

*Mock-up Test Report / Certificate No. 190420-080*

# CANADA GRANDVIEW PROJECT

Door



**ATA에이티에이주식회사**  
Architectural Testing Asia Inc.

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## CANADA GRANDVIEW PROJECT

### Mock-Up Test Report / Door

#### 1. Weather Condition

1-1. Date	May 13th, 2019	May 14th, 2019
1-2. Air Temperature	24.0 °C	28.1 °C
1-3. Relative Humidity	40.6 % R.H.	43.5 % R.H.
1-4. Atmosphere	1 004.4 hPa	1 000.7 hPa
1-5. Weather	Fine	Fine

#### 2. Schedule

2-1. Specimen Install	May 8th, 2019
2-2. Test	May 13th, 2019 09:00 ~ 24:00 Pre-Load, Air, Water(Static, Dynamic), Thermal Cycling Test
	May 14th, 2019 00:00 ~ 15:00 Thermal Cycling, Air, Water(Static), Structural(100 %), Air, Water(Static), Structural(150 %) Test

#### 3. Specimen Type

3-1. Installation Type	Outswing Door
3-2. Glass Type	24 mm Low-E Pair Glass

#### 4. Test Summary

*The specimen carried out at the request of Koinntec and Grandview EAS was met requirements of specification.(Refer to Chapter 7)*

**5. Test Method**

The Specimen Was tested by the ASTM & AAMA standard.

5-1. Air Infiltration  
Test

ASTM E283 ;

Standard Test Method For Determining Rate Of Air Leakage Through Exterior Windows, Curtain Walls, And Doors Under Specified Pressure Differences Across The Specimen

5-2. Water Penetration  
Test

ASTM E331 ;

Standard Test Method For Water Penetration Of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Difference

5-3. Structural Test

ASTM E330/E330M ;

Standard Test Method For Structural Performance Of Exterior Windows, Curtain Walls, And Doors By Uniform Static Pressure Difference

5-4. Thermal Cycling  
Test

AAMA 501.5 ;

Test Method for Thermal Cycling of Exterior Walls

**6. Specimen Description**

6-1. Size

- Full Specimen : 1 000 mm(width) × 2 200 mm(height) = 2.20 m<sup>2</sup>

6-2. Finish

- AL. Frame

·Exposed : PVDF Coat

·Non-Exposed : Milled

6-3. Glass

- 24 mm Pair Glass : 6 mm Glass + 12 mm Ar + 6 mm Low-E Glass

6-4. Glazing Material

- Weather Sealant

**7. Test Result**

**Design Wind Load**

**Positive Design Pressure : +50.00 psf**

**Negative Design Pressure : -50.00 psf**

7-1. Pre-Load Test

① Test Pressure : 25.00 psf / 50 % of Positive Design Pressure

② Duration : 10 Seconds

③ Result : **Pass**

Table 1. Unit Conversion

	<b>USCS</b>	<b>SI</b>	<b>CGS</b>
Mass	Slug	kg	kg
Length	ft, inch	m, cm, mm	m, cm, mm
Force	lb(pound)	N(newton)	kgf
Pressure	psf(lb/ft <sup>2</sup> )	Pa(N/m <sup>2</sup> )	kgf/m <sup>2</sup>

※Unit Conversion & Example :

1 m ≒ 3.280 8 feet

1 kg ≒ 2.204 59 lb(pound)

1 psf ≒ 47.9 Pa

※ cfm = Cubic Foot per minute = ft<sup>3</sup>/min

7-2. Air Infiltration &  
Exfiltration Test  
(1st)

- ① Test Pressure : +6.24 psf(+300 Pa)
- ② Duration : Until the pressure is stable
- ③ Measured : Refer to Table 2
- ④ Compared with Allowance : (The Specimen Area was refer to Chapter 7)  
 Door Area = 23.68 ft<sup>2</sup> × 0.01 cfm/ft<sup>2</sup> = **2.37 cfm**  
 ∴ Infiltration : 2.37 cfm(Allowable) > 0.77 cfm(Actual) -----> O.K  
 Exfiltration : 2.37 cfm(Allowable) > 1.18 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 2. Convert to Standard Condition

<b>1. Weather Condition</b>	-. Temperature : 24.8 °C -. Atmosphere : 1 004.1 hPa -. Relative Humidity : 38.2 % R.H.
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**2. Convert to Standard Condition**

Measured (cfm)					Standard Test Conditions			Convert ( <i>Q<sub>st</sub></i> )
Part	Total ( <i>Q<sub>t</sub></i> )	Extraneous ( <i>Q<sub>e</sub></i> )	Net Specimen ( <i>Q<sub>s</sub></i> )	atmosphere	temp	Air density ( <i>W<sub>s</sub></i> )		
Door	In*	21.74	20.96	0.78	1 013(hPa)	20.8 (°C)	1.202 (kg/m <sup>3</sup> )	<b>0.77 cfm</b>
	Ex*	22.25	21.06	1.19				<b>1.18 cfm</b>

※ Note :

$$Q_{st} = Q(W/W_s)^{1/2}, W = 3.485 \times 10^{-3} (B/(T+273))$$

- . *Q* = air-flow at non-standard conditions,  $Q_s = Q_t - Q_e$
- .  $Q_{st}$  = air-flow corrected to standard conditions
- .  $W_s$  = density of air at reference standard conditions - 1.202 kg/m<sup>3</sup>(0.075 lb/ft<sup>3</sup>)
- .  $W$  = density of air at the test site, kg/m<sup>3</sup>(lb/ft<sup>3</sup>)
- .  $B$  = barometric pressure at the test site corrected for temperature, Pa(in.Hg), and
- .  $T$  = temperature of air at flowmeter, °C

In\* : Infiltration

Ex\* : Exfiltration

7-3. Water Penetration

Test by Static

Pressure

(1st)

- ① Test Pressure : +15.00 psf / By specification
- ② Amount of Water Spray : 3.4 L/(m<sup>2</sup>·min)
- ③ Duration : 15 minutes
- ④ Allowance : No uncontrolled water
- ⑤ Result : **Pass**

7-4. Water Penetration

Test by Dynamic

Pressure

- ① Test Pressure : +15.00 psf(34.22 m/s) / By specification
- ② Amount of Water Spray : 3.4 L/(m<sup>2</sup>·min)
- ③ Duration : 15 minutes
- ④ Allowance : No uncontrolled water
- ⑤ Result : **Pass**

7-5. Thermal Cycling

Test

- ① Test Condition
  - Out Door : Hot Cycle +82 °C ± 3 °C at Air Temperature
  - Cold Cycle -18 °C ± 3 °C at Air Temperature
  - In Door : +24 °C ± 3 °C
- ② Cycle : 3 Cycles
- ③ Allowance : After thermal cycling test, Air & water test was met the allowance.
- ④ Result : **Pass**

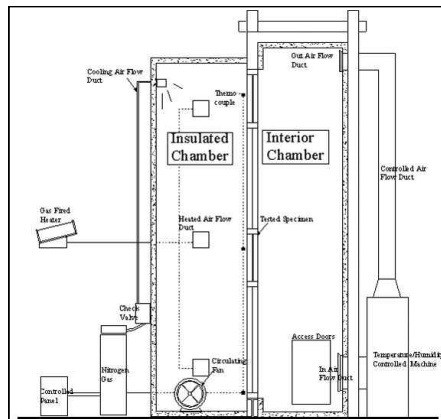


Figure 1. Synopsis of Thermal Cycling Test

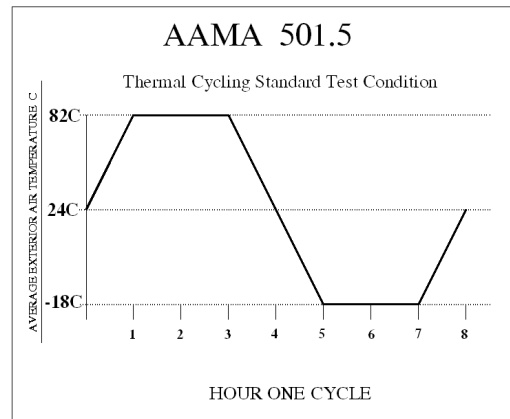


Figure 2. Synopsis of Exterior Temperature

7-6. Air Infiltration &  
 Exfiltration Test  
 (2th)

- ① Test Pressure : +6.24 psf(+300 Pa)
- ② Duration : Until the pressure is stable
- ③ Measured : Refer to Table 3
- ④ Compared with Allowance : (The Specimen Area was refer to Chapter 7)  
 Door Area = 23.68 ft<sup>2</sup> × 0.01 cfm/ft<sup>2</sup> = **2.37 cfm**  
 ∴ Infiltration : 2.37 cfm(Allowable) > 0.98 cfm(Actual) -----> O.K  
 Exfiltration : 2.37 cfm(Allowable) > 1.37 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 3. Convert to Standard Condition

<b>1. Weather Condition</b>	-. Temperature : 28.5 °C -. Atmosphere : 1 000.4 hPa -. Relative Humidity : 41.3 % R.H.
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**2. Convert to Standard Condition**

Measured (cfm)				Standard Test Conditions			Convert ( <i>Q<sub>st</sub></i> )	
Part	Total ( <i>Q<sub>t</sub></i> )	Extraneous ( <i>Q<sub>e</sub></i> )	Net Specimen ( <i>Q<sub>s</sub></i> )	atmosphere	temp	Air density ( <i>W<sub>s</sub></i> )		
Door	In*	21.96	20.96	1.00	1 013(hPa)	20.8 (°C)	1.202 (kg/m <sup>3</sup> )	<b>0.98 cfm</b>
	Ex*	22.46	21.06	1.40				<b>1.37 cfm</b>

※ Note :

$$Q_{st} = Q(W/W_s)^{1/2}, W = 3.485 \times 10^{-3} (B/(T+273))$$

- . *Q* = air-flow at non-standard conditions,  $Q_s = Q_t - Q_e$
- . *Q<sub>st</sub>* = air-flow corrected to standard conditions
- . *W<sub>s</sub>* = density of air at reference standard conditions - 1.202 kg/m<sup>3</sup>(0.075 lb/ft<sup>3</sup>)
- . *W* = density of air at the test site, kg/m<sup>3</sup>(lb/ft<sup>3</sup>)
- . *B* = barometric pressure at the test site corrected for temperature, Pa(in.Hg), and
- . *T* = temperature of air at flowmeter, °C

In\* : Infiltration  
 Ex\* : Exfiltration

7-7. Water Penetration  
 Test by Static  
 Pressure(2th)

- ① Test Pressure : +15.00 psf / By specification
- ② Amount of Water Spray : 3.4 L/(m<sup>2</sup>·min)
- ③ Duration : 15 minutes
- ④ Allowance : No uncontrolled water
- ⑤ Result : **Pass**



7-8. Structural Test  
(@ 100 %)

- ① Test Pressure : +50.00 psf / 100 % of Positive Design Pressure  
-50.00 psf / 100 % of Negative Design Pressure
- ② Duration : 10 seconds
- ③ Allowance :
  - Framing System for Building Cladding Components(According to AAMA TIR-A11-15) ;
  - L / 175 (L ≤ 4 110 mm)
  - FRAME I (Vertical) : 2 050 mm / 175 = 11.71 mm
  - Glass : No Breakage
- ④ Measured : Refer to Table 4 & Figure 3.
- ⑤ Result : **Pass**

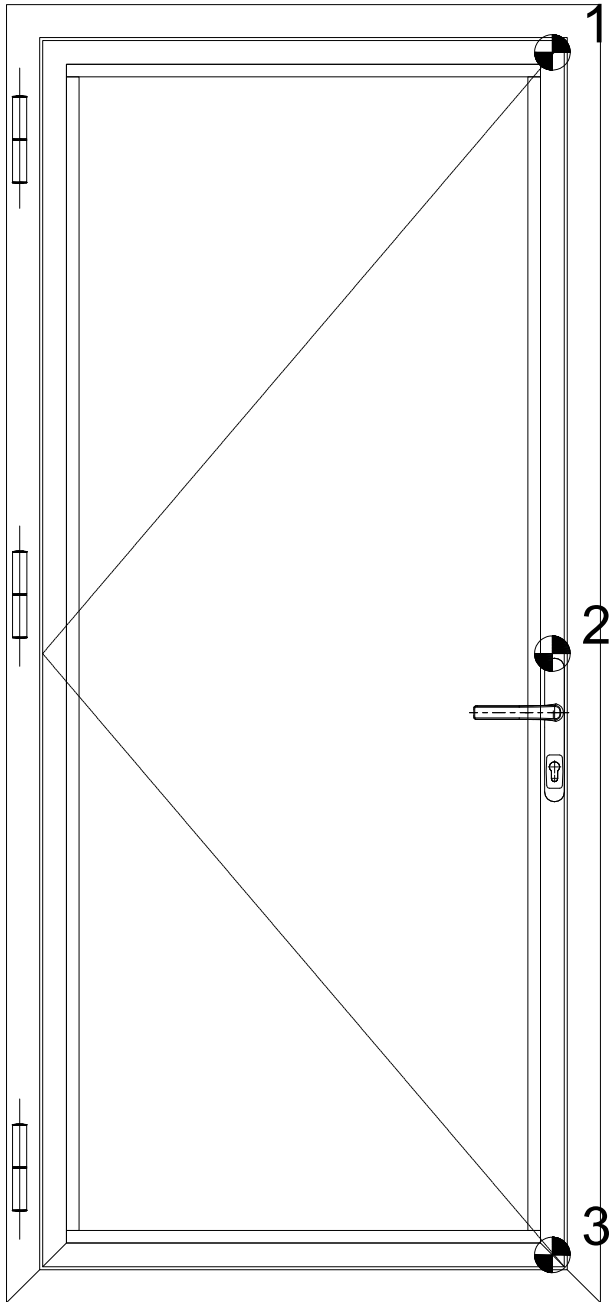
Table 4. Measured the Maximum Deflection of Each Element

unit : mm

Gauge No	Positive		Negative		Allowable
	100 %	Net Deflection	100 %	Net Deflection	
No. 1	3.76	<b>0.89</b>	3.58	<b>0.67</b>	<b>11.71</b>
No. 2	3.99		3.06		
No. 3	2.44		1.21		

※ Net Deflection : Gauge No. 2 - [(Gauge No. 1 + Gauge No. 3) / 2]

Figure 3. Transducer Location for Structural Test



**Location :**

No. 1 : Top of Frame

No. 2 : Mid of Frame

No. 3 : Bottom of Frame

7-9. Air Infiltration &  
 Exfiltration Test  
 (3th)

- ① Test Pressure : +6.24 psf(+300 Pa)
- ② Duration : Until the pressure is stable
- ③ Measured : Refer to Table 5
- ④ Compared with Allowance : (The Specimen Area was refer to Chapter 7)  
 Door Area = 23.68 ft<sup>2</sup> × 0.01 cfm/ft<sup>2</sup> = **2.37 cfm**  
 ∴ Infiltration : 2.37 cfm(Allowable) > 1.31 cfm(Actual) -----> O.K  
 Exfiltration : 2.37 cfm(Allowable) > 1.80 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 5. Convert to Standard Condition

<b>1. Weather Condition</b>	-. Temperature : 29.5 °C -. Atmosphere : 1 000.1 hPa -. Relative Humidity : 37.7 % R.H.
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**2. Convert to Standard Condition**

Measured (cfm)				Standard Test Conditions			Convert ( <i>Q<sub>st</sub></i> )	
Part	Total ( <i>Q<sub>t</sub></i> )	Extraneous ( <i>Q<sub>e</sub></i> )	Net Specimen ( <i>Q<sub>s</sub></i> )	atmosphere	temp	Air density ( <i>W<sub>s</sub></i> )		
Door	In*	22.30	20.96	1.34	1 013(hPa)	20.8 (°C)	1.202 (kg/m <sup>3</sup> )	<b>1.31 cfm</b>
	Ex*	22.90	21.06	1.84				<b>1.80 cfm</b>

※ Note :

$$Q_{st} = Q(W/W_s)^{1/2}, W = 3.485 \times 10^{-3} (B/(T+273))$$

- . *Q* = air-flow at non-standard conditions,  $Q_s = Q_t - Q_e$
- . *Q<sub>st</sub>* = air-flow corrected to standard conditions
- . *W<sub>s</sub>* = density of air at reference standard conditions - 1.202 kg/m<sup>3</sup>(0.075 lb/ft<sup>3</sup>)
- . *W* = density of air at the test site, kg/m<sup>3</sup>(lb/ft<sup>3</sup>)
- . *B* = barometric pressure at the test site corrected for temperature, Pa(in.Hg), and
- . *T* = temperature of air at flowmeter, °C

In\* : Infiltration  
 Ex\* : Exfiltration

7-10. Water Penetration  
 Test by Static  
 Pressure(3th)

- ① Test Pressure : +15.00 psf / By specification
- ② Amount of Water Spray : 3.4 L/(m<sup>2</sup>·min)
- ③ Duration : 15 minutes
- ④ Allowance : No uncontrolled water
- ⑤ Result : **Pass**

7-11. Structural Test  
(@150 %)

- ① Pressure : +75.0 psf / 150 % of Positive Design Pressure  
-75.0 psf / 150 % of Negative Design Pressure
- ② Duration : Maintain target pressure 10 seconds
- ③ Allowance :
  - Framing Member ; 2L / 1 000  
FRAME I (Vertical) : 2 050 mm × 2 / 1 000 = 4.10 mm
  - Glass : No Breakage
- ④ Measured : Refer to Table 6 & Figure 3.
- ⑤ Result : **Pass**

Table 6. Measured the Permanent Deflection of Each Element

unit : mm

Pressure Gauge No	Positive		Negative		Allowance
	150 %	Net Deflection	150 %	Net Deflection	
No. 1	0.18	0.31	0.29	0.15	4.10
No. 2	0.59		0.40		
No. 3	0.39		0.22		

※ Net Deflection : Gauge No. 2 - [(Gauge No. 1 + Gauge No. 3) / 2]

## 8. Photo

### 8-1. Pre-load Test & Air Infiltration Test



### 8-2. Water Penetration Test



8-3. Structural Test





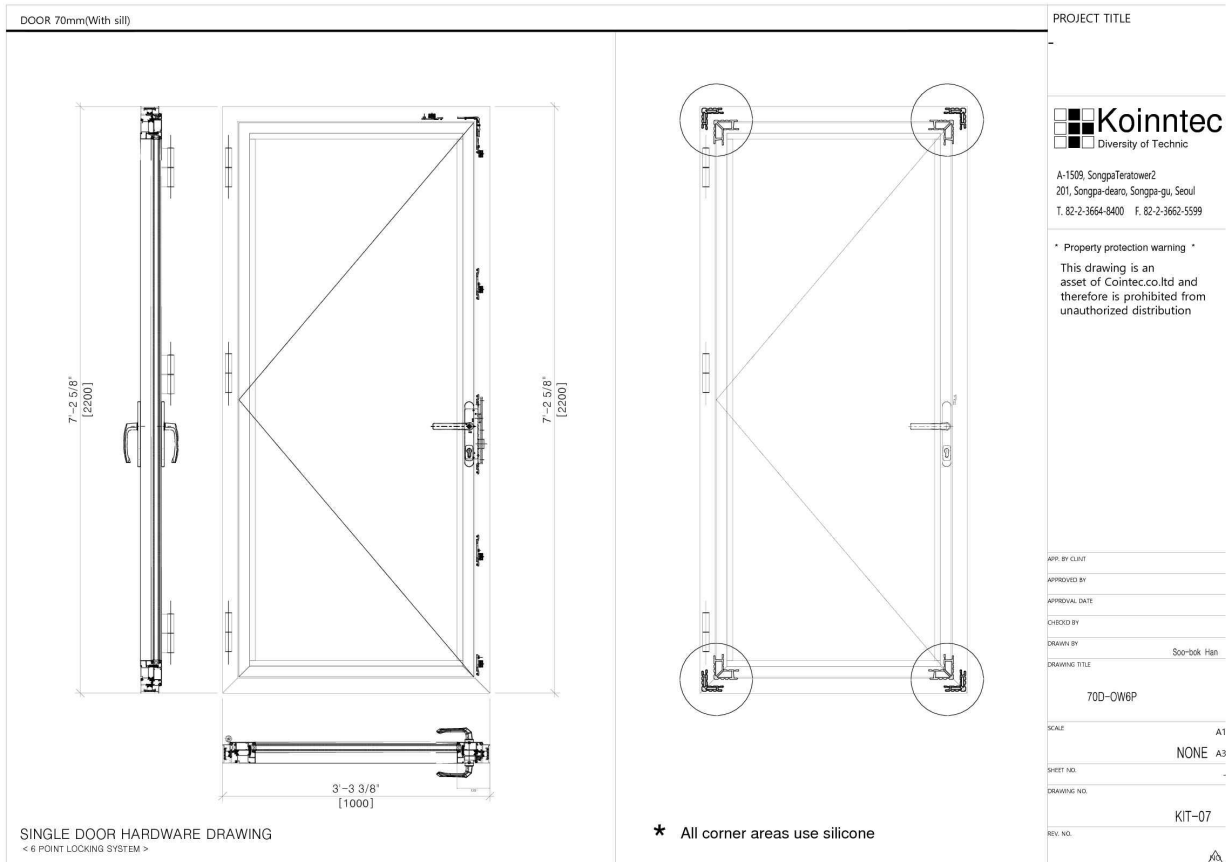
8-4. Thermal Cycling  
Test



Curtain Wall Test by ASTM & AAMA  
Window Test By KS Standard

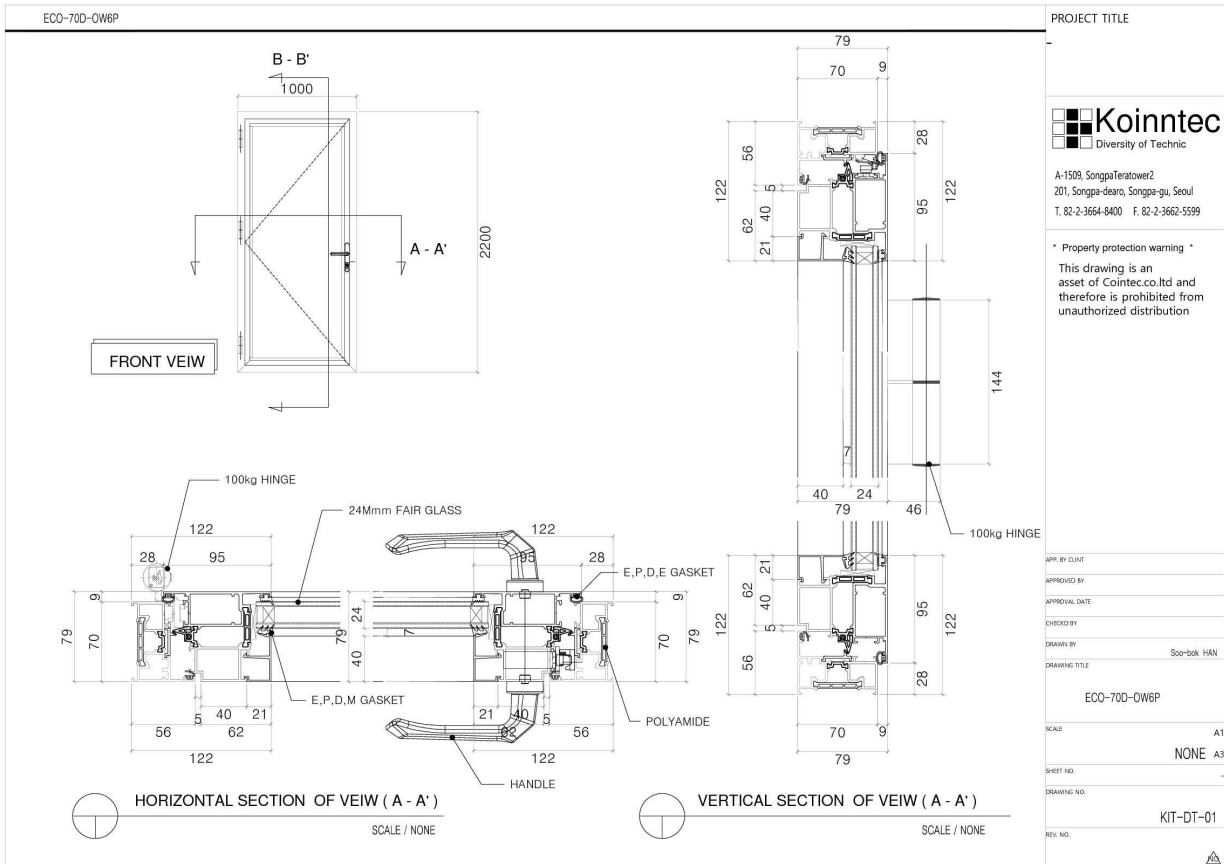
**9. Drawings**

9-1. Elevation





9-2. Detail



10. Certification



No. 487 (1/2)

**CERTIFICATE OF ACCREDITATION**

Name of Laboratory : ATA

Representative : Kim, In Kon

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Chungchongnam-do, Korea

Address of Laboratory : 172-30 Hwangnyongjae-ro Yeonsan-myeon Nonsan-city  
Chungchongnam-do, Korea

Duration : July 20, 2015 ~ July 19, 2019

Scope of Accreditation  
(Scope of Accreditation is described in the accompanying Annex)

This testing laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025 : 2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 8 January 2009).

May 19, 2015

*SEONG SI-HEON*

**Administrator,  
Korea Laboratory Accreditation Scheme(KOLAS)**



No. 487 (2/2)

**1. Mechanical Test**

**1.016 Construction and Material**

Test method	Standard designation	Test range or Limits of detection
KS F 2292 : 2013	The method of air tightness for windows and doors	(0~100) Pa (0~250) m <sup>3</sup> /h
KS F 2293 : 2008	Test method of water tightness for windows and doors	(50~750) Pa 4 L/(m <sup>2</sup> ·min)
KS F 2296 : 1999	Windows and door sets - Wind resistance test	(800~3 600) Pa (0.01~100) mm
ASTM E283-04	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen	(75~300) Pa (0~250) m <sup>3</sup> /h
ASTM E330/E330M-14	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference	(0.01~100) mm
ASTM E331-00	Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference	(300~720) Pa 3.4 L/(m <sup>2</sup> ·min)
ASTM E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors	(75~300) Pa (0~250) m <sup>3</sup> /h
ASTM E1105-00	Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference	(200~720) Pa 3.4 L/(m <sup>2</sup> ·min)

End.

The "As Built" mock-up drawings and a copy of this report will be retained by ATA for a period of four years. This report is the exclusive property of the client so named herein and is applicable to the sample tested.

Results obtained are tested values and do not constitute an opinion or endorsement by this laboratory.

For ARCHITECTURAL TESTING ASIA, INC.

Architectural Testing Asia

Technician

Jangjeon Han



Issue date : Jun 28th, 2019

Architectural Testing Asia

Technical Manager

Jingu Yu



Architectural Testing Asia

President

Inkon Kim

