specimen after a test duration of 90 minutes.

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

SGS authenticate the photo on original report only
******** End of report********

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