RECEIPT No.19981670

TEST REPORT

ON

FIRE TESTS OF DOOR ASSEMBLIES

OF

SAMHOON Machinery Company

FIRE INSURERS LABORATORIES OF KOREA

69-1 Simseok-Ri, Ganam-Myon, Yeoju-Gun, Gyeonggi-Do, 469-881, Korea
TEL : (031) 881-6010, FAX : (031) 884-8102
E-mail : yhjang@kfpa.or.kr

FOREWORD

This report was prepared under a contract between SAMHOON Machinery Company and Fire Insurers Laboratories of Korea(FILK).

This test was intended to determine the performance of the fire door supplied by SAMHOON Machinery Company while subjected to the fire endurance test and hose stream test.

The test result is applied only to the test specimen which was submitted by SAMHOON Machinery Company and this should not be used in a commercial advertisement, a suit or other legal requirements.

All the procedures concerning the tests and making the report were followed the UL 10B-1990(Fire Tests of Door Assemblies).

Report reissued : November 2, 2002.

Approved by :

Ryu Eunyeol

The director of FILK

CONTENTS

1. SUMMARY

1.1 Name of test : Fire endurance and hose stream tests for the fire door

1.2 Applicant : Moo Jongsam, the president of SAMHOON Machinery Company
#532-5, Simgokbon1-Dong, Sosa-Gu, Bucheon-City, Gyeonggi-Do, Korea.

1.3 Test specimen

1.3.1 Name : Fire door(Type : Single swinging door)

1.3.2 Number : 1 ea.

1.3.3 Rating : 3 Hours

1.3.4 Structure

.4.1 Door leaf(steel 1.2t) : W 943 ㎜×H 2,148 ㎜×THK 45 ㎜
.4.2 Core insulation : Glass wool
.4.3 Door frame(steel 1.6t) : W 1,049 ㎜×H 2,255 ㎜×THK 100 ㎜
.4.4 Door hinge : Butterfly type(3 points)
.4.5 Door stiffener(steel 1.2t) : 4 ea.
.4.6 Door Lock stiffener(steel 1.6t) : 1 ea.
.4.7 Surrounding wall : Autoclaved Lightweight Concrete
(W 3,000 ㎜×H 3,000 ㎜×THK 100 ㎜)

1.4 Specific Drawing : Refer to Appendix 1.

1.5 Test Standard : UL 10B-1990(Fire Tests of Door Assemblies).

1.6 Test Result : The test specimen was met the conditions of acceptance of the 3 Hours fire resistance rating specified in the test standard, UL 10B-1990.

2. PURPOSE OF THE TEST

2.1 The purpose of this test was to establish the 3 Hours fire resistance rating of the door assemblies by means of the fire endurance and hose stream tests conducted in accordance with the standard, UL 10B-1990(Fire Tests of Door Assemblies).

(This is the first page of a report consisting of 17 pages and should not be accepted as a substitute for complete report.)

Date tested : March 25, 1999.

Report issued in Korean : April 12, 1999.
Report reissued in English : November 2, 2002.

3. OUTLINE OF THE TEST

3.1 The test specimen was provided and erected by SAMHOON Machinery Company (See Appendix 1)

3.2 The test was conducted to evaluate the performance of the test specimen with respect to the fire endurance and hose stream as given in UL 10B-1990.

3.3 Furnace temperature was controlled in accordance with the standard time/temperature curve specified in UL 10B-1990.

3.4 During the fire endurance and hose stream tests, the test specimen was observed whether it have the following performances specified in UL 10B-1990.

(a) The test assembly shall withstand the fire endurance test and hose stream test, without developing openings anywhere through the assembly.

(b) No flaming shall occur on the unexposed surface of door assembly during the first 30 minutes of the classification period.

Exception

- After 30 minutes, intermittent light flaming[152 ㎜(6 in.) long] for periods not exceeding 5-minute intervals, is capable of occurring along the edges of doors.

- During the last 15 minutes of the classification period light flaming occurring on the unexposed surface area of the door, when it is contained within a distance of 38.1 ㎜(1.5 in.) from a vertical door edge and within 76.2 ㎜(3 in.) from the top edge of the door and within 76.2 ㎜(3 in.) from the top edge of the frame of a vision panel.

(c) Hardware shall hold the door closed for the intended door assembly classification period and the latch bolt shall remain projected and shall be intact after the test.

(d) The movement of swinging doors shall not result in any portion of the edges adjacent to the door frame moving from the original position in a direction perpendicular to the plane of the door more than the thickness of the door during the first half of the classification period, nor more than 1.5 times the door thickness during the entire classification period or as a result of the hose stream test.

(e) The movement of the doors shall not result in any portion of the meeting edges moving more than the thickness of the door away from the adjacent door edge in a direction perpendicular to the plane of the doors during the entire classification period or as a result of the hose stream test.

(f) An assembly consisting of a single swinging door shall not separate more then 12.7 ㎜(0.5 in.) at the latch location.

(g) Door frames to be evaluated with doors shall remain securely fastened to the wall on all sides and shall not reveal through-openings between frame and doors or between frame and adjacent wall.

3.5 Hose stream test was conducted immediately following the fire endurance test. The hose stream was delivered through a 64.5 ㎜(2.5 in.) hose discharge equipped with a 28.6 ㎜(1-1/8 in.) discharge tip of the standard-tapper, smooth-bore pattern without shoulder at the orifice. The water pressure was 310 KPa(45 psi) at the base of the nozzle and duration of application in seconds per square meter of exposed area was 32 s/㎡(3 s/ft^2).
The tip of the nozzle was located 6 m(20 ft) from and on a line normal to the center of the test door.

4. CONSTRUCTION OF THE TEST SPECIMEN

4.1 The overall dimensions of the fire door including the door frame were 1,049 ㎜ width, 2,255 ㎜ height and 100 ㎜ thickness.

4.2 The drawings, illustrated in Appendix 1 which based upon the test specimen and informations provided by SAMHOON Machinery Company show the dimensions and details of the specimen construction and the thermocouple positions.

5. PROCEDURE OF TEST

5.1 The test specimen was mounted into a restraint frame with a refractory concrete lined steel frame and installed in the furnace to be the door opened toward the furnace.

5.2 The frame containing the test specimen was set on the front of the light oil-fired vertical furnace.

5.3 The furnace was controlled by readings of nine thermocouples located in the vertical furnace chamber as shown in Appendix 1.
The hot junction of each thermocouple was located 152 ㎜(6 in.) from the exposed face of the specimen.

5.4 The pressure controller should be operated such that a pressure of zero is established at a height of 500 ㎜ above the notional floor level to the specimen. And the pressure within the furnace should be controlled within ±5 Pa by 5 minute from the start of the test, within ±3 Pa by 10 minute by the pressure relative to the pressure outside the furnace at the same height.

5.5 To measure the temperature rise on the unexposed face of the specimen, five thermocouples were placed on the unexposed face of the specimen.

5.6 During the fire test, the deflections were measured at each part of the fire door.

5.7 Observations were made on the all the behaviour of the test specimen during the fire endurance test.

5.8 The hose stream test was conducted after the fire endurance test.

6. RESULT OF TEST

6.1 The actual time/temperature curve is shown in Appendix 2.
The percentage difference in the areas under the standard time/temperature curve and the actual time/temperature curve is shown in Appendix 2-2.
The percentage difference satisfied the tolerance for the percentage difference of UL 10B-1990.

6.2 The temperature rise on the unexposed face of the specimen during the fire test measured as a reference data.(See Appendix 4)

6.3 The deflections of the door assembly during the fire test were as given in Table 2.(See Appendix 3)
The measurements for the direction perpendicular to the plane of the door after hose stream test and the separation at the latch location worked with hand-operated.

Table 2.

Classification	Tolerance Limits	Max. deflection	Note
Direction perpendicular to the plane of the door	During 90 minutes : no more than 45 ㎜(1.77 in.)	43.3 ㎜(1.70 in.)	Door Thickness : 45 ㎜(1.77 in.)
	During the entire period : no more than 67.5 ㎜(2.66 in.)	44.0 ㎜(1.73 in.) ; after stream test	
Separation at the latch location	12.7 ㎜(0.5 in.)	≤ 12.7 ㎜	

6.4 During the fire endurance test and hose-stream test, there was no openings anywhere through the test specimen.(See Appendix 5, 6)

7. CONCLUSION

As the result of the 3 hours fire endurance and hose stream tests for the fire door applied by SAMHOON Machinery Company in accordance with the UL 10B-1990(Fire Tests of Door Assemblies), the test specimen was met the conditions of acceptance the fire rating(3 Hours) specified in the test standard.

Tested and reported by :

Wang Namwoong
Project Engineer
Fire Resistance Lab.

Reviewed by :

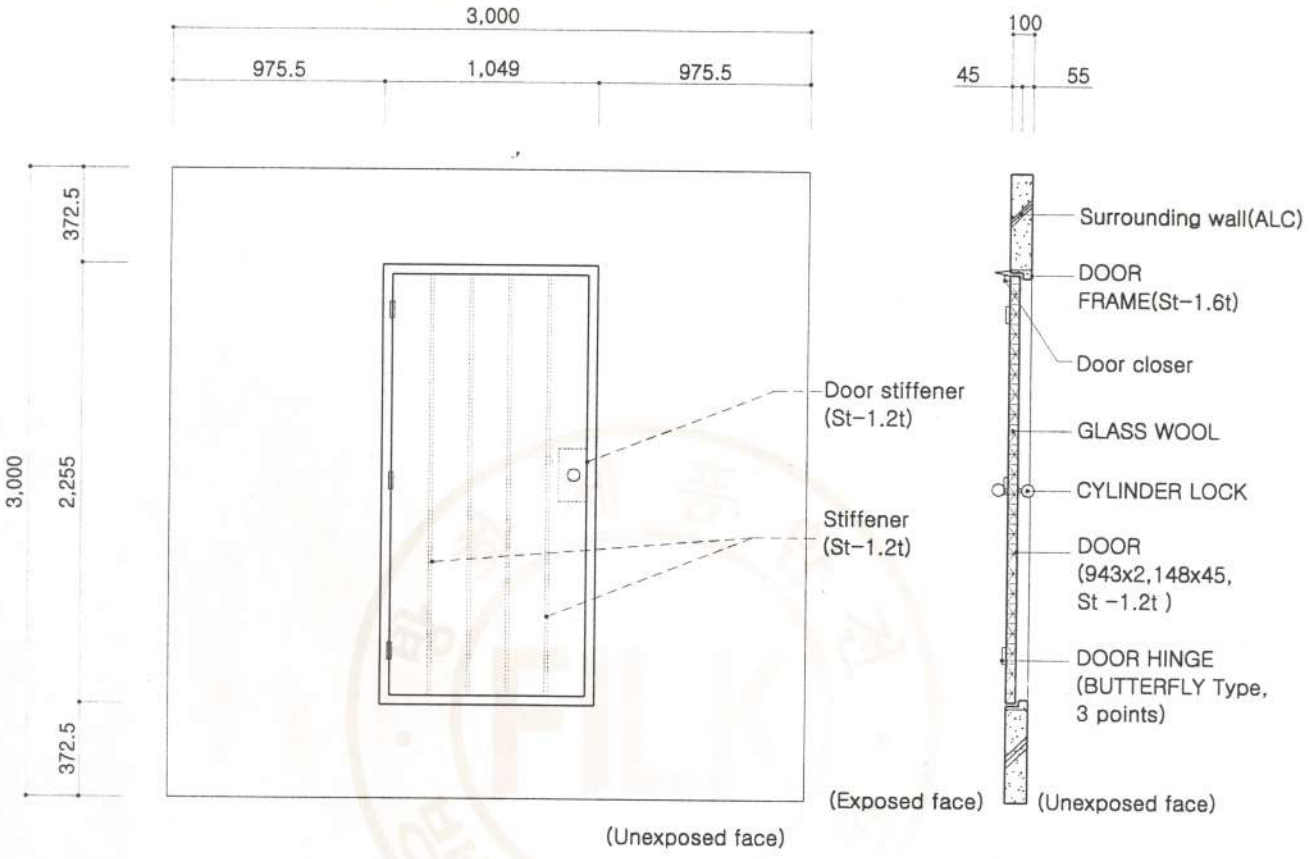
Kim Yeongoo
General Manager
Construction Division

LIST OF APPENDIX

Appendix 1. DRAWINGS OF TEST SPECIMEN

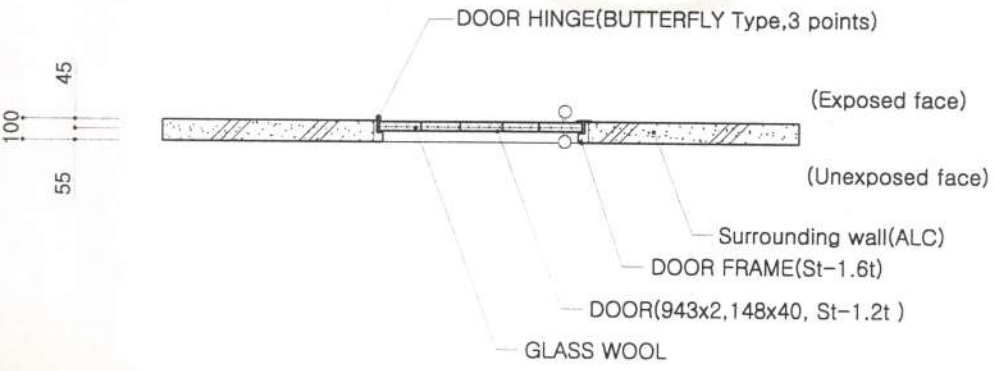
1-1 Construction of the test specimen

(Unit : mm)



ELEVATION

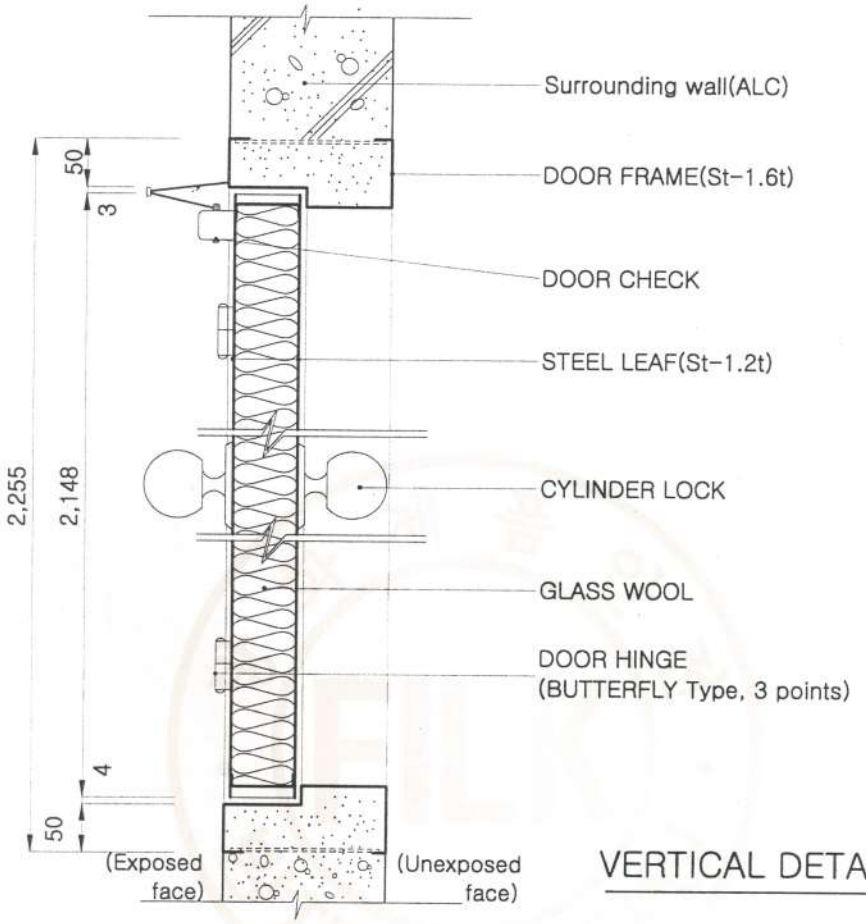
VERTICAL SECTION



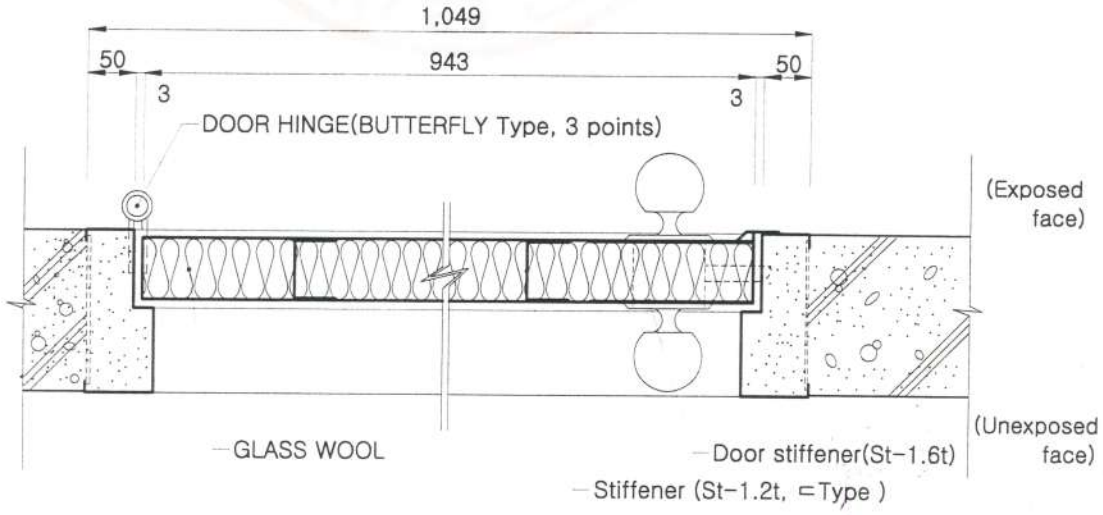
HORIZONTAL SECTION

1-2 Construction details

(Unit : mm)



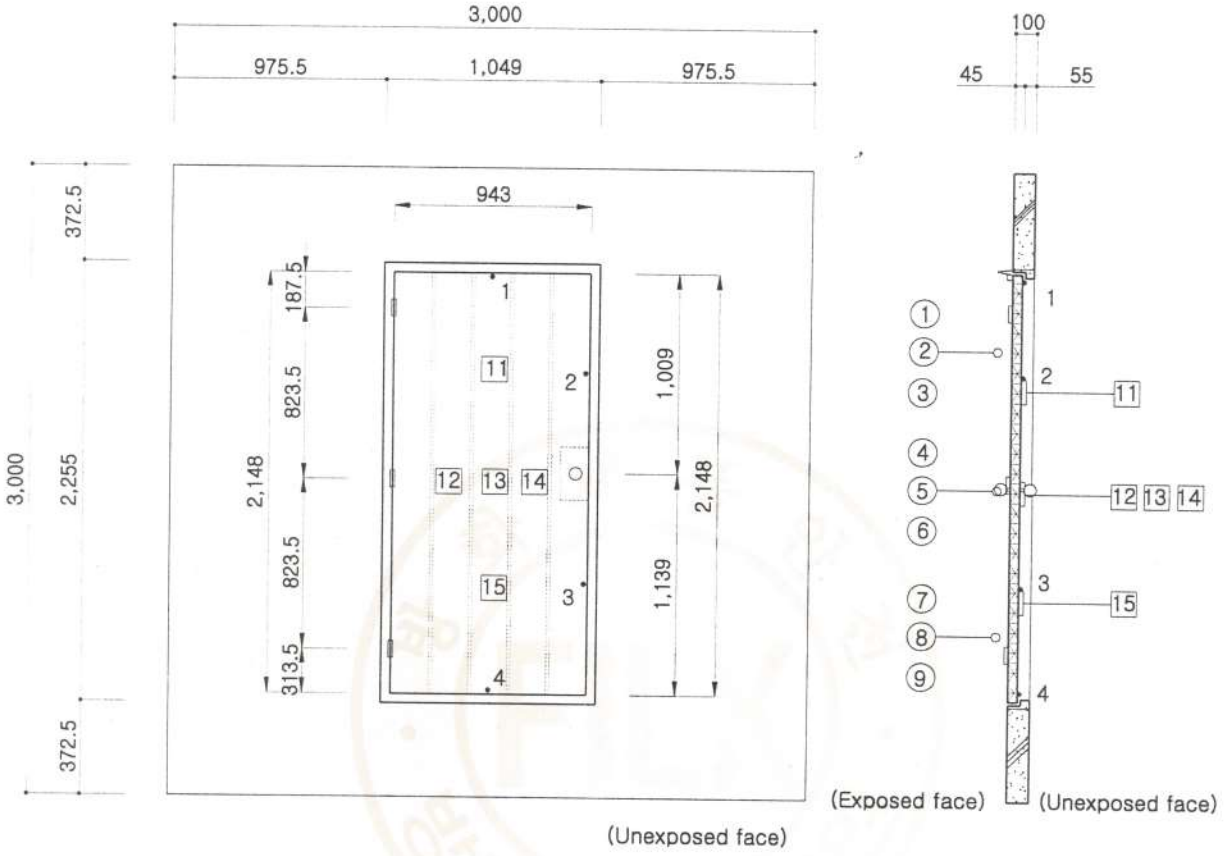
VERTICAL DETAIL



HORIZONTAL DETAIL

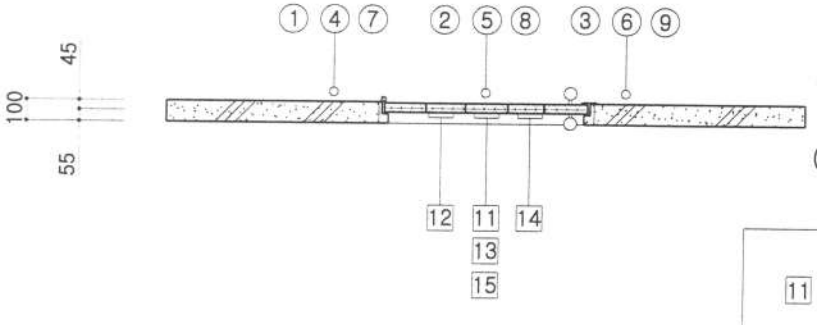
1-3 Drawing of the measurement locations

(Unit : mm)



ELEVATION

VERTICAL SECTION



HORIZONTAL SECTION

INDEX

11 ~ 15	: Measurement location of the temperature on the unexposed face
① ~ ⑨	: Measurement location of the furnace temperature
1● ~ 4●	: Measurement location of deflections

Appendix 2. HEATING TEMPERATURE

2-1 Heating temperature curves

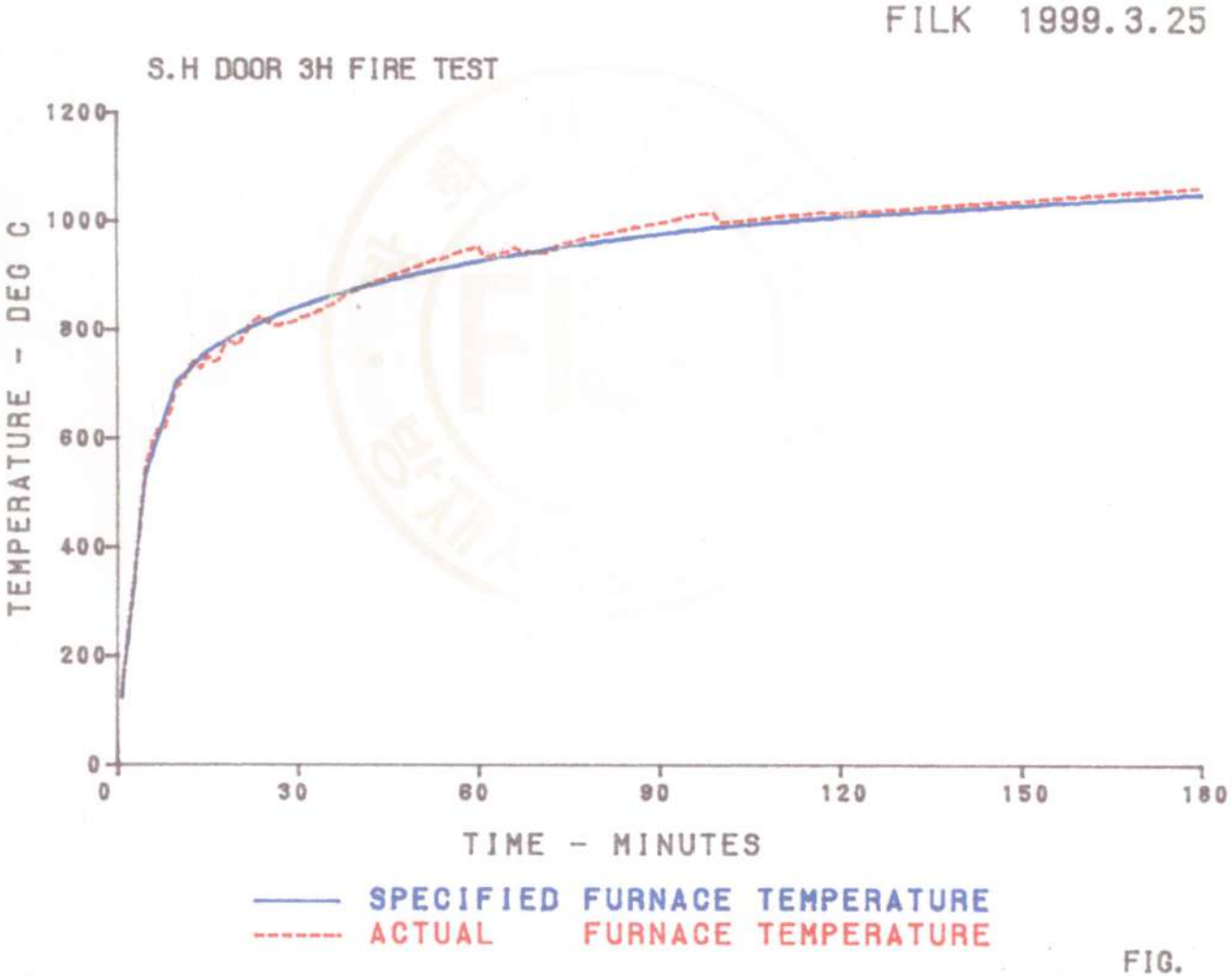


FIG.

2-2 Percentage difference in the areas under the curves

FILK 1999.3.25 S.H DOOR 3H FIRE TEST

TIME	ASTM FURNACE TEMP.	ACTUAL FURNACE TEMP.	AREA UNDER STANDARD CURVE	AREA UNDER ACTUAL CURVE	DIFFERENCE	TOLERANCE (+ or -)
(mins)	(Deg C)	(Deg C)	(Deg C. Min)	(Deg C. Min)	(%)	(%)
0	20	10				
1	127	138				
2	227	238				
3	331	339				
4	434	453				
5	538	553				
6	571	593				
7	604	618				
8	638	619				
9	671	655				
10	704	696				
12	726	730				
14	749	729				
16	767	740				
18	781	774				
20	795	770				
22	805	810				
24	816	828				
26	825	809				
28	834	814				
30	843	821				
35	862	845				
40	878	877				
45	892	899				
50	905	919				
55	916	937				
60	927	956	45741	45734	-0.01	10.00
65	937	945				
70	946	943				
75	955	963				
80	963	976				
85	971	988				
90	978	999				
95	985	1011				
100	991	998				
105	996	1004				
110	1001	1011				
115	1006	1017				
120	1010	1018	103028	103745	0.70	7.50
130	1017	1024				
140	1024	1033				
150	1031	1040				
160	1038	1048				
170	1045	1057				
180	1052	1064	163691	164984	0.79	5.00

Appendix 3. DEFLECTION MEASUREMENT

FILK 1999.3.25 S.H DOOR 3H FIRE TEST

TIME (mins)	CHAN 1	CHAN 2	CHAN 3	CHAN 4
0.00	0.0	0.0	0.0	0.0
5.00	2.5	6.7	7.1	7.1
10.00	9.7	17.2	20.5	14.7
15.00	11.5	19.3	35.3	20.0
20.00	11.5	20.0	35.8	20.2
25.00	14.0	20.8	43.3	22.4
30.00	14.0	20.8	40.3	20.8
35.00	14.1	21.5	40.0	20.6
40.00	14.0	21.8	39.9	20.5
45.00	14.0	22.1	39.9	20.8
50.00	14.1	22.0	40.3	20.8
55.00	14.1	22.1	41.0	20.8
60.00	14.0	22.1	42.1	20.8
65.00	14.1	22.1	43.0	20.9
70.00	14.1	21.2	41.8	20.0
75.00	14.1	21.2	41.7	19.9
80.00	14.3	21.2	41.7	19.9
85.00	14.1	21.2	41.7	20.0
90.00	14.1	21.2	41.7	20.0
95.00	14.3	21.2	42.0	20.0
100.00	13.7	21.2	42.5	20.0
105.00	14.1	21.2	42.8	20.3
110.00	14.1	21.2	43.3	20.3
115.00	14.0	21.2	44.1	20.3
120.00	14.1	21.4	44.2	20.2
125.00	14.1	20.9	43.7	19.8
130.00	14.1	20.8	43.7	19.8
135.00	14.1	20.5	43.7	19.8
140.00	14.1	20.5	43.7	19.8
145.00	14.1	20.3	43.7	19.8
150.00	14.1	20.3	43.7	19.8
155.00	14.0	20.3	43.5	19.8
160.00	14.1	20.2	43.7	19.8
165.00	14.1	20.2	43.7	19.8
170.00	14.0	20.3	43.7	19.8
175.00	14.0	20.3	43.7	19.8
180.00	14.0	20.2	43.7	19.8

Appendix 4. UNEXPOSED FACE TEMPERATURE RISE (REFERENCE DATA)

FILK 1999.3.25 S.H DOOR 3H FIRE TEST

Initial Temp : 9 Deg C

TIME (mins)	CHAN 11	CHAN 12	CHAN 13	CHAN 14	CHAN 15	AVERAGE (deg)	MAXIMUM (deg)
0.00	0	0	0	0	0	0	0
5.00	0	0	0	1	0	0	1
10.00	2	6	2	2	1	2	6
15.00	10	28	15	17	12	16	28
20.00	28	57	39	48	34	41	57
25.00	55	85	69	91	68	74	91
30.00	84	113	96	110	98	100	113
35.00	105	132	115	126	117	119	132
40.00	120	144	128	137	132	132	144
45.00	131	152	138	147	145	143	152
50.00	140	162	148	156	157	152	162
55.00	147	168	156	164	167	160	168
60.00	153	174	163	171	174	167	174
65.00	158	181	169	177	180	173	181
70.00	164	185	172	179	178	175	185
75.00	164	182	170	175	175	173	182
80.00	165	183	170	174	174	173	183
85.00	166	185	170	175	174	174	185
90.00	168	186	170	175	175	175	186
95.00	169	186	171	177	176	176	186
100.00	172	190	174	179	180	179	190
105.00	175	194	177	181	182	182	194
110.00	178	198	179	184	186	185	198
115.00	182	201	182	188	190	189	201
120.00	184	204	185	190	191	191	204
125.00	184	203	185	191	191	191	203
130.00	182	202	184	190	191	190	202
135.00	182	204	184	190	193	191	204
140.00	183	204	186	192	193	192	204
145.00	184	205	187	193	194	192	205
150.00	185	207	188	194	195	194	207
155.00	186	208	188	194	196	194	208
160.00	188	210	190	195	197	196	210
165.00	189	212	191	196	199	197	212
170.00	190	213	192	197	200	199	213
175.00	191	213	193	199	202	199	213
180.00	192	215	194	200	204	201	215

Appendix 5. OBSERVATIONS FOR TEST SPECIMEN

TIME(min)	OBSERVATION
00 : 00	Test commenced.
05 : 00	Smoke began to be leaked from the unexposed face of the test specimen and the specimen began to be bent toward the furnace chamber.
17 : 00	The unexposed face of the test specimen began to be discolored
114 : 00	The unexposed face of the test specimen began to be red-hot.
180 : 00	The test was terminated. There was no special appearance.

Appendix 6. PHOTOGRAPHS

[Photo 1] Exposed face of the specimen before fire test.

[Photo 2] Exposed face of the specimen after fire test.

[Photo 3] Unexposed face of the specimen before fire test.

[Photo 4] Unexposed face of the specimen after fire test

[Photo 5] View of hose stream test

[Photo 6] The specimen after hose stream test