MOCK-UP TEST REPORT
PERFORMANCE TEST OF BLAST DOOR

CNC
TESTING LABORATORY

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TESTING LABORATORY

#1720, SUSEO HYUNDAI-VENTURE VILLE, 713
SUSEO-DONG, GANGNAM-KU, SEOUL, KOREA
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안성 시험소 TEL:(031) 656-6761 /FAX:656-6785

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1. GENERAL

1-1. PROJECT : PERFORMANCE TEST OF BLAST DOOR
1-2. PLACE OF TEST : CNC TESTING LABORATORY
1-3. DATE OF TEST : JUNE 25th. 08. 10:45 A.M. ~ 12:00 P.M. (DOUBLE SWING DOOR)
JUNE 25th. 08. 7:20 P.M. ~ 8:10 P.M. (SINGLE SWING DOOR)
1-4. DATE OF REPORT : JULY 4th. 08.
1-5. CLIENT : SAM HOON CO.,LTD.

2. WEATHER CONDITION

2-1. WEATHER : CLEAR
2-2. TEMPERATURE : 27 deg.C
2-3. HUMIDITY : 49 %
2-4. ATMOSPHERIC PRESSURE : 996 HPa

3. PARTICIPANTS

SEUNG-HYUN BAEK (TEAM LEADER) : KRCC
WOO-SUNG KIM (DIRECTOR) : SAM HOON CO.,LTD.
JIN-HEE KIM (MANAGER) : CNC
JIN-SE CHUNG (PRESIDENT) : CNC

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4. INSTALLATION SCHEDULE OF SPECIMEN

4-1. INSTALLATION OF CHAMBER : MAY 9th. 08.
4-2. INSTALLATION OF SPECIMEN : JUNE 24th. 08.
4-3. CHAMBER CLOSING : JUNE 25th. 08.

5. SPECIMEN DESCRIPTION

5-1. SPECIMEN DIMENSION : 1,600 mm (W) × 2,200 mm (H) - DOUBLE SWING DOOR
1,000 mm (W) × 2,200 mm (H) - SINGLE SWING DOOR

5-2. MATERIAL : DOOR FRONT PLATE - THK 6 mm STEEL
DOOR REAR PLATE - THK 3.2 mm STEEL
FRAME - THK 3.2 mm STEEL
INSULATION - CERAKWOOL

6. TEST SPECIFICATION

6-1. AIR INFILTRATION TEST : ASTM E 283
Standard Test Method For Determining Rate Of Air Leakage
Through Exterior Windows, Curtain Walls, And Doors
Under Specified Pressure Differences Across The Specimen

6-2. STRUCTURAL PERFORMANCE TEST
: ASTM E 330
Standard Test Method For Structural Performance Of Exterior Windows,
Curtain Walls, And Doors By Uniform Static Pressure Difference

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7. METHOD & RESULT OF TEST

7-1. DOUBLE SWING DOOR

7-1-1. DOOR OPERATION

5 (FIVE) CYCLES OF OPEN, CLOSING AND LOCKING FOR DOOR

SPECIFICATION : NO FAILURE

TEST RESULTS ARE SATISFACTORY.

7-1-2. PRE-LOAD

AT +150 kg/m^2 STATIC PRESSURE
(POSITIVE WIND PRESSURE FOR 10 SECONDS)

SPECIFICATION : NO FAILURE

TEST RESULTS ARE SATISFACTORY.

7-1-3. STATIC AIR INFILTRATION TEST : ASTM E 283 - PHASE I

AT +7.6 kg/m^2 STATIC PRESSURE

7-1-3-1 ; DOOR AREA

FILM ON	:	3.2 cfm (AIR LEAKAGE AT CHAMBER)
FILM OFF	:	5.2 cfm
=> AIR LEAKAGE AT DOOR	:	2.0 cfm

SPECIFICATION : DOOR는 0.3 cfm/ft^2 (0.0915 m^3/min/m^2) 이하

ALLOWABLE : 33.96 ft^2 × 0.3 cfm/ft^2 = 10.1 cfm > 2.0 cfm

TEST RESULTS ARE SATISFACTORY.

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7-1-4. STATIC AIR INFILTRATION TEST : ASTM E 283 - PHASE II

AT +30.4 kg/m^2 STATIC PRESSURE

7-1-4-1 ; DOOR AREA

FILM ON	:	7.5 cfm (AIR LEAKAGE AT CHAMBER)
FILM OFF	:	12.5 cfm
=> AIR LEAKAGE AT DOOR	:	5.0 cfm

SPECIFICATION : DOOR는 0.3 cfm/ft^2 (0.0915 m^3/min/m^2) 이하

ALLOWABLE : 33.96 ft^2 × 0.3 cfm/ft^2 = 10.1 cfm > 5.0 cfm

TEST RESULTS ARE SATISFACTORY.

7-1-5. STRUCTURAL PERFORMANCE BY STATIC PRESSURE : ASTM E 330

HELD FOR TEN(10) SECONDS FOR LOADS.

DEFLECTIONS AND PERMANENT SET WILL BE MEASURED WITH DIGITAL INDICATORS.

+3044 kg/m^2

+6088 kg/m^2

+9130 kg/m^2

SPECIFICATION : NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR
BEING ABLE TO OPERATE THE DOOR AFTER PRESSURE BUILD-UP

TEST RESULTS ARE SATISFACTORY.

REF. : TABLE 7-1-5-1, 7-1-5-2, 7-1-5-3, 7-1-5-4

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TABLE 7-1-5-1

TEST PRESSURE = +3044 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	3.89 / 0.32			
2	DOOR LEAF	CENTER	9.35 / 0.45	5.57	0.03	2070
3	DOOR LEAF	BOTTOM	3.67 / 0.53			
4						
5						
6						

△/PS : DEFLECTION/PERMANENT SET
NR : NO READING
* : NET DEFLECTION

TABLE 7-1-5-2

TEST PRESSURE = +6088 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	5.50 / 0.33			
2	DOOR LEAF	CENTER	15.15 / 0.86	9.85	0.50	2070
3	DOOR LEAF	BOTTOM	5.09 / 0.39			
4						
5						
6						

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TABLE 7-1-5-3

TEST PRESSURE = 9130 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	7.68 / 1.01			
2	DOOR LEAF	CENTER	21.40 / 1.81	13.96	0.61	2070
3	DOOR LEAF	BOTTOM	7.20 / 1.40			
4						
5						
6						

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7-2. SINGLE SWING DOOR

7-2-1. DOOR OPERATION

5 (FIVE) CYCLES OF OPEN, CLOSING AND LOCKING FOR DOOR

SPECIFICATION : NO FAILURE

TEST RESULTS ARE SATISFACTORY.

7-2-2. PRE-LOAD

AT +150 kg/m^2 STATIC PRESSURE
(POSITIVE WIND PRESSURE FOR 10 SECONDS)

SPECIFICATION : NO FAILURE

TEST RESULTS ARE SATISFACTORY.

7-2-3. STATIC AIR INFILTRATION TEST : ASTM E 283 - PHASE I

AT +7.6 kg/m^2 STATIC PRESSURE

7-2-3-1 ; DOOR AREA

FILM ON	:	3.0 cfm (AIR LEAKAGE AT CHAMBER)
FILM OFF	:	3.5 cfm
=> AIR LEAKAGE AT DOOR	:	0.5 cfm

SPECIFICATION : DOOR는 0.3 cfm/ft^2 (0.0915 m^3/min/m^2) 이하

ALLOWABLE : 20.40 ft^2 × 0.3 cfm/ft^2 = 6.1 cfm > 0.5 cfm

TEST RESULTS ARE SATISFACTORY.

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7-2-4. STATIC AIR INFILTRATION TEST : ASTM E 283 - PHASE II

AT +30.4 kg/m^2 STATIC PRESSURE

7-2-4-1 ; DOOR AREA

FILM ON	:	7.5 cfm (AIR LEAKAGE AT CHAMBER)
FILM OFF	:	8.5 cfm
=> AIR LEAKAGE AT DOOR	:	1.0 cfm

SPECIFICATION : DOOR는 0.3 cfm/ft^2 (0.0915 m^3/min/m^2) 이하

ALLOWABLE : 20.40 ft^2 × 0.3 cfm/ft^2 = 6.1 cfm > 1.0 cfm

TEST RESULTS ARE SATISFACTORY.

7-2-5. STRUCTURAL PERFORMANCE BY STATIC PRESSURE : ASTM E 330

HELD FOR TEN(10) SECONDS FOR LOADS.

DEFLECTIONS AND PERMANENT SET WILL BE MEASURED WITH DIGITAL INDICATORS.

+3044 kg/m^2

+6088 kg/m^2

+9130 kg/m^2

SPECIFICATION : NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR
BEING ABLE TO OPERATE THE DOOR AFTER PRESSURE BUILD-UP

TEST RESULTS ARE SATISFACTORY.

REF. : TABLE 7-2-5-1, 7-2-5-2, 7-2-5-3, 7-2-5-4

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TABLE 7-2-5-1

TEST PRESSURE = +3044 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	5.46 /-0.03			
2	DOOR LEAF	CENTER	7.96 / 0.02	3.57	0.12	2070
3	DOOR LEAF	BOTTOM	3.33 /-0.16			
4						
5						
6						

△/PS : DEFLECTION/PERMANENT SET
NR : NO READING
* : NET DEFLECTION

TABLE 7-2-5-2

TEST PRESSURE = +6088 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	9.17 / 1.28			
2	DOOR LEAF	CENTER	16.94 / 2.05	9.75	0.91	2070
3	DOOR LEAF	BOTTOM	5.21 / 1.00			
4						
5						
6						

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TABLE 7-2-5-3

TEST PRESSURE = 9130 kg/m^2 POSITIVE UNIT: mm

NO.	INDICATOR LOCATION	POS	△/PS	NET△	NET PS	SPAN
1	DOOR LEAF	TOP	12.39 / 1.63			
2	DOOR LEAF	CENTER	24.62 / 3.40	15.47	2.04	2070
3	DOOR LEAF	BOTTOM	5.92 / 1.09			
4						
5						
6						

△/PS : DEFLECTION/PERMANENT SET
NR : NO READING
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8. SUMMARY

TEST RESULTS OF PERFORMANCE TEST OF BLAST DOOR ARE AS FOLLOWS.

(1) DOUBLE SWING DOOR

1) BEFORE THE TEST, DOOR WAS OPERATED WELL.
2) THE TEST RESULT OF AIR INFILTRATION WAS WITHIN THE ALLOWABLE PER EACH PHASE.
3) AFTER THE PRESSURE WAS APPLIED TO 9130 kg/m^2 , THERE WERE NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR AND THE DOOR WAS OPERATED WELL.
   §. FOR REFERENCE, THE MAXIMUM DEFLECTION OF THE DOOR LEAF WAS 13.96 mm AND THE PERMANENT SET OF THE DOOR LEAF WAS 0.61 mm.

(2) SINGLE SWING DOOR

1) BEFORE THE TEST, DOOR WAS OPERATED WELL.
2) THE TEST RESULT OF AIR INFILTRATION WAS WITHIN THE ALLOWABLE PER EACH PHASE.
3) AFTER THE PRESSURE WAS APPLIED TO 9130 kg/m^2 , THERE WERE NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR AND THE DOOR WAS OPERATED WELL.
   §. FOR REFERENCE, THE MAXIMUM DEFLECTION OF THE DOOR LEAF WAS 15.47 mm AND THE PERMANENT SET OF THE DOOR LEAF WAS 2.04 mm.

PLEASE DO NOT HESITATE TO ASK TO LABORATORY WHEN YOU HAVE QUESTIONS ABOUT THIS TEST OR TEST REPORT.

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President CHUNG, JIN SE

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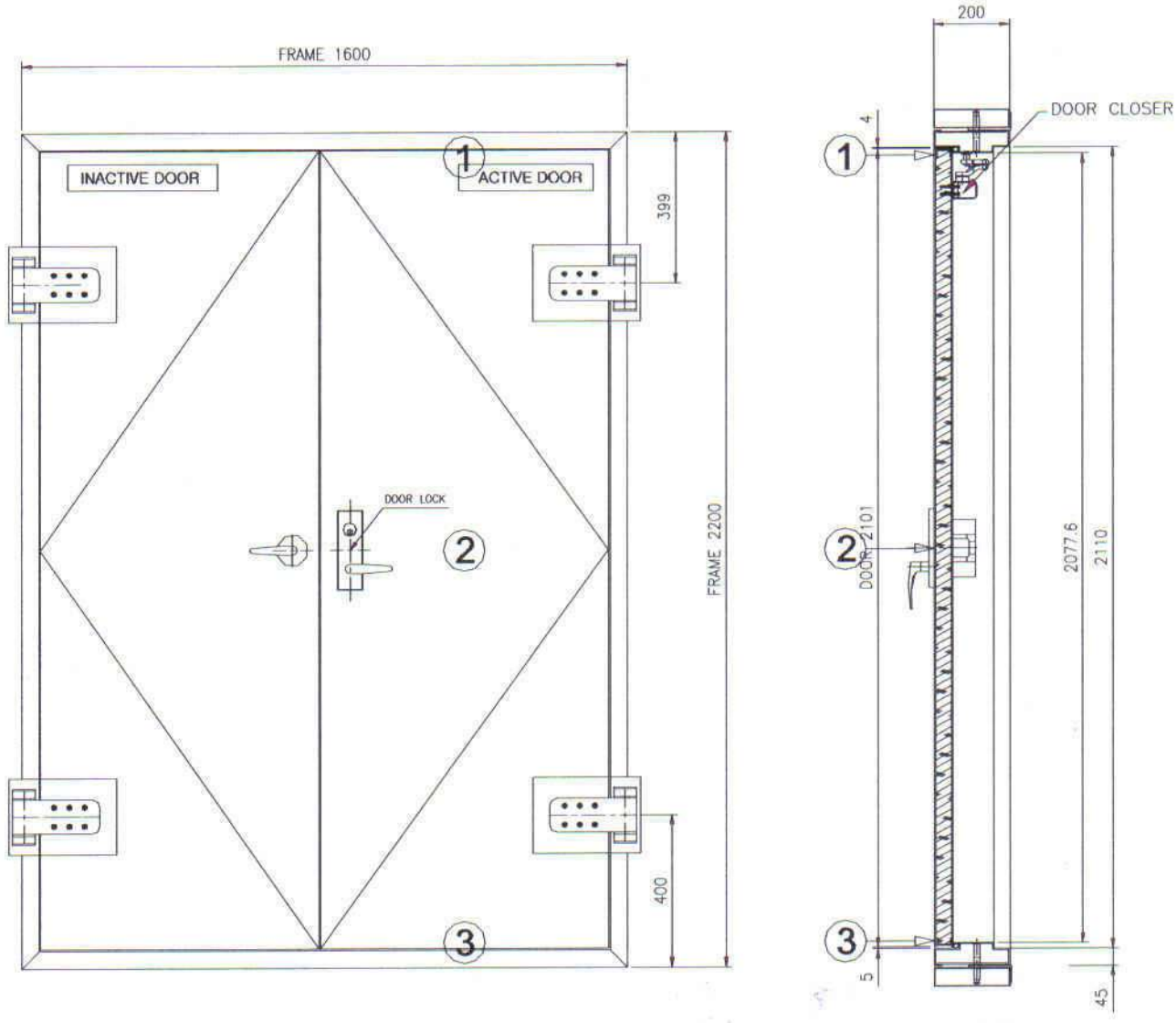
9. ELEVATION OF TRANSDUCER LOCATION

9-1. DOUBLE SWING DOOR



TRANSDUCER LOCATION FOR TEST MOCK-UP
EXTERIOR VIEW

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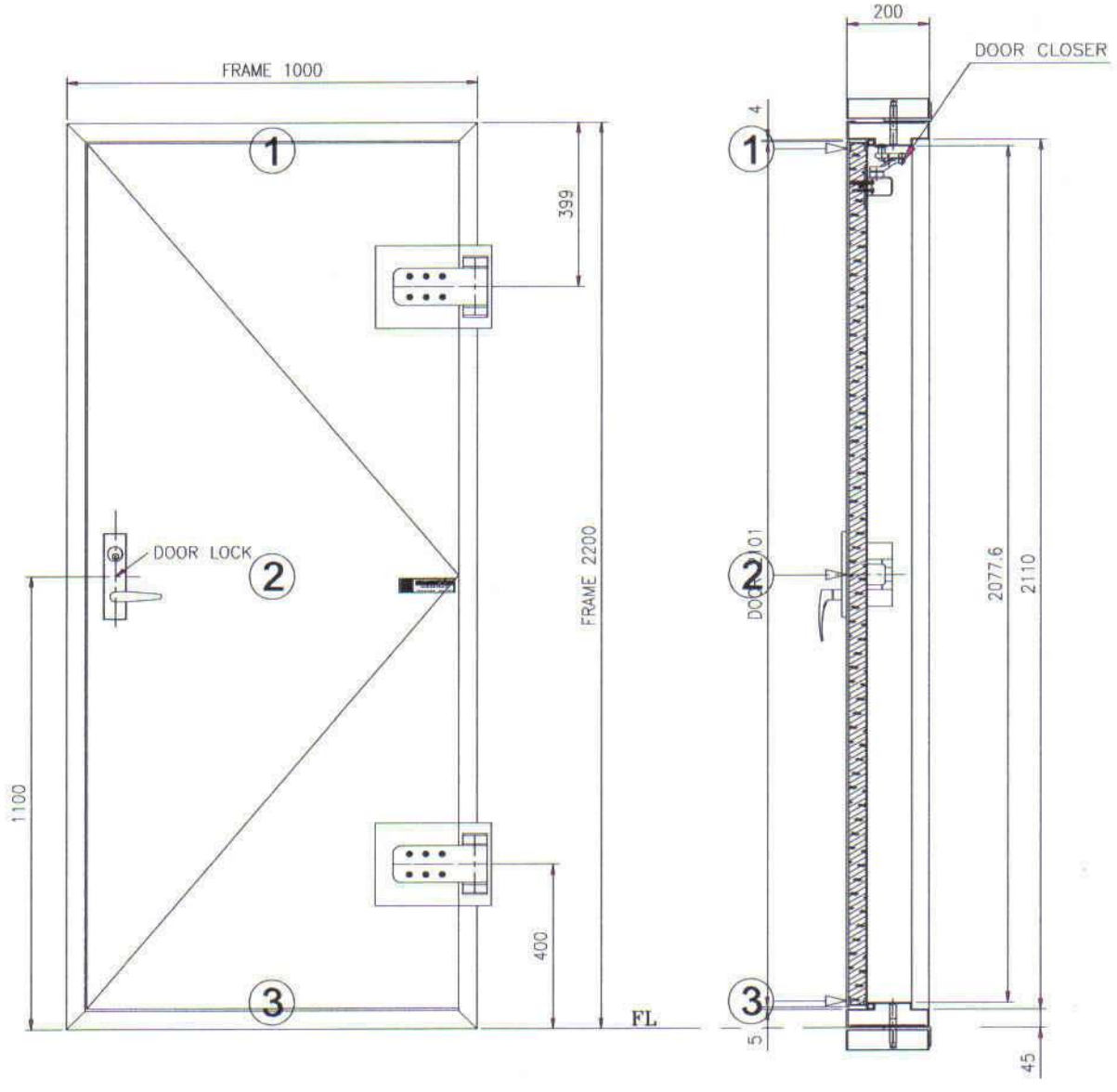
9-2. SINGLE SWING DOOR



TRANSDUCER LOCATION FOR TEST MOCK-UP

EXTERIOR VIEW

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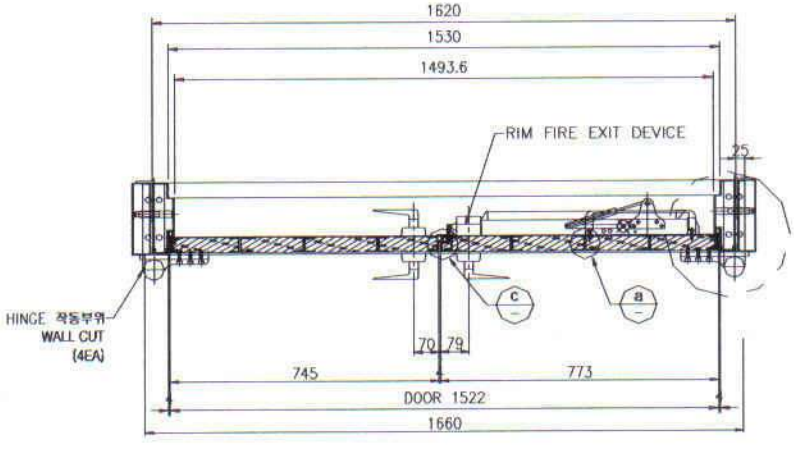
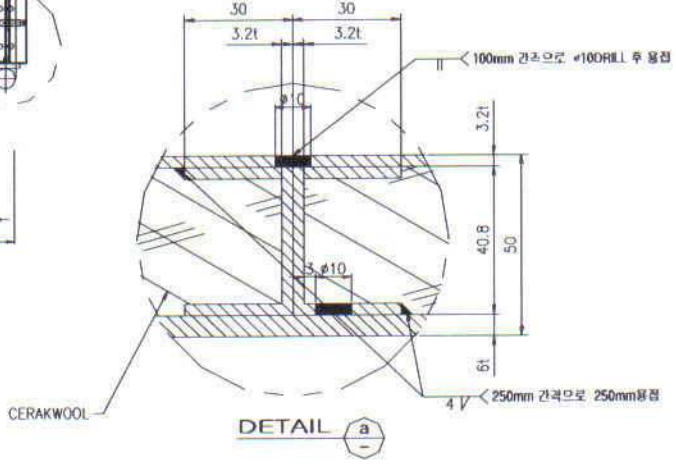
10. MOCK-UP DWG.

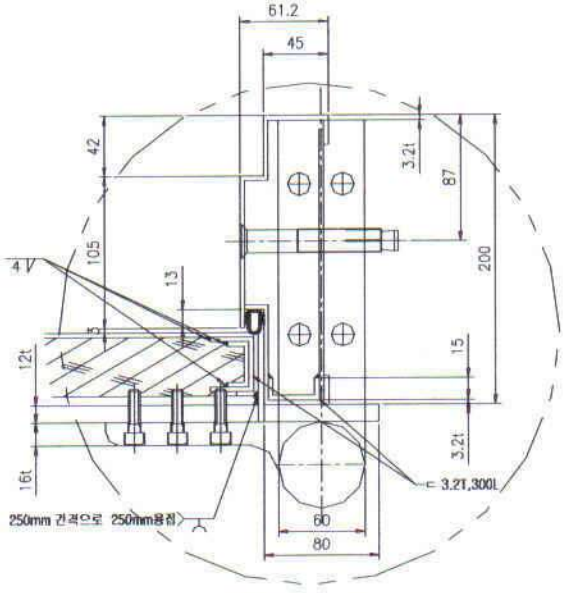
* REFER TO ADDITIONAL DETAIL OF MOCK-UP DWG.

10-1. HORIZONTAL SECTION I ; DOUBLE SWING DOOR

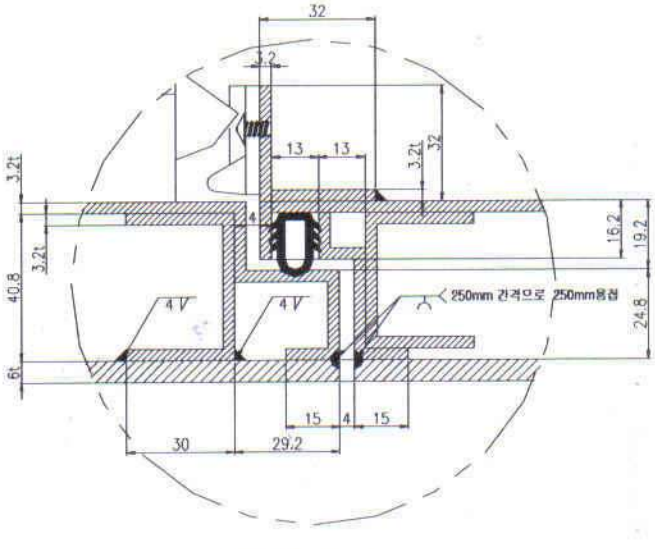




DETAIL (a)



DETAIL (b)



DETAIL (c)

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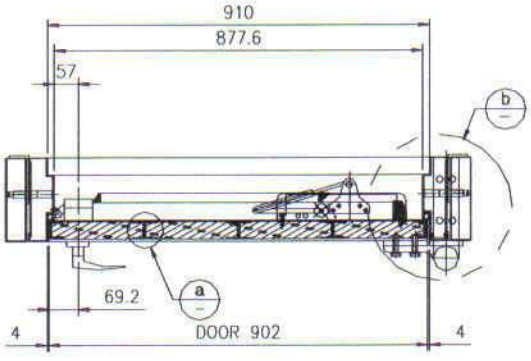
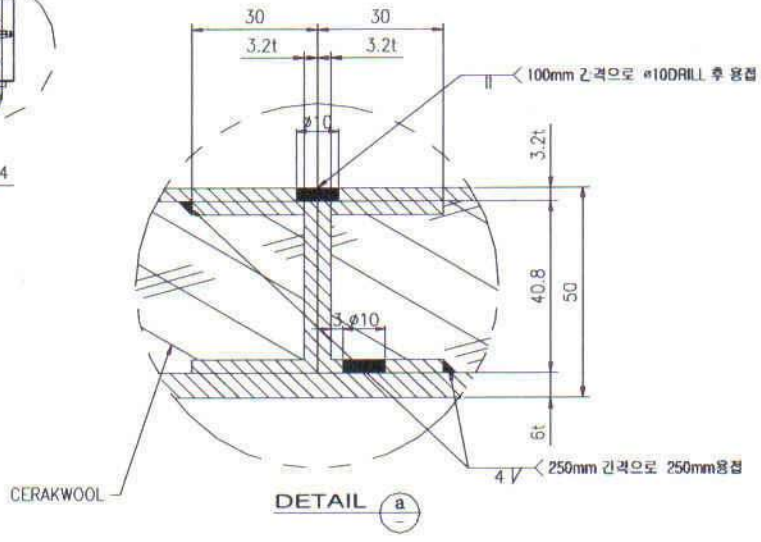
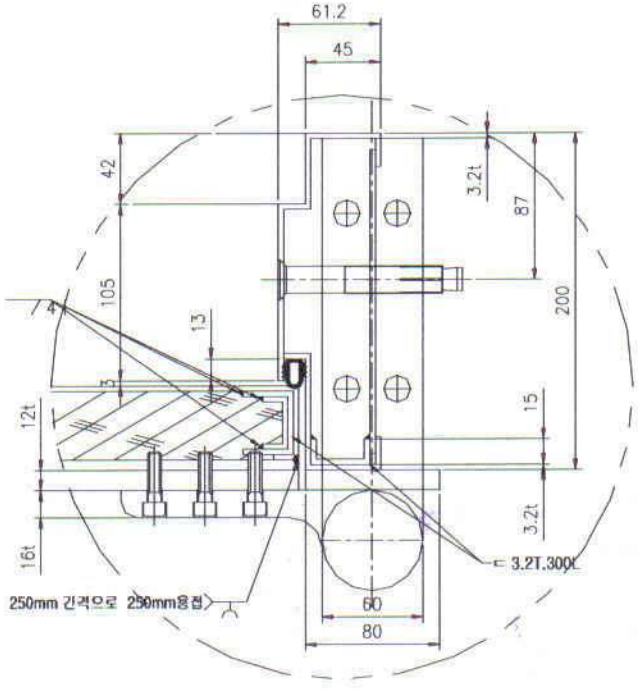
10-2. HORIZONTAL SECTION II ; SINGLE SWING DOOR





DETAIL a



DETAIL b

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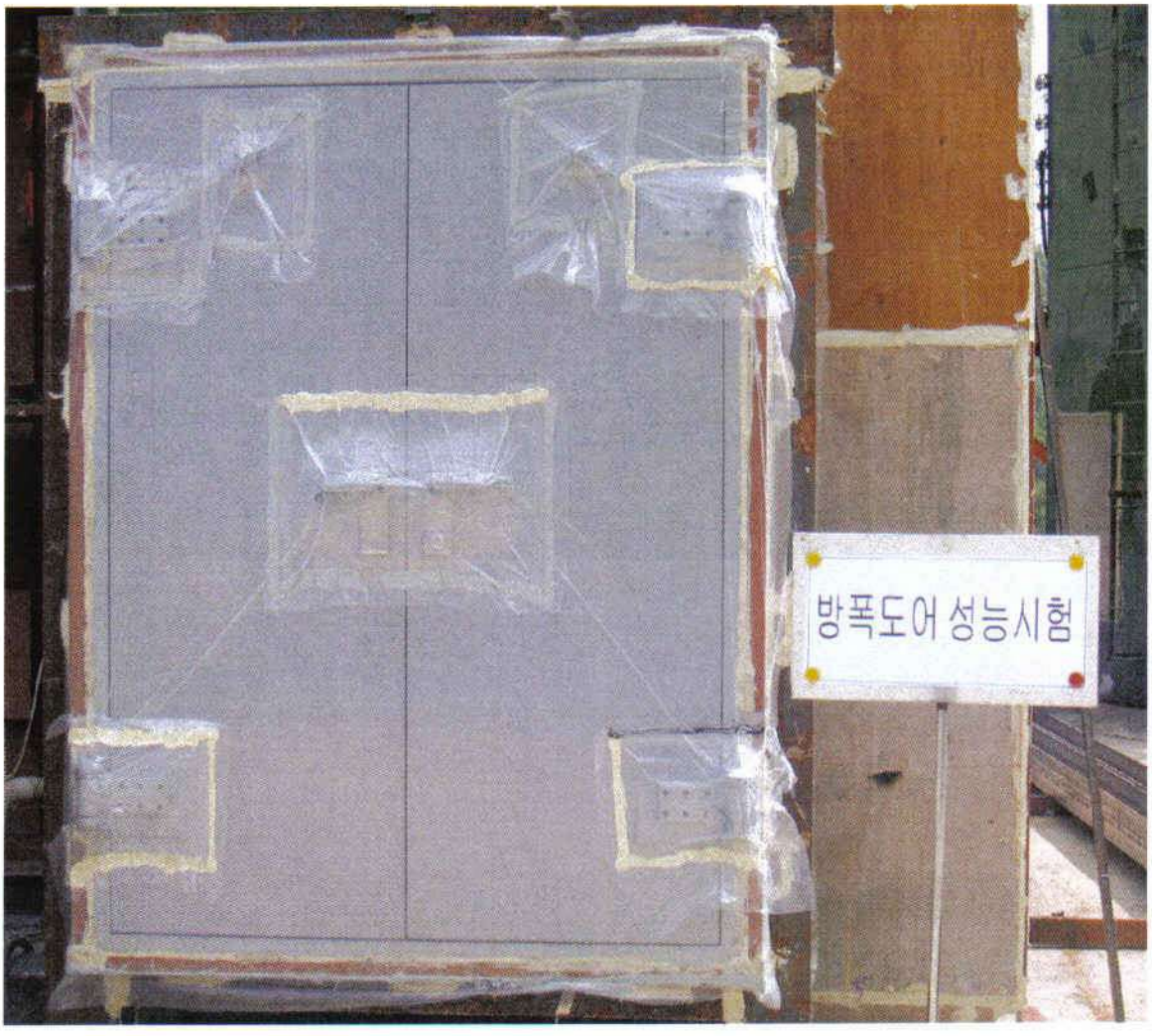
PHOTOS OF MOCK-UP TEST

1. A PANORAMIC PHOTO OF SPECIMEN

1-1. DOUBLE SWING DOOR



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1-2. SINGLE SWING DOOR

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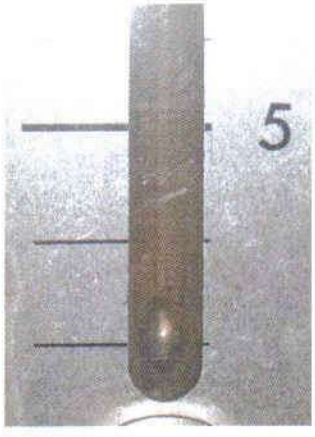
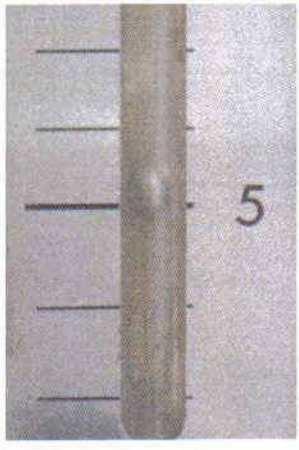
2. STATIC AIR INFILTRATION TEST ; ASTM E 283

2-1. DOUBLE SWING DOOR - PHASE I

△ AIR PRESSURE DIFFERENCE
7.6 kg/m^2 (= 0.3"H_2O)

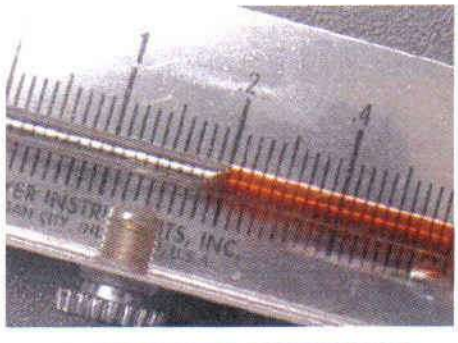


△ 3.2 cfm
(AIR LEAKAGE AT CHAMBER)

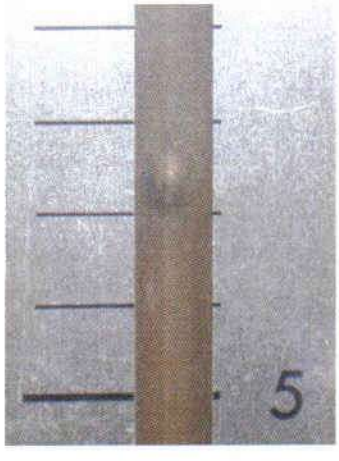


△ 5.2 cfm
(FILM OFF)

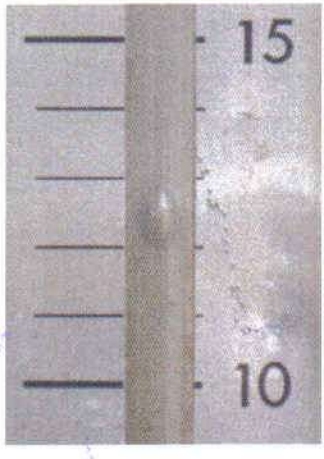
2-2. DOUBLE SWING DOOR - PHASE II



△ AIR PRESSURE DIFFERENCE
30.4 kg/m^2 (= 1.2"H_2O)



△ 7.5 cfm
(AIR LEAKAGE AT CHAMBER)



△ 12.5 cfm
(FILM OFF)

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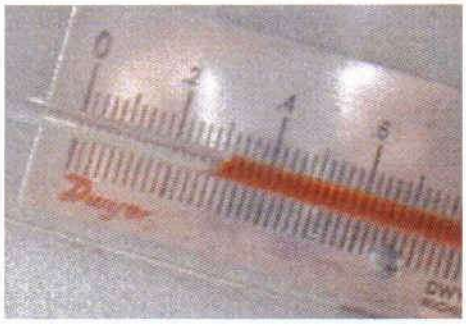
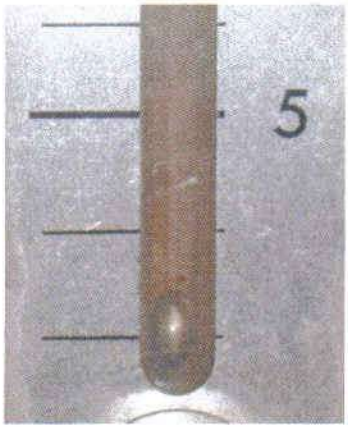
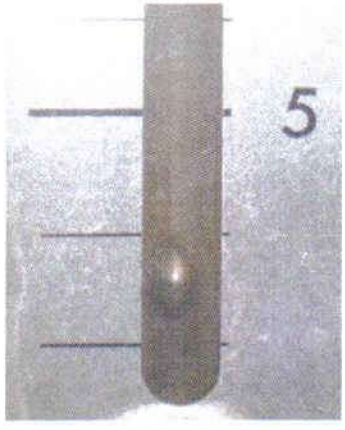
2-3. SINGLE SWING DOOR - PHASE I



△ AIR PRESSURE DIFFERENCE
7.6 kg/m^2 (= 0.3"H_2O)

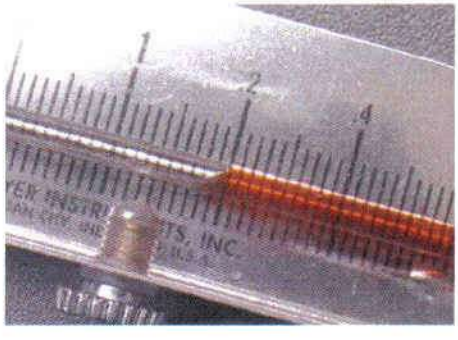


△ 3.0 cfm
(AIR LEAKAGE AT CHAMBER)

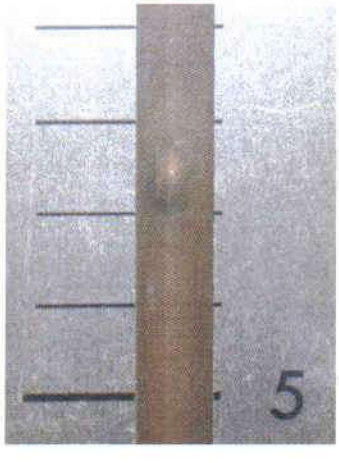


△ 3.5 cfm
(FILM OFF)

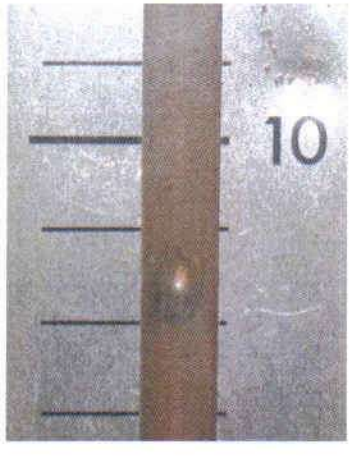
2-4. SINGLE SWING DOOR - PHASE II



△ AIR PRESSURE DIFFERENCE
30.4 kg/m^2 (= 1.2"H_2O)



△ 7.5 cfm
(AIR LEAKAGE AT CHAMBER)



△ 8.5 cfm
(FILM OFF)

#1720, SUSEO HYUNDAI-VENTURE VILLE, 713
SUSEO-DONG, GANGNAM-KU, SEOUL, KOREA
TEL : (02) 2040-7791
FAX : (02) 2040-7795
안성 시험소 TEL:(031) 656-6761 /FAX:656-6785

3. TRANSDUCER INSTALLATION

3-1. DOUBLE SWING DOOR

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3-2. SINGLE SWING DOOR

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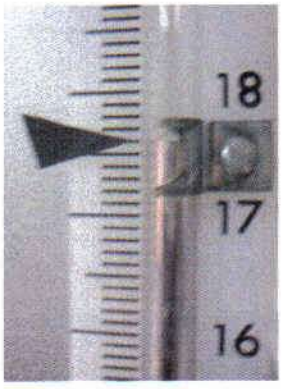
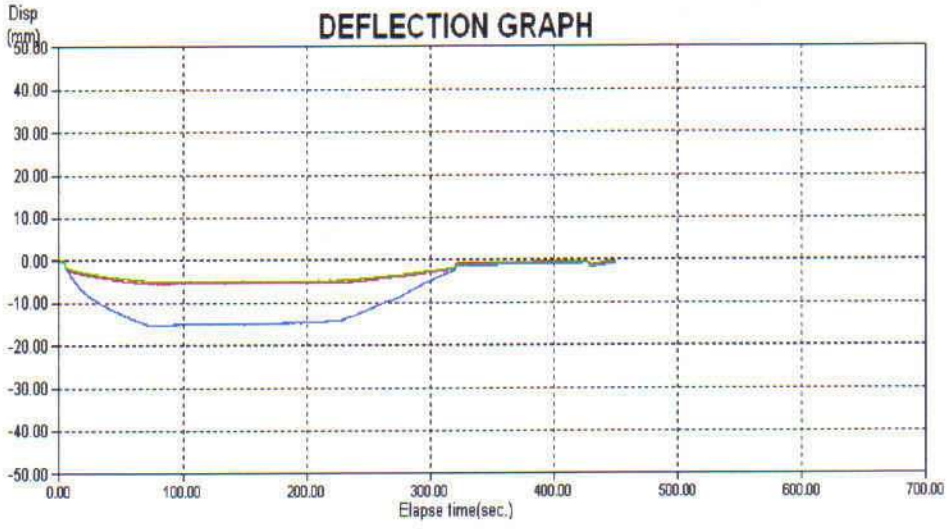
4. STRUCTURAL PERFORMANCE TEST BY STATIC PRESSURE (구조성능시험) ; ASTM E 330

4-1. DOUBLE SWING DOOR

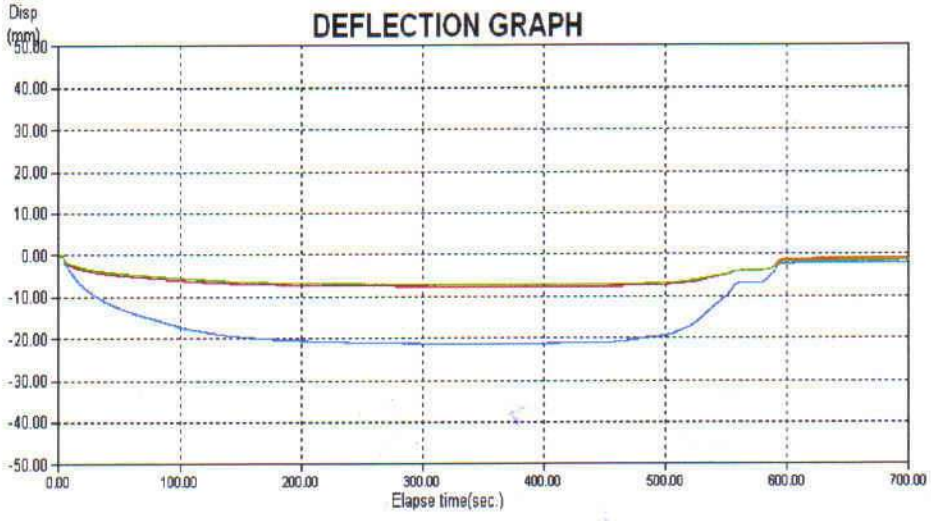


△ WIND LOAD
+ 6088 kg/m^2 (=17.6˝Hg)



△ MAX. DEFLECTION AND PERMANENT SET

△ WIND LOAD
+ 9130 kg/m^2 (=26.4˝Hg)



△ MAX. DEFLECTION AND PERMANENT SET

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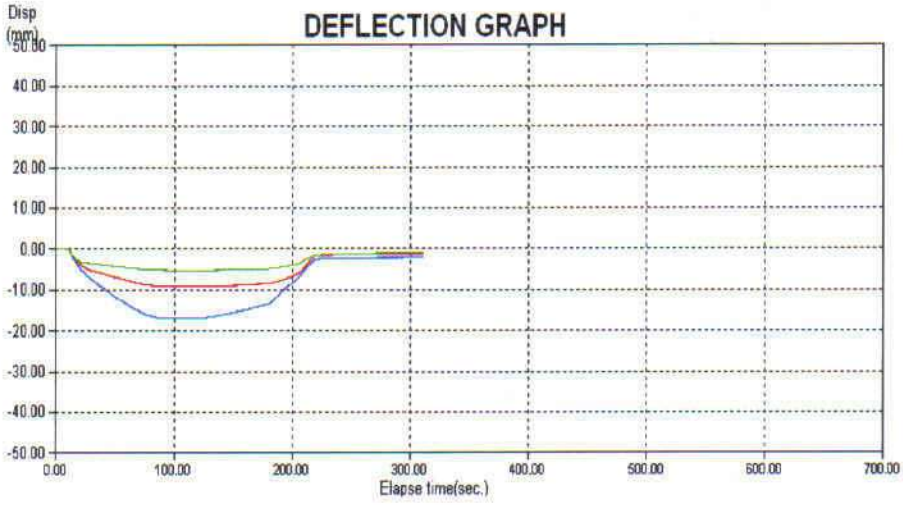
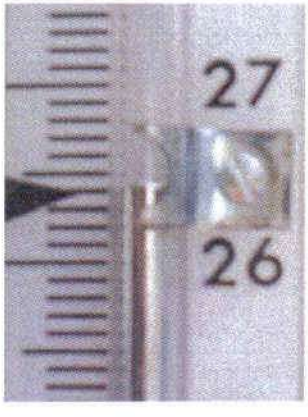
4-2. SINGLE SWING DOOR

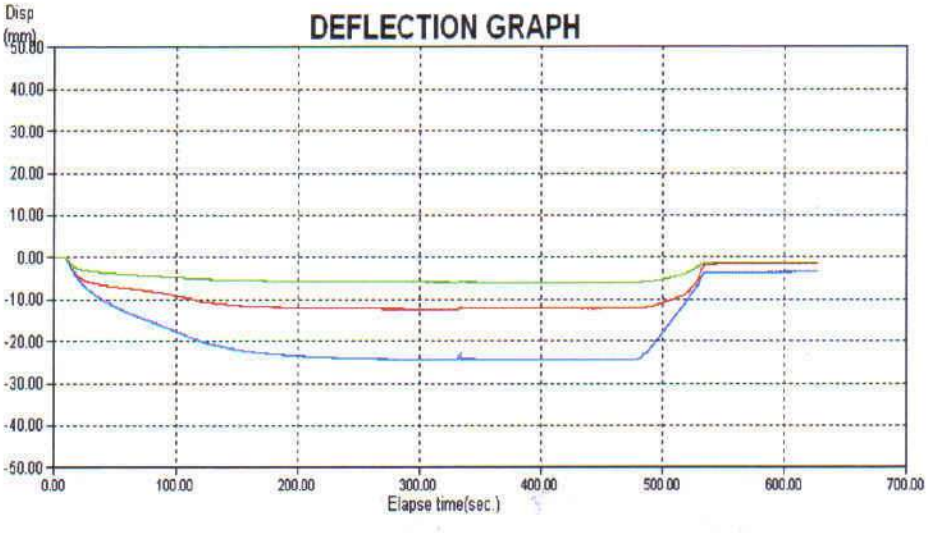
△ WIND LOAD
+ 6088 kg/m^2 (=17.6˝Hg)



△ MAX. DEFLECTION AND PERMANENT SET



△ WIND LOAD
+ 9130 kg/m^2 (=26.4˝Hg)



△ MAX. DEFLECTION AND PERMANENT SET

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8. SUMMARY

TEST RESULTS OF PERFORMANCE TEST OF BLAST DOOR ARE AS FOLLOWS.

(1) DOUBLE SWING DOOR

1) BEFORE THE TEST, DOOR WAS OPERATED WELL.
2) THE TEST RESULT OF AIR INFILTRATION WAS WITHIN THE ALLOWABLE PER EACH PHASE.
3) AFTER THE PRESSURE WAS APPLIED TO 9130 kg/m^2 , THERE WERE NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR AND THE DOOR WAS OPERATED WELL.
   §. FOR REFERENCE, THE MAXIMUM DEFLECTION OF THE DOOR LEAF WAS 13.96 mm AND THE PERMANENT SET OF THE DOOR LEAF WAS 0.61 mm.

(2) SINGLE SWING DOOR

1) BEFORE THE TEST, DOOR WAS OPERATED WELL.
2) THE TEST RESULT OF AIR INFILTRATION WAS WITHIN THE ALLOWABLE PER EACH PHASE.
3) AFTER THE PRESSURE WAS APPLIED TO 9130 kg/m^2 , THERE WERE NO FAILURE OR GROSS PERMANENT DISTORTION OF DOOR AND THE DOOR WAS OPERATED WELL.
   §. FOR REFERENCE, THE MAXIMUM DEFLECTION OF THE DOOR LEAF WAS 15.47 mm AND THE PERMANENT SET OF THE DOOR LEAF WAS 2.04 mm.

PLEASE DO NOT HESITATE TO ASK TO LABORATORY WHEN YOU HAVE QUESTIONS ABOUT THIS TEST OR TEST REPORT.

CNC
TESTING LABORATORY

President CHUNG, JIN SE