TEST REPORT

FILK
a Subsidiary of KFPA

1030, Gyeongchung-daero, Ganam-eup, Yeoju-si, Gyeonggi-do, 12661, Korea

Report No : G2018-0485E
Page(1)/(18)Pages

1. Client
   - Name : ALCOPANEL CO., LTD
   - Address : #269 Dae Cheng-ro, Samsung-myun, Eumsung-gun, ChungCheongbuk-do, Korea
   - Date of Receipt : May 23, 2018
2. Test specimen : Aluminum Composite Panel Wall(FR)
3. Date of Test : May 28, 2018
4. Use of Report : Capability verification
5. Test method used : ASTM E 119 : 2016 (Standard Test Methods for Fire Tests of Building Construction and Materials) partially used
6. Test Results :

Test items	Fire resistance performance
Fire resistance test	120 min

* The results shown in this test report refer only to the specimen(s) tested unless otherwise stated.

Affirmation	Tested by	Technical Manager
	Name : Seungjea Lee (Signature)	Name : Choi Dongho (Signature)

Fire Insurers Laboratories of Korea
a subsidiary of Korean Fire Protection Association

FPD03-10A(5) (210×297) ㎜

CONTENTS

1. SUMMARY

1.1 Name of test : Fire resistance test for Aluminum Composite Panel Wall(FR)

1.2 Applicant : Yoon Sang Chul & Kim Min Han, the president of ALCOPANEL CO., LTD

1.3 Test specimen

1.3.1 Name : Aluminum Composite Panel Wall(FR)

1.3.2 Number : 1 ea

1.3.3 Rating : 2 hours fire resistance

1.3.4 Size : 3 000 ㎜ width × 3 000 ㎜ length

1.3.5 Structure : Fire proof gypsum wallboard(thickness 15 ㎜, double layers) + Void (thickness 50 ㎜) + Fire proof gypsum wallboard(thickness 15 ㎜, double layers) + ALCOPANEL(thickness 4 ㎜)
Light weight steel stud(C - 50 ㎜ × 45 ㎜ × 0.8 ㎜, @450)

1.4 Specific Drawing : Refer to Appendix 1

1.5 Test Standard : ASTM E 119 : 2016 (Standard Test Methods for Fire Tests of Building Construction and Materials) partially used.

1.6 Test Environment : Temperature - (22 ± 1) ℃, Humidity - (59 ± 2) %RH

1.7 Test Result : The test specimen has 2 hour fire resistance performance specified in ASTM E 119 : 2016.
(This test was done only on the side of the specimen which the ALCOPANEL was attached by request of the applicant.)

Date tested : May 28, 2018
Report issued in Korean : September 18, 2018 Report issued in English : March 27, 2019

2. PURPOSE OF THE TEST

The purpose of this test is to determine whether the Aluminum Composite Panel Wall(FR) supplied by ALCOPANEL CO., LTD would have a 2 hour fire resistance performance according to ASTM E 119 : 2016.

3. OUTLINE OF THE TEST

3.1 The test specimen was provided by ALCOPANEL CO., LTD. (See Appendix 1)

3.2 The fire tests were conducted to evaluate the performances of specimen with respect to the fire endurance and hose stream performances as given in ASTM E 119 : 2016.

3.3 Furnace temperature was controlled in accordance with the standard time/temperature curve specified in ASTM E 119 : 2016.

3.4 During the fire endurance and hose stream tests, the test specimen was observed whether it has the following performance specified in ASTM E 119 : 2016.

3.4.1 The specimen shall withstand the fire endurance test without passage of flame or hot gases enough to ignite cotton waste.

3.4.2 The average temperature rise on the unexposed face of the specimen should not be more than 139 ℃, and the temperature rise recorded at any of the individual unexposed face thermocouples should not be more than 181 ℃.

3.4.3 During the hose stream test, there should not be any opening that would permit a projection of water from the stream beyond unexposed surface of the specimen.

4. CONSTRUCTION OF THE TEST SPECIMEN

4.1 The specimen for the fire endurance test was sampled by applicant and verified by FILK for the conformity with the drawings and method of assembly provided by the applicant prior to commencement of the test.

4.2 Four edges of the specimen were fixed to L-shaped fixing cleats which were fixed to the restraint frame.
The overall dimension of the test specimen was 3 000 ㎜ width, 3 000 ㎜ height.

4.3 The drawings, illustrated in Appendix 1 which based upon the test specimen and informations provided by ALCOPANEL CO., LTD. show the dimensions and details of the specimen construction and temperature measurement position.

5. TEST PROCEDURE

5.1 Fire endurance test

5.1.1 The test specimen was mounted into the test frame with a refractory concrete lined steel frame.

5.1.2 The frame containing the test specimen was set on the front of the light oil-fired vertical furnace for the ALCOPANEL side of specimen to be an exposed side. (See Appendix 1)

5.1.3 The furnace was controlled by readings of nine thermocouples located in the vertical furnace chamber as shown in Appendix 1-2.

5.1.4 The accuracy of the furnace control was such that the area under the time/temperature curve is within 10 % for 1 hour and within 7.5 % for over 1 hour and up to 2 hour of the corresponding area under the time/temperature curve specified in ASTM E 119 : 2016.

5.1.5 To measure the temperature rise, eleven thermocouples were placed on the unexposed face of the specimen. (See Appendix 1-2)

5.1.6 Observation was made on the behavior of the specimen for compliance with the relevant criteria during the test.

5.2 Hose stream test

5.2.1 After 2 hour fire endurance test, the hose stream test was conducted to the exposed face of the initially tested specimen. The stream was delivered at a distance of 6 m from the exposed face of the specimen through a nozzle of 29 ㎜ diameter with a pressure of 207 ㎪ for 150 seconds.

5.2.2 The stream was directed firstly at the center and then at all parts of the exposed face, changing direction slowly.

5.2.3 Observation was made on the general behavior of the test specimen during the test.

6. TEST RESULTS

6.1 Fire endurance test

6.1.1 The vertical furnace was heated in accordance with the standard time/temperature curve specified in ASTM E 119 : 2016.

6.1.2 The actual furnace temperature curve and the specified time/temperature curve are shown in Appendix 2-1.
The percentage difference between the areas under specified and actual temperature curves compared with the percentage tolerance of ASTM E 119 : 2016 are shown in Appendix 2-1.

6.1.3 During the fire endurance test, the specimen withstood without passage of flame or hot gases enough to ignite cotton waste.(See Appendix 4)

6.1.4 The average and maximum temperature rise on the unexposed face of the specimen during the fire endurance test were 56℃(120 min.) and 70℃(120 min.) respectively.
(See Appendix 3)

6.2 Hose stream test
During the hose stream test, there were no openings that would permit a projection of water from the stream beyond unexposed surface of the specimen. (See Appendix 6)

7. CONCLUSION

This test was done only on the side of the specimen which the ALCOPANEL was attached by request of the applicant. The result of 2 hour fire tests in accordance with ASTM E 119 : 2016 for the Aluminium Composite Panel Wall supplied by ALCOPANEL CO., LTD. was shown in Table 1.

Table 1. The fire performance of the Aluminium Composite Panel Wall

Test items	Fire Performance
Fire endurance and hose stream tests	120 min

APPENDIX

Appendix 1. DRAWINGS OF TEST SPECIMEN

Appendix 2. FIRE ENDURANCE TEST

Appendix 3. UNEXPOSED FACE TEMPERATURE RISE ····· 13

Appendix 4. OBSERVATION FOR TEST SPECIMEN ····· 15

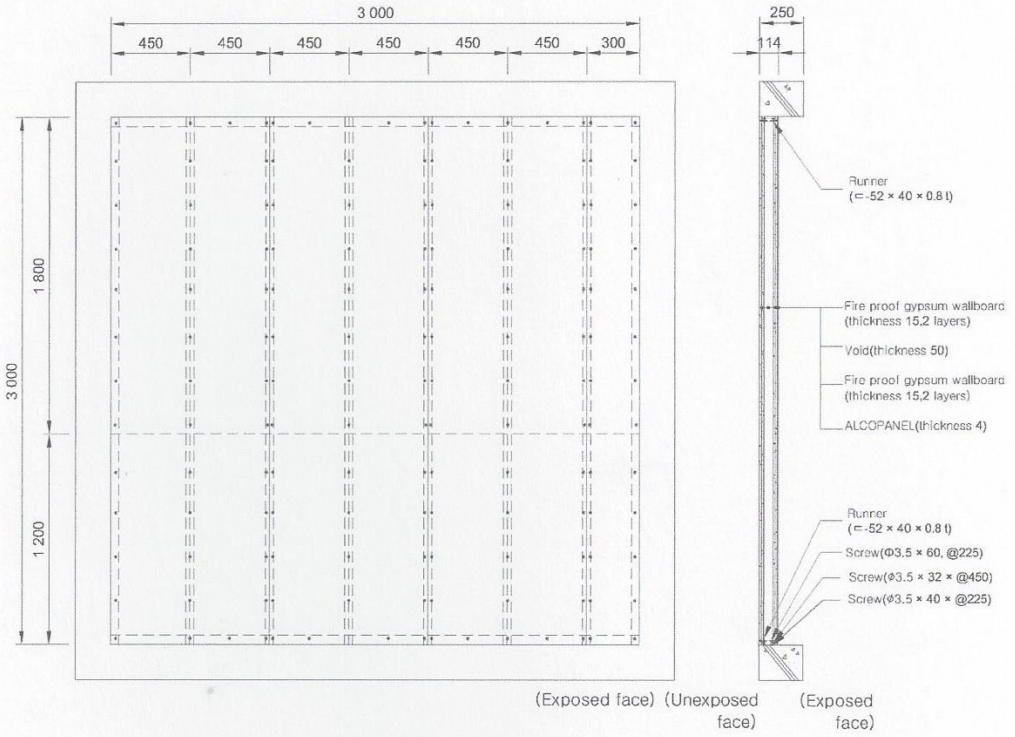
Appendix 5. Photographs ····· 16

Appendix 6. HOSE STREAM TEST (Photographs) ····· 18

Appendix 1. DRAWINGS OF TEST SPECIMEN

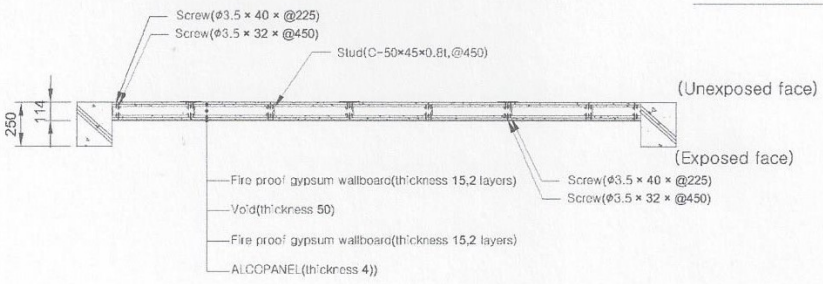
1-1 Construction & materials of the test specimen

(Dimension: ㎜)



ELEVATION

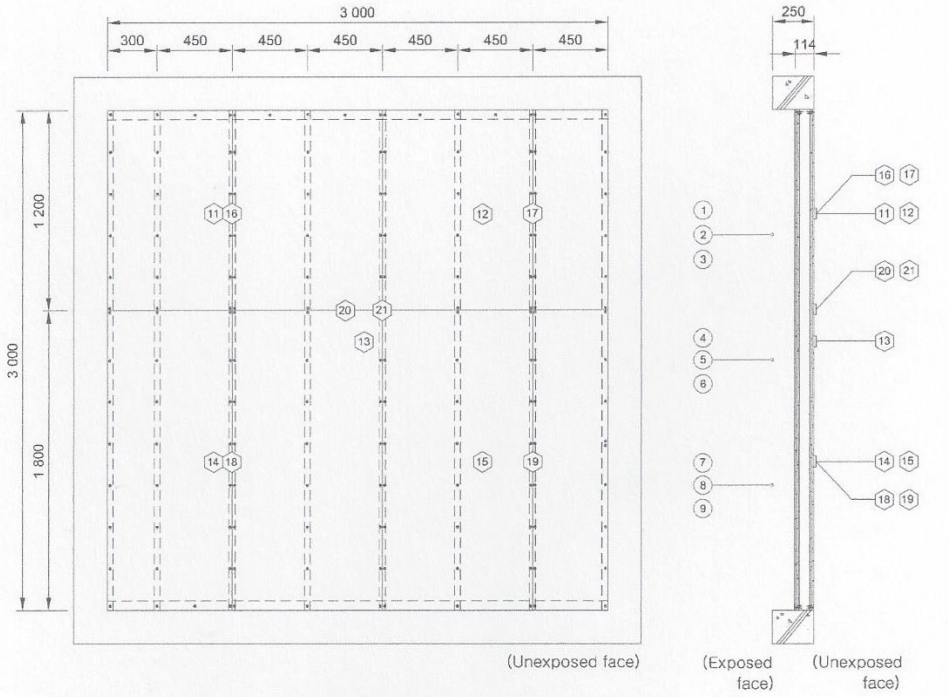
VERTICAL SECTION



HORIZONTAL SECTION

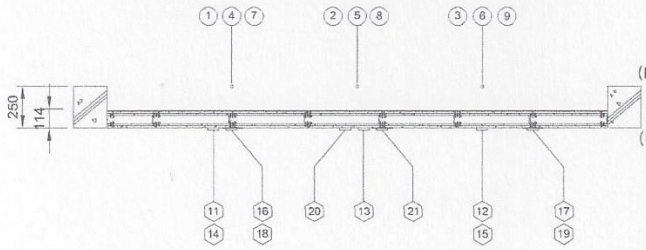
1-2 Drawing of measurement locations

(Dimension: ㎜)



ELEVATION

VERTICAL SECTION



HORIZONTAL SECTION

INDEX

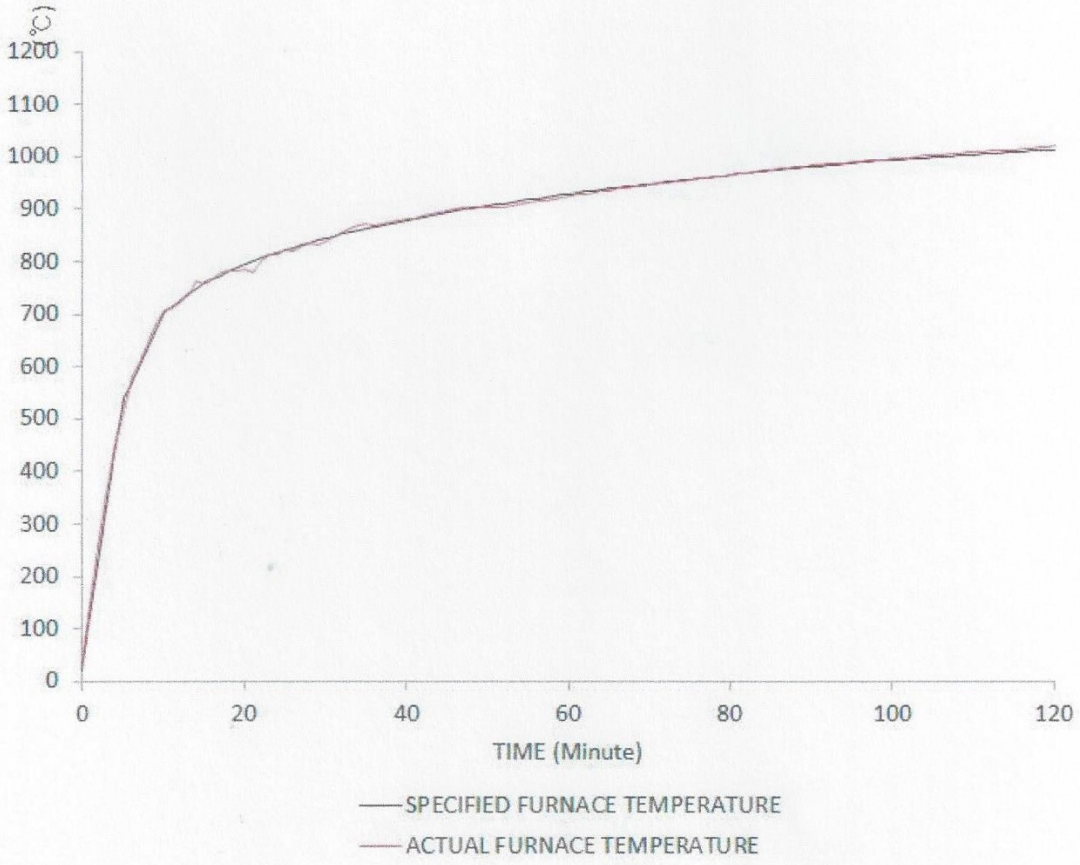
① ~ ⑨ : Measurement location of the furnace temperture

⑪ ~ ㉑ : Measurement location of the temperture rise on the unexposed face

Appendix 2. FIRE ENDURANCE TEST

2-1 Heating temperature

1) Heating temperature curves



2) Difference of areas under heating temperature curves

TIME	ASTM FURNACE TEMP.	ACTUAL FURNACE TEMP.	AREA UNDER STANDARD CURVE	AREA UNDER ACTUAL CURVE	DIFFERENCE	TOLERANCE (+ o r -)
(Mins)	(Deg C)	(Deg C)	(Deg C. Min)	(Deg C. Min)	(%)	(%)
0	20	28	0			
1	127	144	74			
2	227	256	251			
3	331	354	530			
4	434	443	912			
5	538	516	1398			
6	571	581	1953			
7	604	610	2540			
8	638	646	3161			
9	671	684	3816			
10	704	708	4503			
12	726	723	5933			
14	749	763	7409			
16	767	766	8927			
18	781	781	10475			
20	795	786	12051			
22	805	801	13651			
24	816	812	15272			
26	825	820	16914			
28	834	835	18573			
30	843	838	20251			
35	862	871	24513			
40	878	879	28863			
45	892	894	33288			
50	905	901	37781			
55	916	911	42333			
60	927	923	46941	45741	46033	0.64
70	946	945	56308			
80	963	963	65856			
90	978	980	75563			
100	991	993	85411			
110	1001	1005	95371			
120	1010	1017	105428	103028	103714	0.67

Appendix 3. UNEXPOSED FACE TEMPERATURE RISE

3-1 Average temperature rise

(Unit: Deg C)

TIME (Mins)	CHAN 11	CHAN 12	CHAN 13	CHAN 14	CHAN 15	AVERAGE (deg)
0	0	0	0	0	0	0
3	0	0	0	0	0	0
6	0	0	0	0	0	0
9	1	0	1	0	1	1
12	1	1	1	1	1	1
15	1	1	1	1	1	1
18	2	2	1	1	1	1
21	3	3	2	2	2	2
24	6	5	4	3	4	4
27	13	9	7	5	6	8
30	20	13	11	10	9	13
33	27	18	16	17	12	18
36	33	23	20	23	16	23
39	36	28	24	29	20	27
42	39	34	29	34	24	32
45	40	39	33	38	29	36
48	42	43	36	40	34	39
51	43	46	39	42	39	42
54	43	48	41	43	42	43
57	43	48	42	44	44	44
60	44	48	43	44	45	45
63	44	48	43	44	45	45
66	45	48	43	45	45	45
69	47	50	44	46	47	47
72	48	52	46	47	49	48
75	49	53	47	48	50	49
78	49	54	48	49	51	50
81	50	55	49	50	52	51
84	50	55	49	50	52	51
87	50	55	49	50	53	51
90	51	56	50	50	53	52
93	51	56	50	51	53	52
96	51	55	50	51	53	52
99	51	55	50	51	53	52
102	51	55	50	51	53	52
105	51	55	50	51	53	52
108	51	55	50	51	53	52
111	52	56	50	50	54	52
114	51	56	51	51	54	53
117	52	58	52	52	56	54
119	54	59	53	52	58	55
120	54	60	55	53	59	56

3-2 Maximum temperature rise

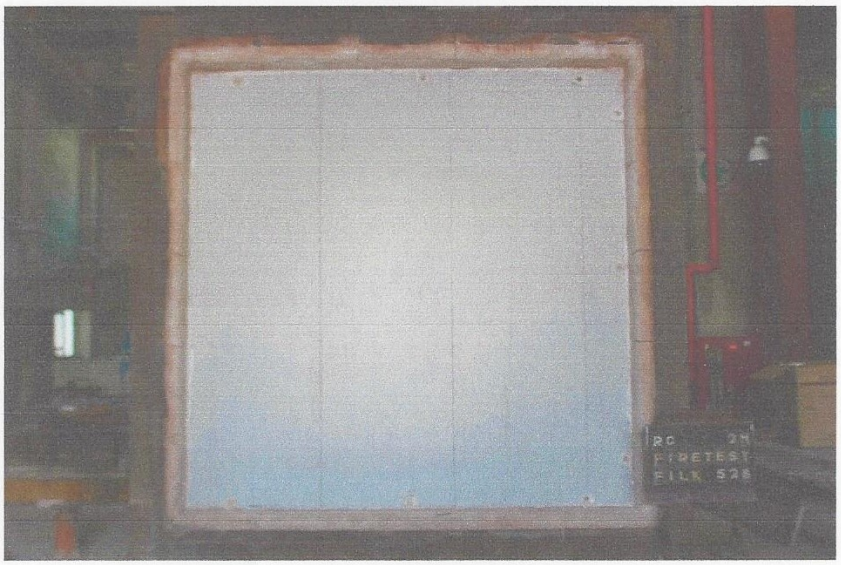
(Unit: Deg C)

TIME (Mins)	CHAN 11	CHAN 12	CHAN 13	CHAN 14	CHAN 15	CHAN 16	CHAN 17	CHAN 18	CHAN 19	CHAN 20	CHAN 21	MAXIMUM (deg)
0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0	1	0	1	0	0	0	1	1	1	1
12	1	1	1	1	1	1	0	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1
18	2	2	1	1	1	1	1	2	1	2	2	2
21	3	3	2	2	2	2	2	3	2	3	3	3
24	6	5	4	3	4	4	4	6	3	4	5	6
27	13	9	7	5	6	8	8	12	5	5	9	13
30	20	13	11	10	9	14	12	17	8	7	13	20
33	27	18	16	17	12	20	17	22	11	9	18	27
36	33	23	20	23	16	25	22	25	15	12	22	33
39	36	28	24	29	20	31	26	27	19	14	27	36
42	39	34	29	34	24	37	30	31	23	17	31	39
45	40	39	33	38	29	43	33	34	27	20	35	43
48	42	43	36	40	34	47	35	38	30	24	39	47
51	43	46	39	42	39	50	37	41	32	27	43	50
54	43	48	41	43	42	51	38	42	34	30	46	51
57	43	48	42	44	44	51	40	44	35	33	47	51
60	44	48	43	44	45	51	41	44	36	36	47	51
63	44	48	43	44	45	51	42	45	37	37	46	51
66	45	48	43	45	45	52	44	48	38	39	47	52
69	47	50	44	46	47	55	46	52	40	40	51	55
72	48	52	46	47	49	55	48	55	43	42	54	55
75	49	53	47	48	50	55	49	57	45	43	56	57
78	49	54	48	49	51	56	50	58	49	44	58	58
81	50	55	49	50	52	56	50	59	50	45	62	62
84	50	55	49	50	52	56	51	60	53	46	64	64
87	50	55	49	50	53	58	51	61	57	47	65	65
90	51	56	50	50	53	59	51	61	61	47	66	66
93	51	56	50	51	53	60	52	62	64	47	67	67
96	51	55	50	51	53	61	52	63	66	48	67	67
99	51	55	50	51	53	61	52	63	66	49	67	67
102	51	55	50	51	53	62	52	63	66	48	67	67
105	51	55	50	51	53	62	52	63	67	49	67	67
108	51	55	50	51	53	62	52	63	67	49	68	68
111	52	56	50	50	54	62	52	63	67	48	69	69
114	51	56	51	51	54	63	52	61	68	48	69	69
117	52	58	52	52	56	64	52	61	67	49	69	69
118	53	58	52	52	57	64	51	61	67	49	69	69
119	54	59	53	52	58	64	52	61	66	50	70	70
120	54	60	55	53	59	64	52	61	65	50	70	70

Appendix 4. OBSERVATIONS FOR TEST SPECIMEN

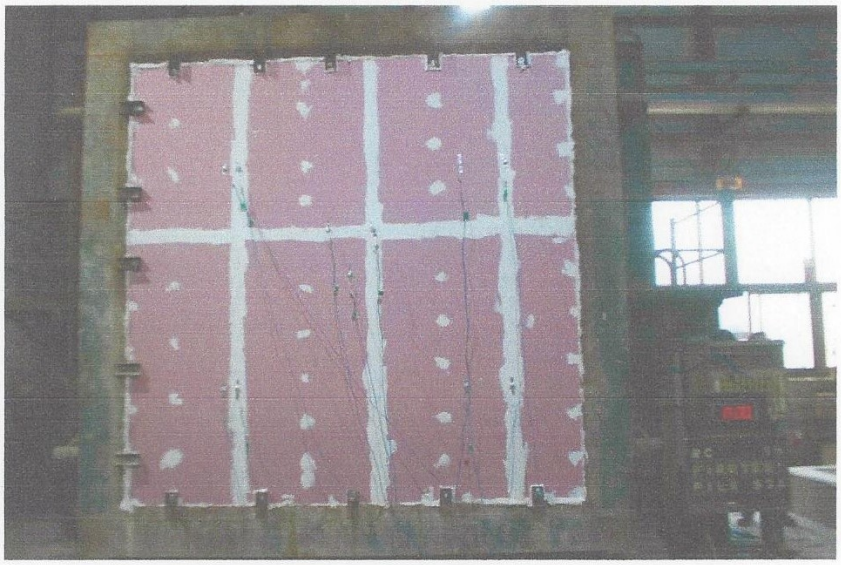
TIME(min)	OBSERVATIONS
00 : 00	Test started.
75 : 00	Smoke began to be released from the unexposed face of specimen.
110 : 00	the color of specimen began to be changed on the connection of fire proof gypsum wallboard.
120 : 00	The test was terminated. There was no crack, other opening to pass through the gap gauges, and there was no flaming for an uninterrupted period of not less than 10s on the unexposed face of the test specimen.

Appendix 5. PHOTOGRAPHS

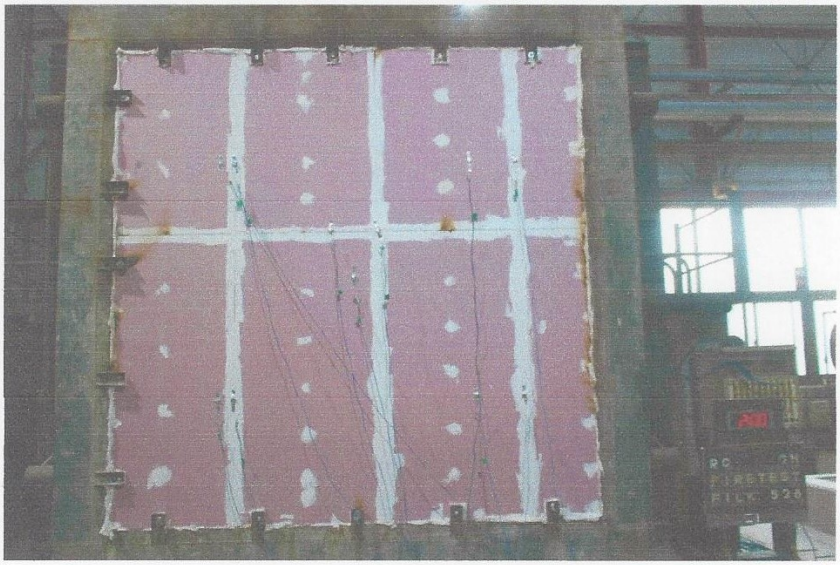


Exposed face of the specimen before fire test

Exposed face of the specimen after fire test



Unexposed face of the specimen before fire test



Unexposed face of the specimen after fire test

Appendix 5. HOSE STREAM TEST (Photographs)

Exposed face of the specimen while hose steam test

Exposed face of the specimen after hose stream test