

*Mock-up Test Report / Certificate No. 190314-033-1*

# CANADA GRANDVIEW PROJECT

Window Wall



**ATA에이티에이주식회사**  
Architectural Testing Asia Inc.

# Contents

<b>1. Weather Condition</b>	<b>1</b>
<b>2. Schedule</b>	<b>1</b>
<b>3. Witness</b>	<b>1</b>
<b>4. Specimen Type</b>	<b>2</b>
<b>5. Test Summary</b>	<b>2</b>
<b>6. Test Method</b>	<b>2</b>
<b>7. Specimen Description</b>	<b>3</b>
<b>8. Test Result</b>	<b>4</b>
8-1. Pre-Load Test	4
8-2. Air Infiltration & Exfiltration Test(1st)	5
8-3. Water Penetration Test by Static Pressure(1st)	6
8-4. Water Penetration Test by Dynamic Pressure	6
8-5. Vertical Movement Test	6
8-6. Air Infiltration & Exfiltration Test(2nd)	7
8-7. Water Penetration Test by Static Pressure(2nd)	7
8-8. Horizontal Movement Test(1st)	8
8-9. Air Infiltration & Exfiltration Test(3rd)	9
8-10. Water Penetration Test by Static Pressure(3rd)	9
8-11. Thermal Cycling	10
8-12. Air Infiltration & Exfiltration Test(4th)	11
8-13. Water Penetration Test by Static Pressure(4th)	11
8-14. Structural Test(100 %)	12
8-15. Air Infiltration & Exfiltration Test(5th)	14
8-16. Water Penetration Test by Static Pressure(5th)	14
8-17. Structural Test(150 %)	15
8-18. Horizontal Movement Test(2nd)	16
<b>9. Photo</b>	<b>17</b>
<b>10. Drawings</b>	<b>21</b>
<b>11. Certification</b>	<b>35</b>

## CANADA GRANDVIEW PROJECT

## Mock-Up Test Report / Window Wall

## 1. Weather Condition

1-1. Date	Mar 26th, 2019	Mar 27th, 2019	Mar 28th, 2019
1-2. Air Temperature	20.1 °C	13.8 °C	21.2 °C
1-3. Relative Humidity	38.5 % R.H.	41.5 % R.H.	25.1 % R.H.
1-4. Atmosphere	1 005.4 hPa	1 007.2 hPa	1 001.1 hPa
1-5. Weather	Fine	Fine	Fine

## 2. Schedule

2-1. Specimen Install	Mar 19th, 2019 ~ Mar 22th, 2019
2-2. Test	Mar 26th, 2019 18:00 ~ 21:00 Pre-Load, Air, Water(Static, Dynamic), Vertical Movement, Air, Water Test(Static)
	Mar 27th, 2019 09:00 ~ 24:00 Horizontal, Air, Water(Static), Thermal Cycling Test
	Mar 28th, 2019 00:00 ~ 19:00 Thermal Cycling, Air, Water(Static), Structural(100 %), Air, Water(Static), Structural(150 %), Horizontal Movement Test

## 3. Witness

## Test Witness

• Project : CANADA GRAND VIEW PROJECT

• Test Date : Mar 27th, 2019

Company	Name	Signature
ALPRO ALUMINUM PRODUCTS LTD	CATALIN KALI DINIA	
Grandview	Gordon Makwich	
JRS Engineering	Joel Schwartz	
"	Adam Jarolin	
GRANDVIEW	Robert Hobson	
Nonsan Aluminum	Yoon Byoung Suk	
"	Jeong Bae, Ahn	
"	Eun Hee, Jung	

**4. Specimen Type**

- 4-1. Installation Type      Window Wall  
4-2. Glass Type              24 mm Low-E Pair Glass

**5. Test Summary**

*The specimen carried out at the request of namsun aluminum was not met requirements of specification on structural test.(Refer to Chapter 8)*

**6. Test Method**

The Specimen Was tested by the ASTM & AAMA standard.

- 6-1. 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
- 6-2. Water Penetration Test      ASTM E331 ;  
Standard Test Method For Water Penetration Of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Difference
- 6-3. Structural Test              ASTM E330/E330M ;  
Standard Test Method For Structural Performance Of Exterior Windows, Curtain Walls, And Doors By Uniform Static Pressure Difference
- 6-4. Vertical Test                AAMA 501.7 ;  
Recommend Static Test Method for Evaluating Windows, Window Wall, Curtain Wall and Storefront Systems Subjected to Vertical Inter-story Movements
- 6-5. Horizontal Test            AAMA 501.4 ;  
Recommended Static Test Method For Evaluating Curtain Wall And Storefront Systems Subjected to Seismic And Wind Induced Inter-story Drifts
- 6-6. Thermal Cycling Test      AAMA 501.5 ;  
Test Method for Thermal Cycling of Exterior Walls



**7. Specimen Description**

- 7-1. Size
  - Full Specimen : 5 260 mm width × 5 880 mm height
  - Fixed Area : 29.54 m<sup>2</sup>(317.95 ft<sup>2</sup>)
  - Vent Area(2EA) : 1.39 m<sup>2</sup>(14.96 ft<sup>2</sup>)
- 7-2. Finish
  - AL. Frame
    - Exposed : PVDF Coat
    - Non-Exposed : Milled
- 7-3. Glass
  - 24 mm Pair Glass : 6 mm Low-E Glass + 12 mm Air + 6 mm Glass
- 7-4. Glazing Material
  - Weather Sealant
  - Structural Sealant

## 8. Test Result

### Design Wind Load

Positive Design Pressure : +50 psf

Negative Design Pressure : -50 psf

#### 8-1. Pre-Load Test

① Test Pressure : 25 psf / 50 % of Positive Design Pressure

② Duration : 10 Seconds

③ Result : **Pass**

Table 1. Unit Conversion

	USCS	SI	CGS
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 &amp; Example :

1 m  $\approx$  3.280 8 feet1 kg  $\approx$  2.204 59 lb(pound)1 psf  $\approx$  47.9 Pa※ cfm = Cubic Foot per minute = ft<sup>3</sup>/min

8-2. Air Infiltration &  
Exfiltration Test  
(1st)

- ① Test Pressure : +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)  
 Fixed Area =  $317.95 \text{ ft}^2 \times 0.04 \text{ cfm/ft}^2 = \mathbf{12.72 \text{ cfm}}$   
 $\therefore$  Infiltration : 12.72 cfm(Allowable) > 0.80 cfm(Actual) -----> O.K  
 Exfiltration : 12.72 cfm(Allowable) > 1.38 cfm(Actual) -----> O.K  
 Vent Area =  $14.96 \text{ ft}^2 \times 0.10 \text{ cfm/ft}^2 = \mathbf{1.50 \text{ cfm}}$   
 $\therefore$  Infiltration : 1.50 cfm(Allowable) > 0.06 cfm(Actual) -----> O.K  
 Exfiltration : 1.50 cfm(Allowable) > 0.60 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 2. Convert to Standard Condition

<b>1. Weather Condition</b>	-. Temperature : 20.5 °C -. Atmosphere : 1 005.5 hPa -. Relative Humidity : 37.8 % R.H.
-----------------------------	---

**2. Convert to Standard Condition**

Measured (cfm)					Standard Test Conditions			Convert ( $Q_{st}$ )
Part		Total ( $Q_t$ )	Extraneous ( $Q_e$ )	Net Specimen ( $Q_s$ )	atmosphere	temp	Air density ( $W_s$ )	
In★	Fixed	51.24	50.44	0.80	1 013 (hPa)	20.8 (°C)	1.202 (kg/m³)	<b>0.80 cfm</b>
Ex★	Area	51.44	50.06	1.38				<b>1.38 cfm</b>
In★	Vent	51.30	51.24	0.06				<b>0.06 cfm</b>
Ex★	Area	52.04	51.44	0.60				<b>0.60 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/m³(0.075 lb/ft³)
- .  $W$  = density of air at the test site, kg/m³(lb/ft³)
- .  $B$  = barometric pressure at the test site corrected for temperature, Pa(in.Hg), and
- .  $T$  = temperature of air at flowmeter, °C

In★ : Infiltration

Ex★ : Exfiltration

8-3. Water Penetration

Test by Static

Pressure

(1st)

① Test Pressure : +15 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**

8-4. Water Penetration

Test by Dynamic

Pressure

① Test Pressure : 34.22 m/s(+15 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**

8-5. Vertical

Movement Test

① Displacement : Up 15 mm Down 15 mm (Total 30 mm)

② Cycle : 3 times

③ Allowance :

- No glass breakage and no permanent damage to panels, fasteners or anchors.

④ Result : **Pass**

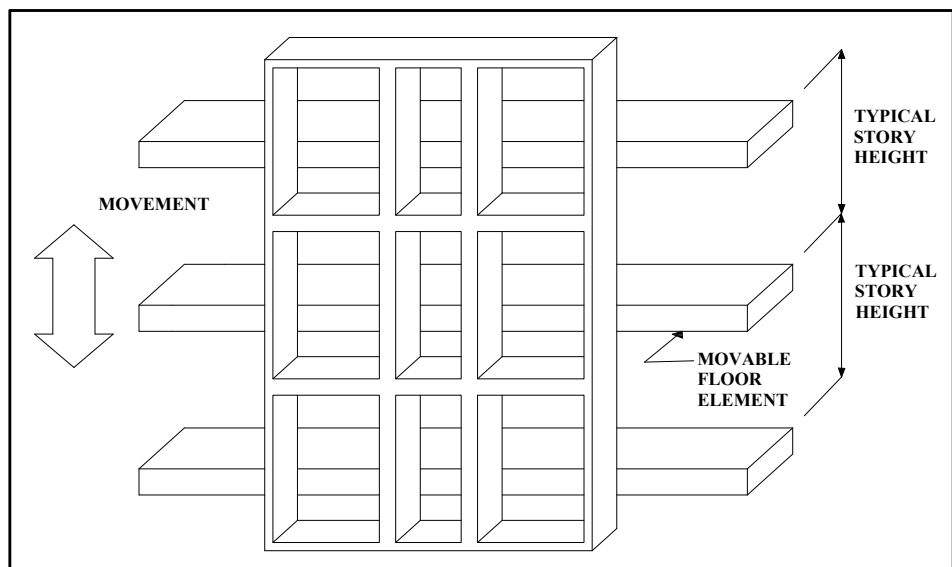


Figure 1. Synopsis of Vertical Movement Test

8-6. Air Infiltration &  
Exfiltration Test  
(2nd)

- ① Test Pressure : +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)  
Fixed Area =  $317.95 \text{ ft}^2 \times 0.04 \text{ cfm/ft}^2 = \mathbf{12.72 \text{ cfm}}$   
 $\therefore$  Infiltration : 12.72 cfm(Allowable) > 1.46 cfm(Actual) -----> O.K  
Exfiltration : 12.72 cfm(Allowable) > 1.62 cfm(Actual) -----> O.K  
Vent Area =  $14.96 \text{ ft}^2 \times 0.10 \text{ cfm/ft}^2 = \mathbf{1.50 \text{ cfm}}$   
 $\therefore$  Infiltration : 1.50 cfm(Allowable) > 0.32 cfm(Actual) -----> O.K  
Exfiltration : 1.50 cfm(Allowable) > 0.63 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 3. Convert to Standard Condition

1. Weather Condition		- Temperature : 17.6 °C						
		- Atmosphere : 1 006.8 hPa						
		- Relative Humidity : 48.4 % R.H.						
2. Convert to Standard Condition								
Measured (cfm)					Standard Test Conditions			Convert ( $Q_{st}$ )
Part		Total ( $Q_t$ )	Extraneous ( $Q_e$ )	Net Specimen ( $Q_s$ )	atmosphere	temp	Air density ( $W_s$ )	
In★	Fixed Area	51.90	50.44	1.46	1 013 (hPa)	20.8 (°C)	1.202 (kg/m <sup>3</sup> )	1.46 cfm
Ex★		51.68	50.06	1.62				1.62 cfm
In★	Vent Area	52.22	51.90	0.32				0.32 cfm
Ex★		52.31	51.68	0.63				0.63 cfm

※ 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

8-7. Water Penetration  
Test by Static  
Pressure(2nd)

- ① Test Pressure : +15 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**

8-8. Horizontal

Movement Test(1st)

① Displacement : Left 30 mm Right 30 mm (Total 60 mm)

② Cycle : 3 times

③ Allowance :

- No visible damage to framing or trim components or assemblies is allowed
- No glass breakage or glass fallout is allowed
- Full disengagement of gaskets or weatherseals is not allowed at any location
- Air infiltration and water penetration resistance shall remain within specified allowable limits without adjustments or repair, except as specifically noted herein
- No wall components may fall off

④ Result : **Pass**

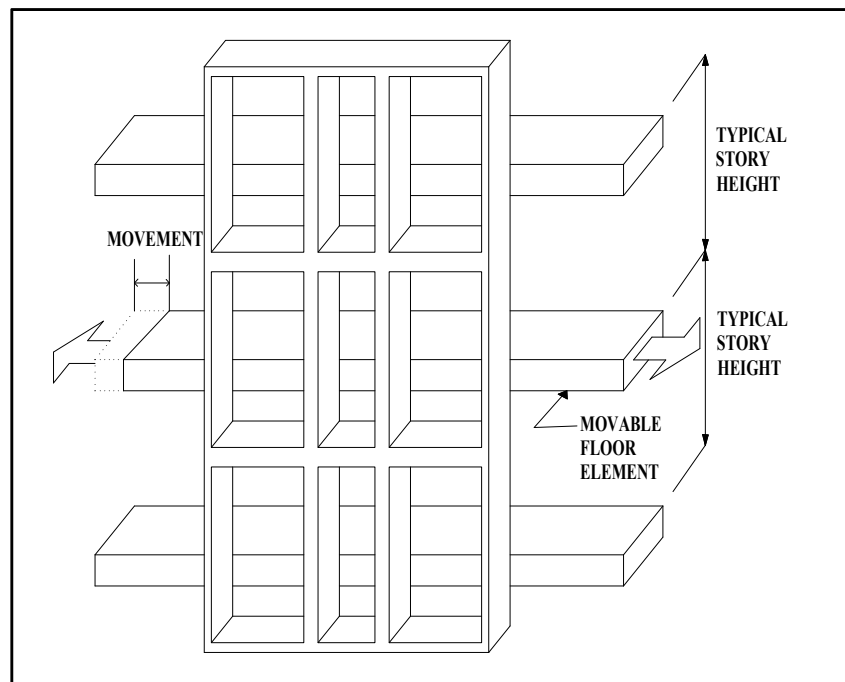


Figure 2. Synopsis of Horizontal Movement Test

8-9. Air Infiltration &  
Exfiltration Test  
(3rd)

- ① Test Pressure : +300 Pa
- ② Duration : Until the pressure is stable
- ③ Measured : Refer to Table 4
- ④ Compared with Allowance : (The Specimen Area was refer to Chapter 7)  
 Fixed Area =  $317.95 \text{ ft}^2 \times 0.04 \text{ cfm/ft}^2 = \mathbf{12.72 \text{ cfm}}$   
 $\therefore$  Infiltration : 12.72 cfm(Allowable) > 2.96 cfm(Actual) -----> O.K  
 Exfiltration : 12.72 cfm(Allowable) > 2.33 cfm(Actual) -----> O.K  
 Vent Area =  $14.96 \text{ ft}^2 \times 0.10 \text{ cfm/ft}^2 = \mathbf{1.50 \text{ cfm}}$   
 $\therefore$  Infiltration : 1.50 cfm(Allowable) > 0.17 cfm(Actual) -----> O.K  
 Exfiltration : 1.50 cfm(Allowable) > 0.26 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 4. Convert to Standard Condition

1. Weather Condition				-. Temperature : 18.0 °C -. Atmosphere : 1 003.8 hPa -. Relative Humidity : 46.9 % R.H.				
2. Convert to Standard Condition								
Measured (cfm)					Standard Test Conditions			Convert ( $Q_{st}$ )
Part		Total ( $Q_t$ )	Extraneous ( $Q_e$ )	Net Specimen ( $Q_s$ )	atmosphere	temp	Air density ( $W_s$ )	
In*	Fixed Area	53.40	50.44	2.96	1 013 (hPa)	20.8 (°C)	1.202 (kg/m³)	2.96 cfm
Ex*		52.39	50.06	2.33				2.33 cfm
In*	Vent Area	53.57	53.40	0.17				0.17 cfm
Ex*		52.65	52.39	0.26				0.26 cfm

※ 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/m³(0.075 lb/ft³)
- .  $W$  = density of air at the test site, kg/m³(lb/ft³)
- .  $B$  = barometric pressure at the test site corrected for temperature, Pa(in.Hg), and
- .  $T$  = temperature of air at flowmeter, °C

 8-10. Water Penetration  
Test by Static  
Pressure  
(3rd)

- ① Test Pressure : +15 psf / By specification
- ② Amount of Water Spray : 3.4 L/(m²·min)
- ③ Duration : 15 minutes
- ④ Allowance : No uncontrolled water
- ⑤ Result : **Pass**

8-11. Thermal Cycling  
Test

① Test Condition

Out Door : Hot Cycle  $+82\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  at Air Temperature

Cold Cycle  $-18\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  at Air Temperature

In Door :  $+24\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$

② Cycle : 3 Cycles

③ Allowance : After thermal cycling test, Air & water test was met the allowance.

④ Result : **Pass**

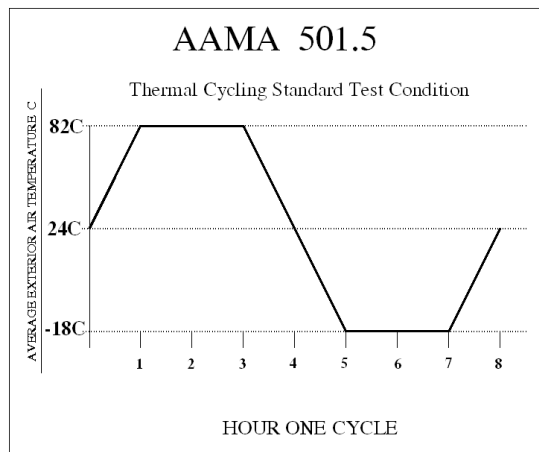


Figure 3. Synopsis of Exterior Temperature

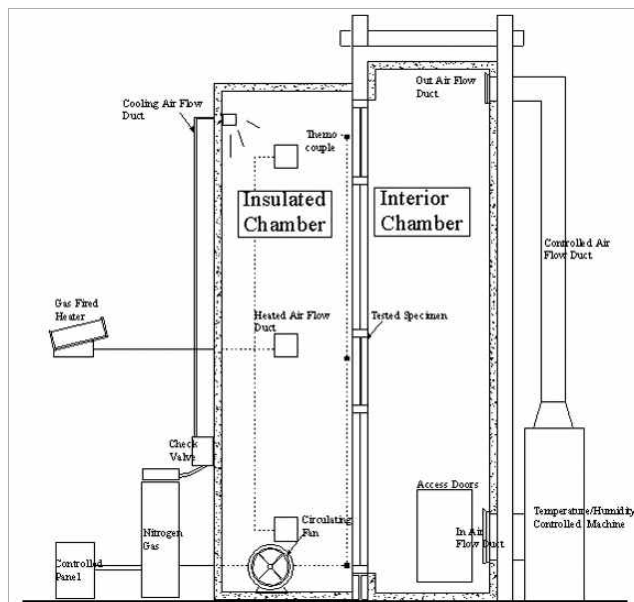


Figure 4. Synopsis of Thermal Cycling Test



8-12. Air Infiltration &  
Exfiltration Test  
(4th)

- ① Test Pressure : +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)  
 Fixed Area =  $317.95 \text{ ft}^2 \times 0.04 \text{ cfm/ft}^2 = \mathbf{12.72 \text{ cfm}}$   
 $\therefore$  Infiltration : 12.72 cfm(Allowable) > 3.18 cfm(Actual) -----> O.K  
 Exfiltration : 12.72 cfm(Allowable) > 3.18 cfm(Actual) -----> O.K  
 Vent Area =  $14.96 \text{ ft}^2 \times 0.10 \text{ cfm/ft}^2 = \mathbf{1.50 \text{ cfm}}$   
 $\therefore$  Infiltration : 1.50 cfm(Allowable) > 0.11 cfm(Actual) -----> O.K  
 Exfiltration : 1.50 cfm(Allowable) > 0.54 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 5. Convert to Standard Condition

1. Weather Condition					- Temperature : 21.5 °C - Atmosphere : 1 001.0 hPa - Relative Humidity : 25.9 % R.H.			
2. Convert to Standard Condition								
Measured (cfm)					Standard Test Conditions			Convert ( $Q_{st}$ )
Part		Total ( $Q_t$ )	Extraneous ( $Q_e$ )	Net Specimen ( $Q_s$ )	atmosphere	temp	Air density ( $W_s$ )	
In★	Fixed Area	53.64	50.44	3.20	1 013 (hPa)	20.8 (°C)	1.202 (kg/m³)	3.18 cfm
Ex★		53.26	50.06	3.20				3.18 cfm
In★	Vent Area	53.75	53.64	0.11				0.11 cfm
Ex★		53.80	53.26	0.54				0.54 cfm

8-14. Structural Test  
(@100 %)

① Test Pressure : +50 psf / 100 % of Positive Design Pressure  
-50 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 ( $L \leq 4110$  mm)

FRAME I (Vertical) :  $2953 \text{ mm} / 175 = 16.87 \text{ mm}$ 

FRAME II (Vertical) :  $2635 \text{ mm} / 175 = 15.06 \text{ mm}$ 

FRAME III (Transom) :  $1170 \text{ mm} / 175 = 6.69 \text{ mm}$ 

- Glass : No Breakage

④ Measured : Refer to Table 6 &amp; Figure 5.

⑤ Result : **Fail**

*9 feet window wall(1st floor) is pass,  
but 10 feet window wall(2nd floor) is fail*

Table 6. Measured the Maximum Deflection of Each Element

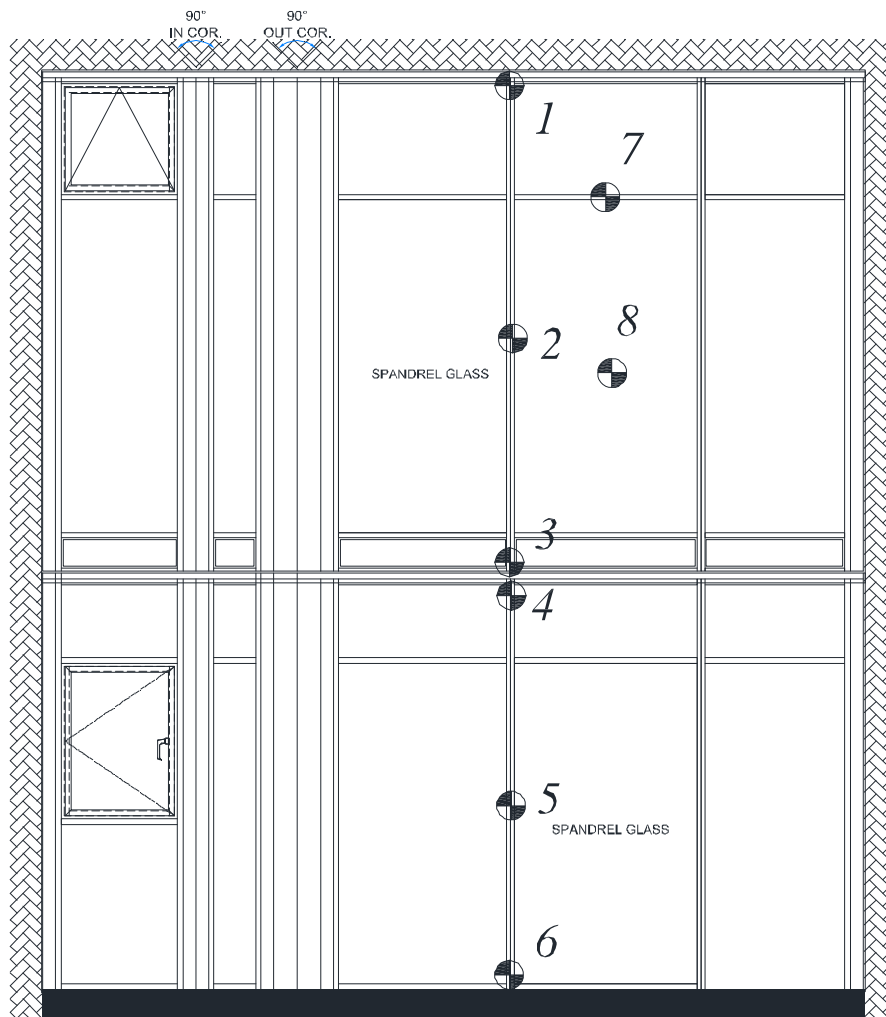
unit : mm

Pressure Gauge No	Positive		Negative		Allowable
	100 %	Net Deflection	100 %	Net Deflection	
No. 1	8.97	15.82	10.69	19.84	16.87
No. 2	20.80		26.09		
No. 3	1.00		1.82		
No. 4	6.68	8.79	7.28	12.93	15.06
No. 5	12.55		17.19		
No. 6	0.85		1.25		
No. 7	0.83	0.83	0.75	0.75	6.69
No. 8	6.78	6.78	7.95	7.95	No Breakage

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

Net Deflection : Gauge No. 5 - [(Gauge No. 4 + Gauge No. 6) / 2]

Figure 5. Transducer Location for Structural Test



**Location :**

- No. 1 : Top of Frame I
- No. 2 : Mid of Frame I
- No. 3 : Bottom of Frame I
- No. 4 : Top of Frame II
- No. 5 : Mid of Frame II
- No. 6 : Bottom of Frame II
- No. 7 : Mid of Frame III
- No. 8 : Center of Glass

8-15. Air Infiltration &  
Exfiltration Test  
(5th)

- ① Test Pressure : +300 Pa
- ② Duration : Until the pressure is stable
- ③ Measured : Refer to Table 7
- ④ Compared with Allowance : (The Specimen Area was refer to Chapter 7)  
 Fixed Area =  $317.95 \text{ ft}^2 \times 0.04 \text{ cfm/ft}^2 = \mathbf{12.72 \text{ cfm}}$   
 $\therefore$  Infiltration : 12.72 cfm(Allowable) > 3.58 cfm(Actual) -----> O.K  
 Exfiltration : 12.72 cfm(Allowable) > 5.20 cfm(Actual) -----> O.K  
 Vent Area =  $14.96 \text{ ft}^2 \times 0.10 \text{ cfm/ft}^2 = \mathbf{1.50 \text{ cfm}}$   
 $\therefore$  Infiltration : 1.50 cfm(Allowable) > 0.06 cfm(Actual) -----> O.K  
 Exfiltration : 1.50 cfm(Allowable) > 0.26 cfm(Actual) -----> O.K
- ⑤ Result : **Pass**

Table 7. Convert to Standard Condition

1. Weather Condition					- Temperature : 20.2 °C - Atmosphere : 1 001.7 hPa - Relative Humidity : 30.2 % R.H.			
2. Convert to Standard Condition								
Measured (cfm)					Standard Test Conditions			Convert ( $Q_{st}$ )
Part		Total ( $Q_t$ )	Extraneous ( $Q_e$ )	Net Specimen ( $Q_s$ )	atmosphere	temp	Air density ( $W_s$ )	
In★	Fixed Area	54.04	50.44	3.60	1 013 (hPa)	20.8 (°C)	1.202 (kg/m <sup>3</sup> )	3.58 cfm
Ex★		55.28	50.06	5.22				5.20 cfm
In★	Vent Area	54.10	54.04	0.06				0.06 cfm
Ex★		55.54	55.28	0.26				0.26 cfm

8-17. Structural Test  
(@150 %)

- ① Pressure : +75 psf / 150 % of Positive Design Pressure
- 
- 75 psf / 150 % of Negative Design Pressure

- ② Duration : Maintain target pressure 10 seconds

- ③ Allowance :

- Framing Member ; 2L / 1 000

FRAME I (Vertical) :  $2\,953\text{ mm} \times 2 / 1\,000 = 5.91\text{ mm}$ 

FRAME II (Vertical) :  $2\,635\text{ mm} \times 2 / 1\,000 = 5.27\text{ mm}$ 

FRAME III (Transom) :  $1\,170\text{ mm} \times 2 / 1\,000 = 2.34\text{ mm}$ 

- Glass : No Breakage

- ④ Measured : Refer to Table 8 & Figure 5.

- ⑤ Result :
- Pass**

Table 8. Measured the Permanent Deflection of Each Element

unit : mm

Pressure Gauge No	Positive		Negative		Allowance
	150 %	Net Deflection	150 %	Net Deflection	
No. 1	1.74	<b>2.67</b>	1.26	<b>2.28</b>	<b>5.91</b>
No. 2	3.67		3.26		
No. 3	0.29		0.71		
No. 4	1.20	<b>2.79</b>	1.30	<b>2.59</b>	<b>5.27</b>
No. 5	3.61		3.42		
No. 6	0.44		0.36		
No. 7	0.18	<b>0.18</b>	0.18	<b>0.18</b>	<b>2.34</b>
No. 8	0.18	<b>0.18</b>	0.08	<b>0.08</b>	<b>No Breakage</b>

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

Net Deflection : Gauge No. 5 - [(Gauge No. 4 + Gauge No. 6) / 2]

8-18. Horizontal

Movement Test(2nd)

① Displacement : Left 45 mm Right 45 mm (Total 90 mm)

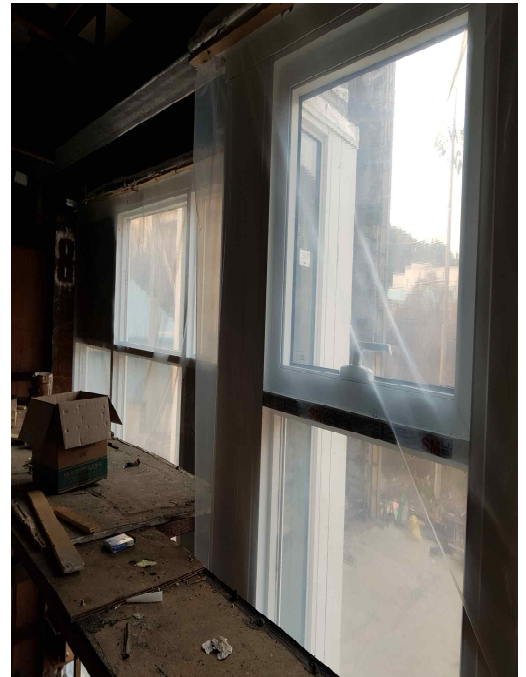
② Cycle : 3 times

③ Allowance :

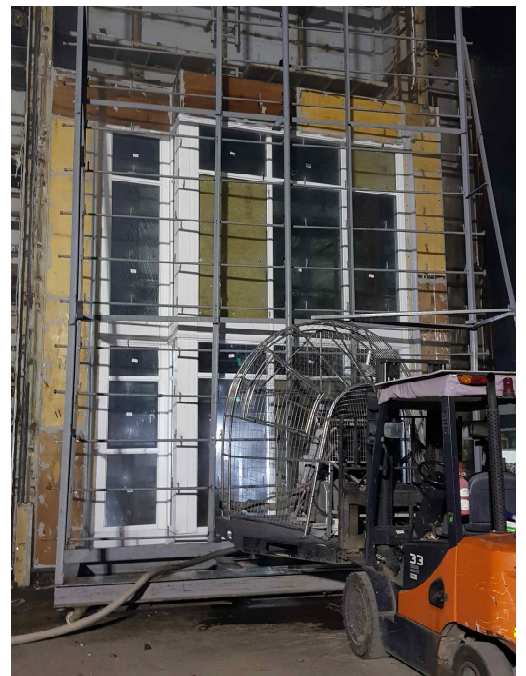
-. *No visible damage to framing or trim components or assemblies is allowed*-. *No glass breakage or glass fallout is allowed*-. *Full disengagement of gaskets or weatherseals is not allowed at any location*-. *Air infiltration and water penetration resistance shall remain within specified allowable limits without adjustments or repair, except as specifically noted herein*-. *No wall components may fall off*④ Result : **Pass**

## 9. Photo

### 9-1. Pre-load Test & Air Infiltration Test



### 9-2. Water Penetration Test

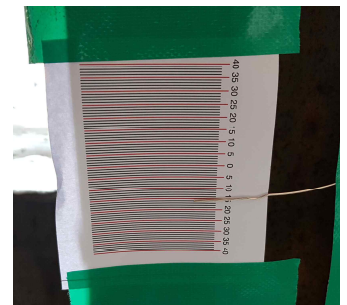
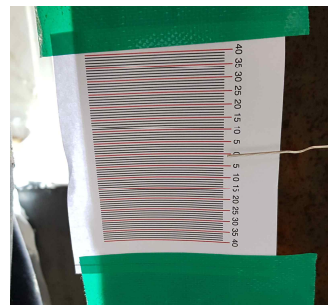
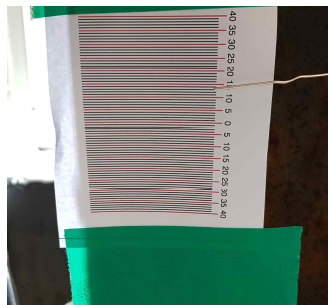




### 9-3. Structural Test

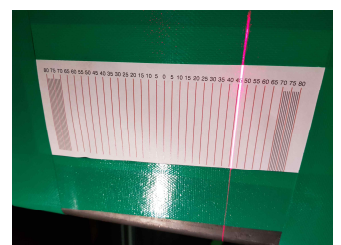
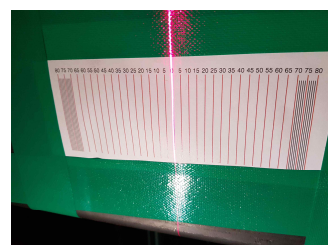
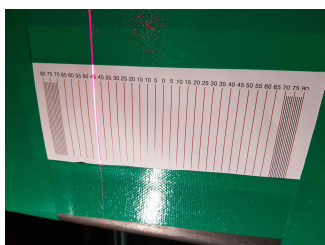
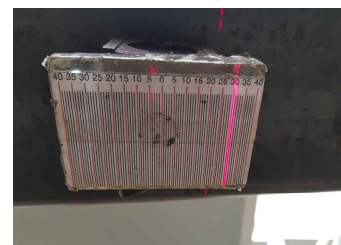
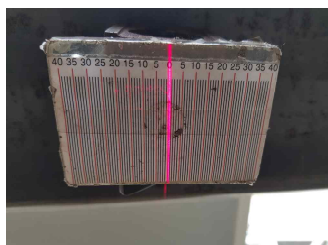


### 9-4. Vertical Test





9-5. Horizontal Test

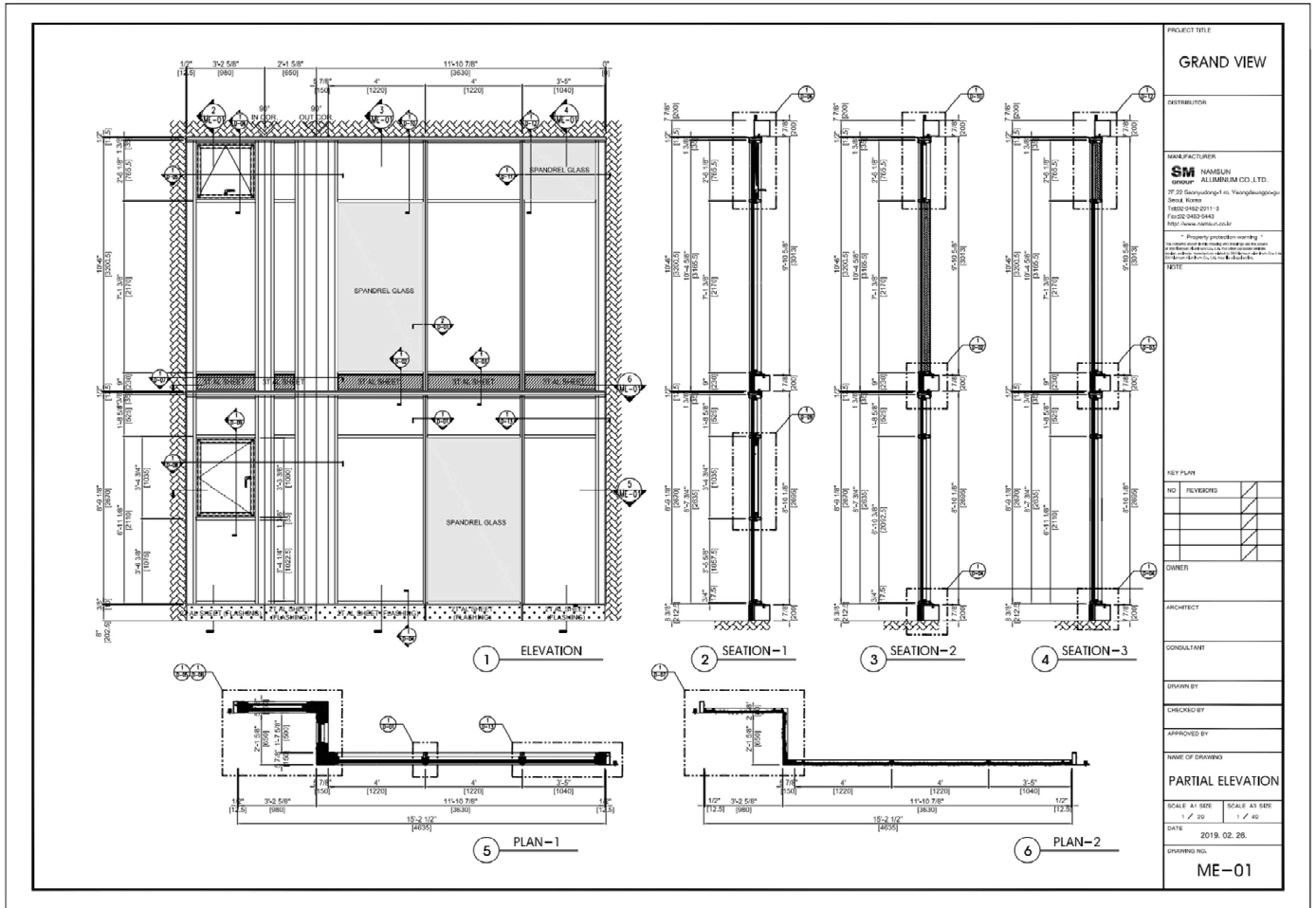


9-6. Thermal Cycling  
Test

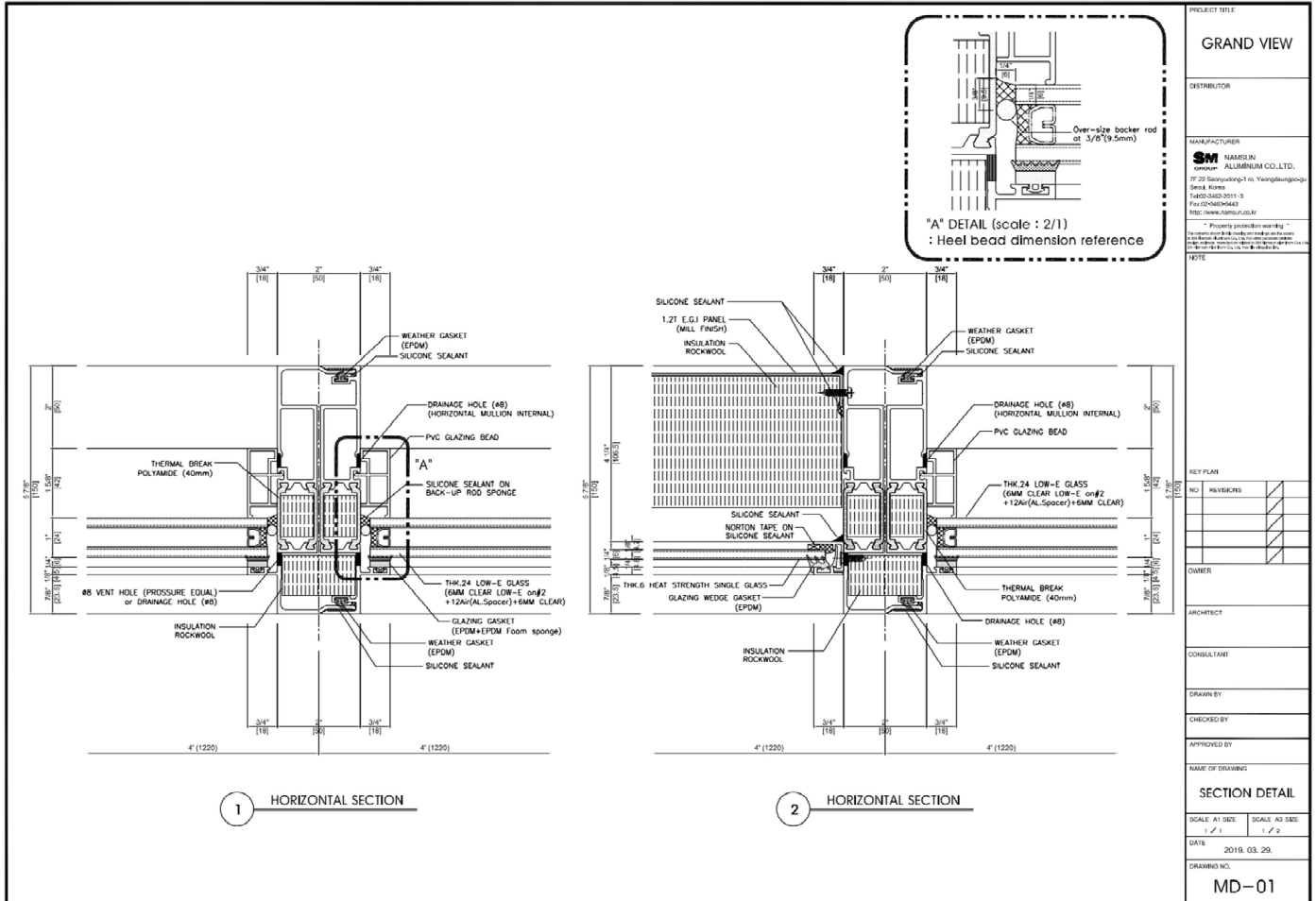


## 10. Drawings

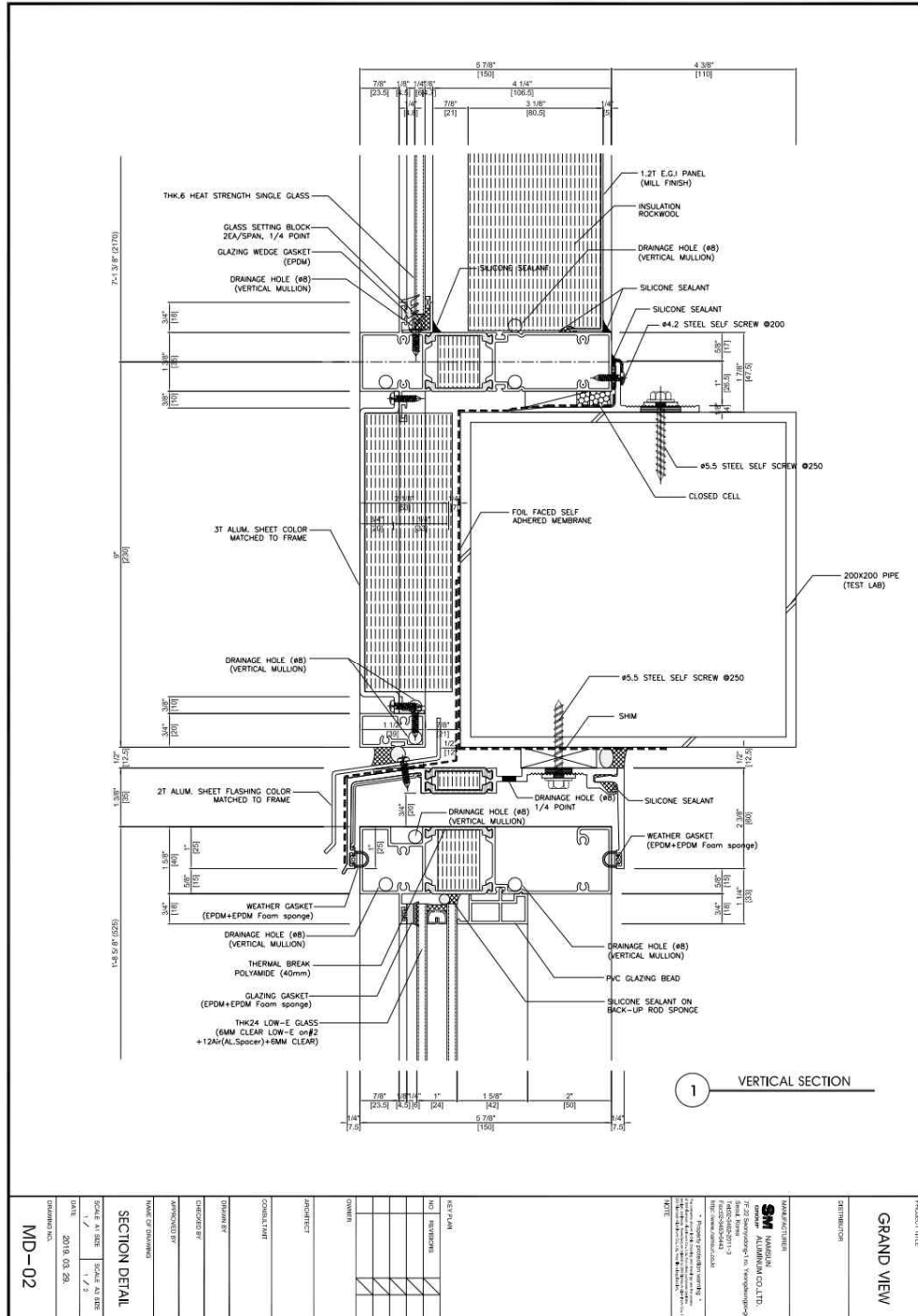
### 10-1. Elevation



10-2. Detail

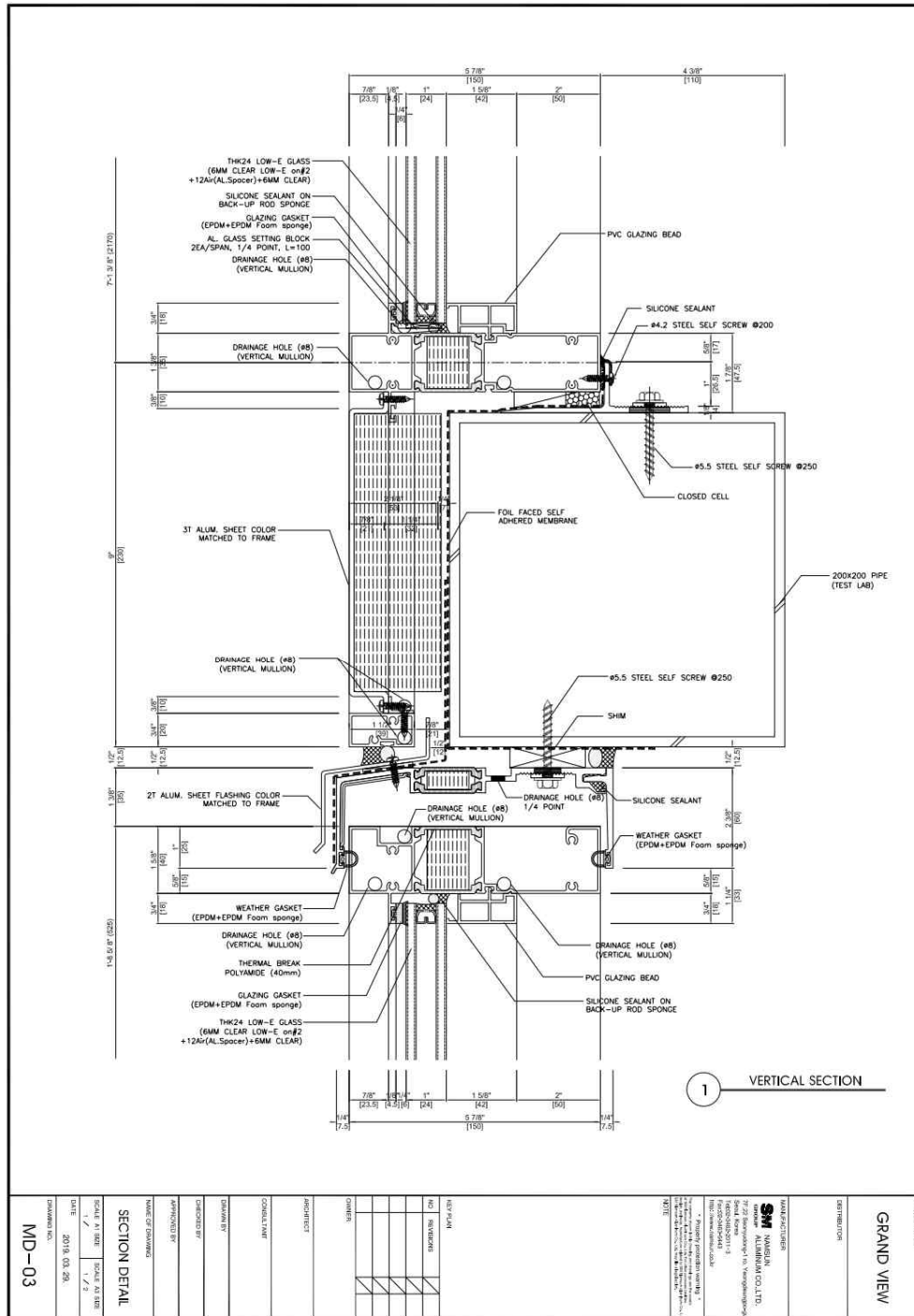


10-3. Detail

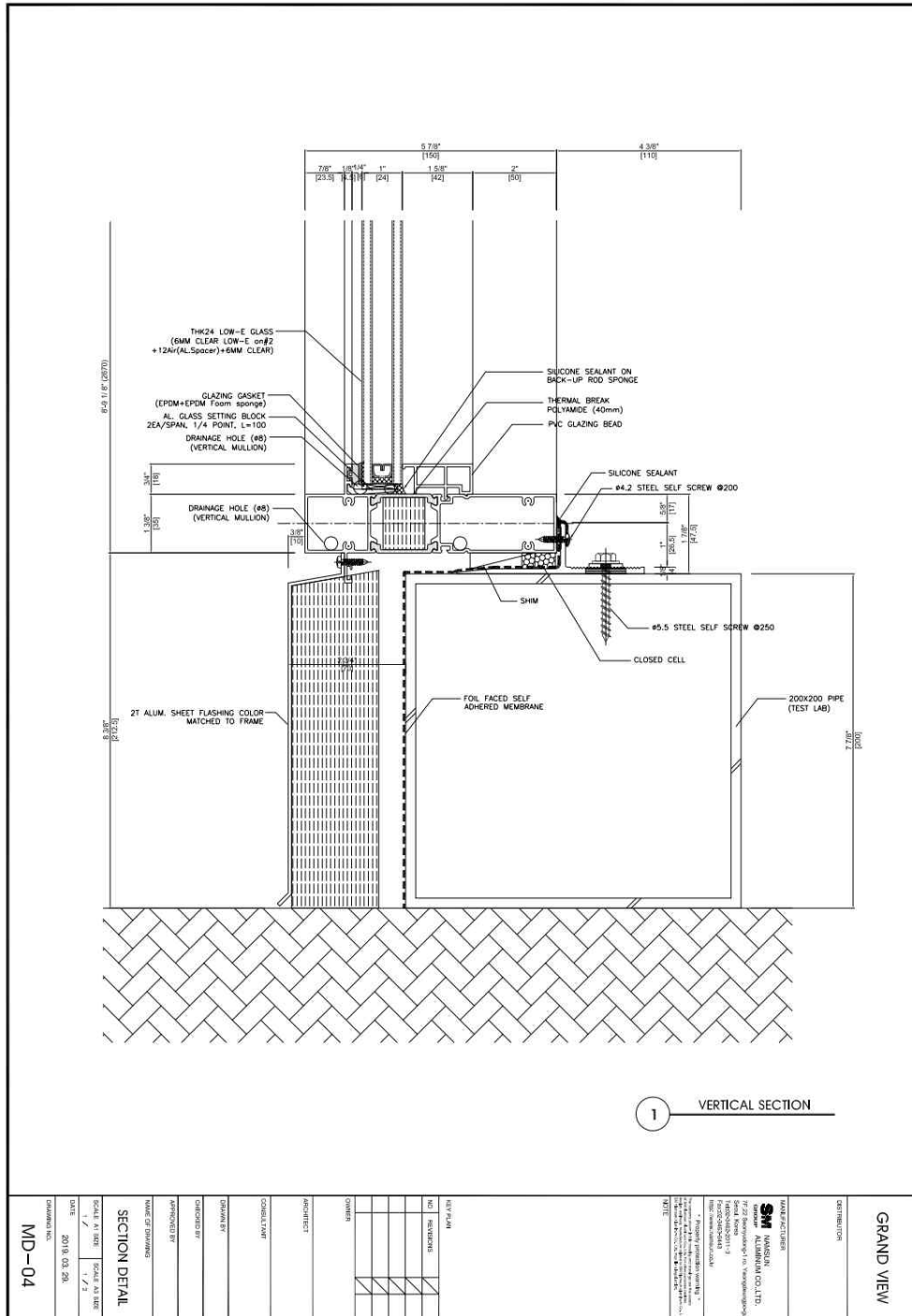




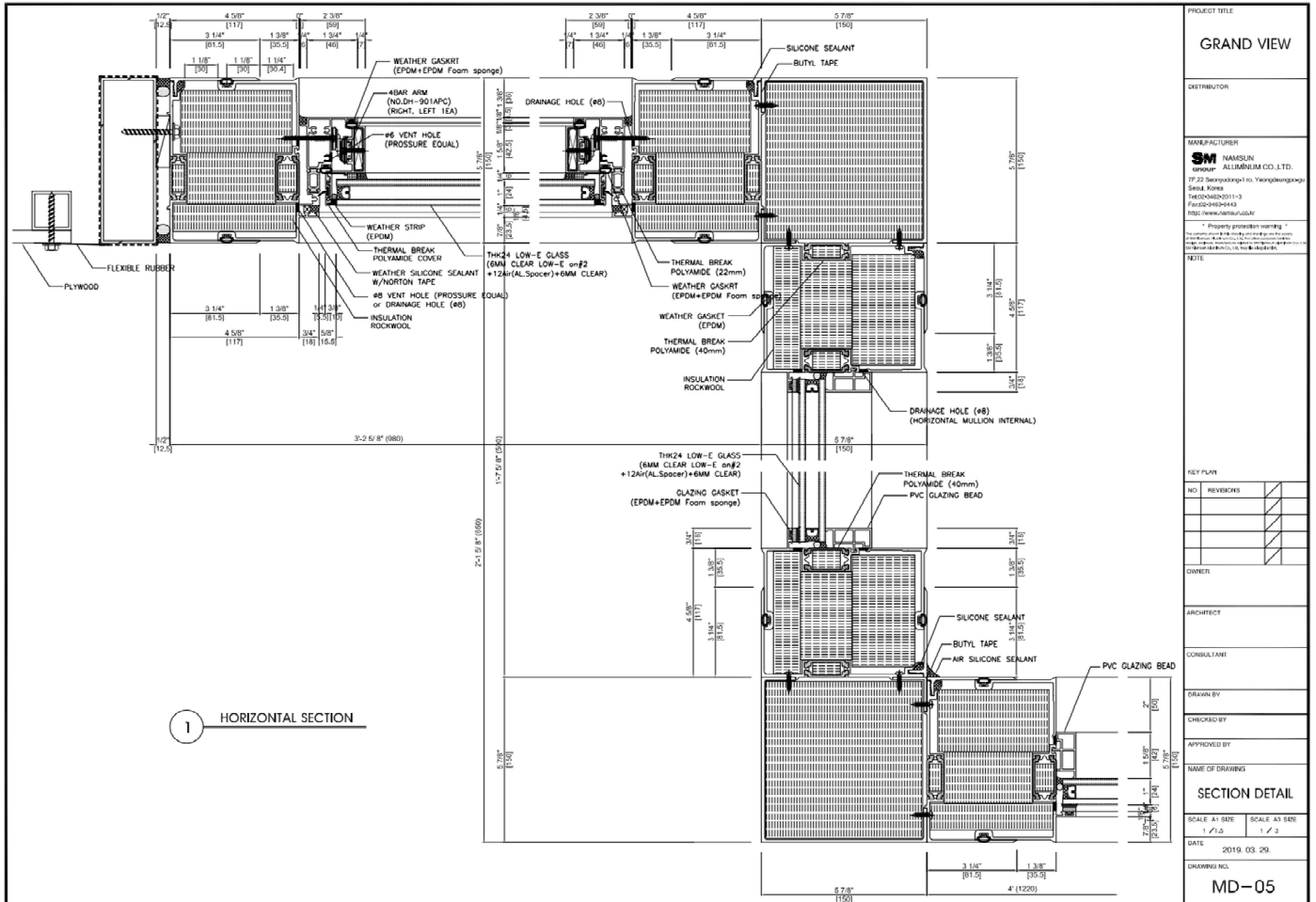
#### 10-4. Detail



10-5. Detail

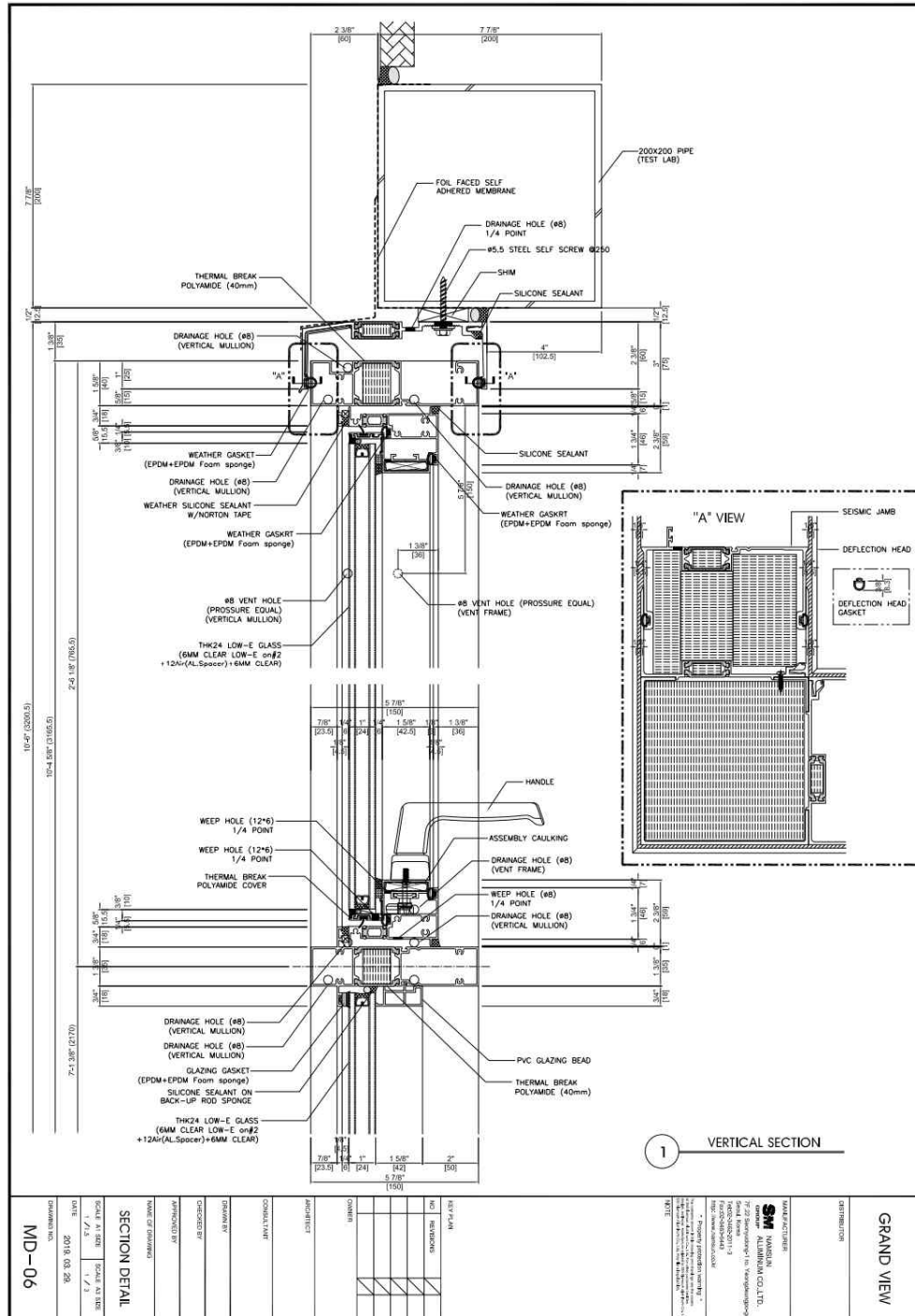


10-6. Detail

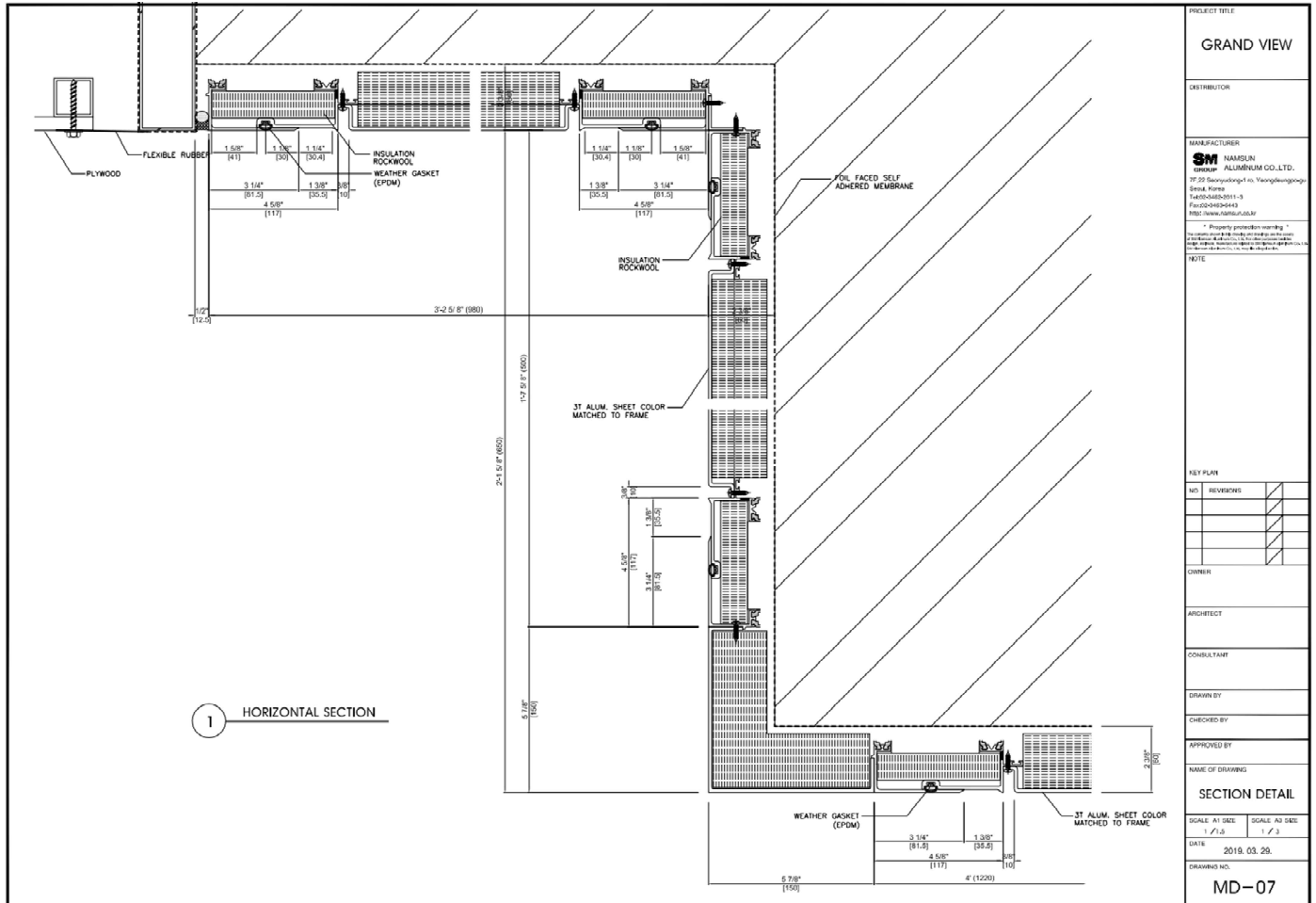




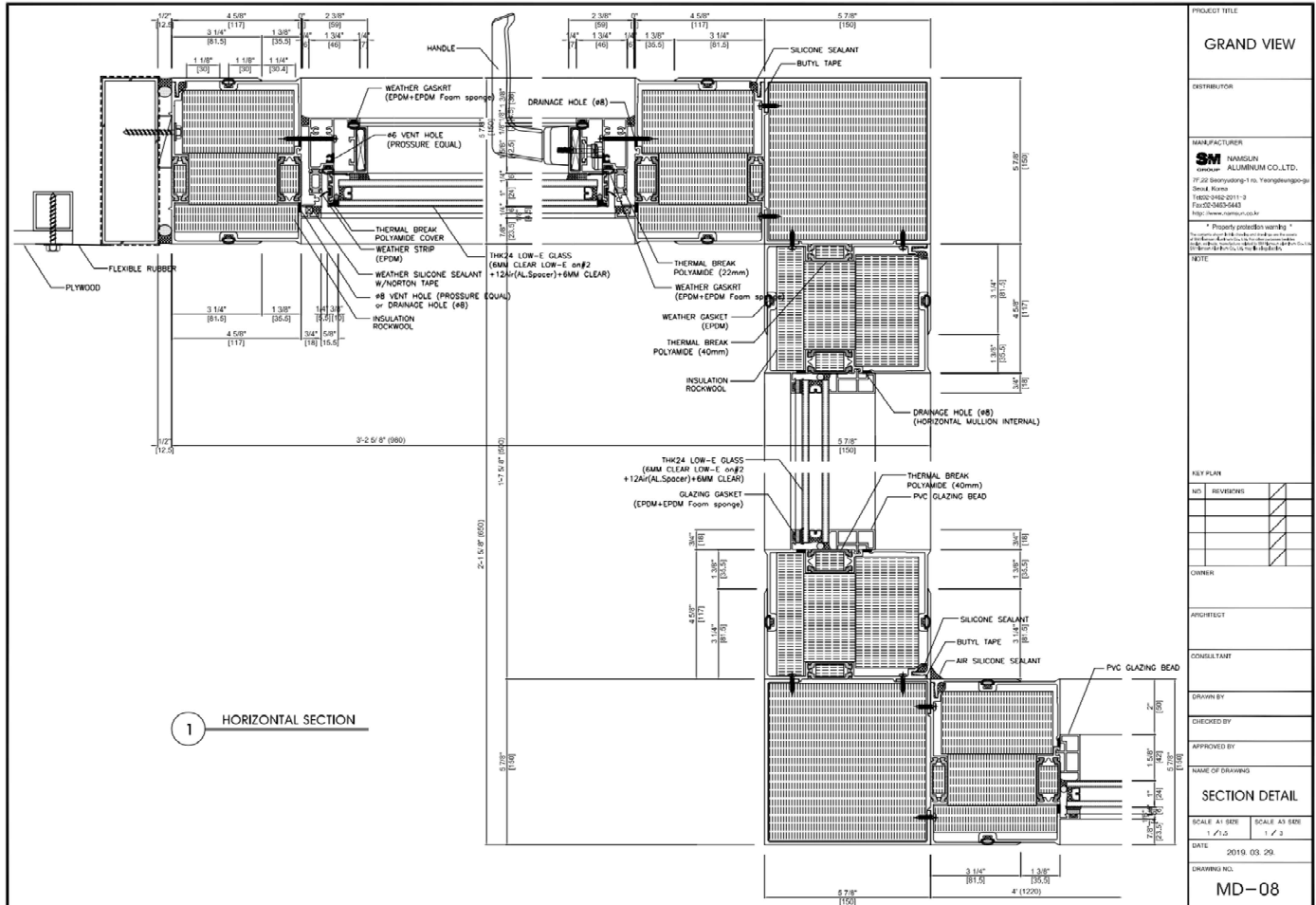
### 10-7. Detail



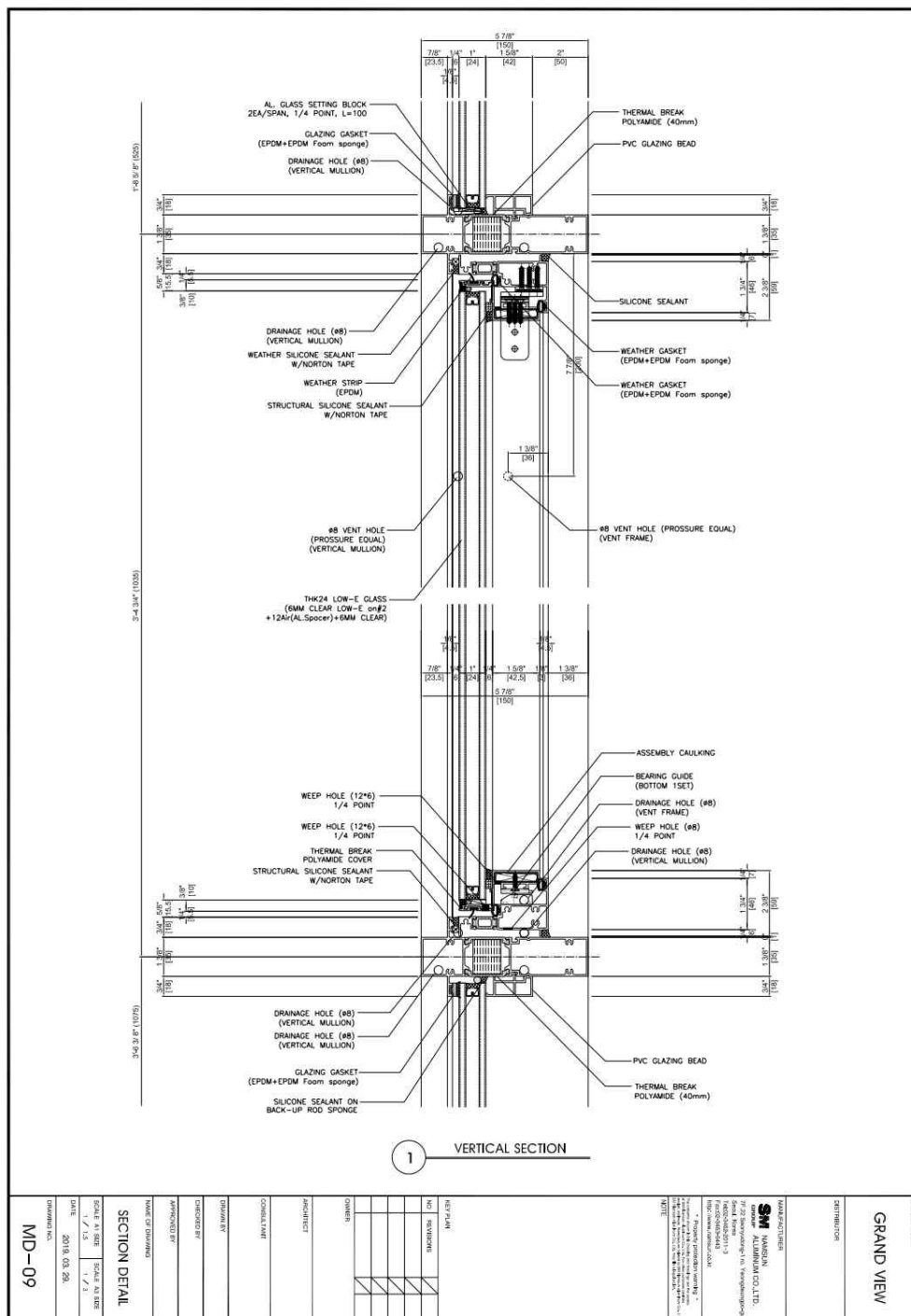
10-8. Detail



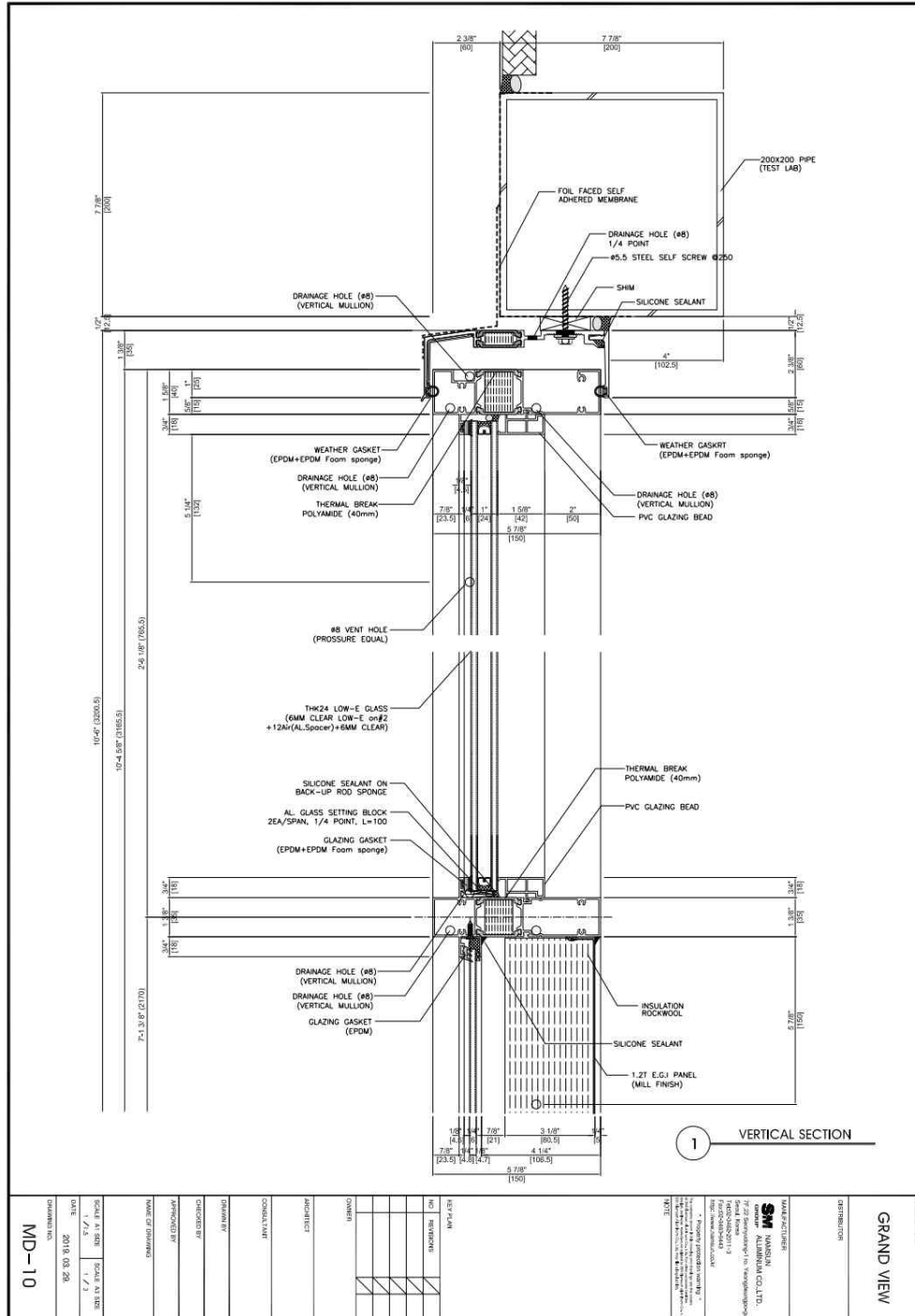
10-9. Detail



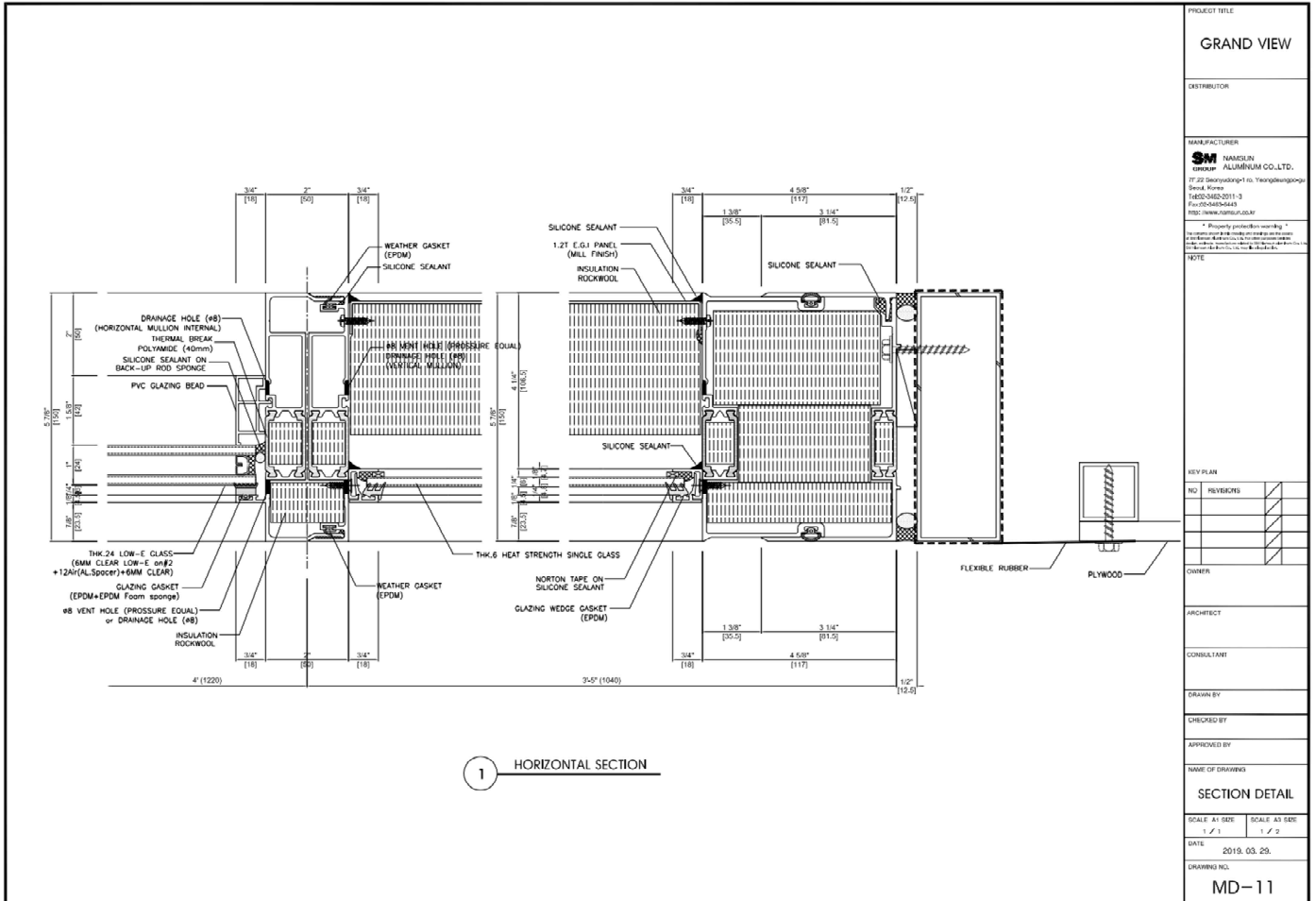
### 10-10. Detail



10-11. Detail

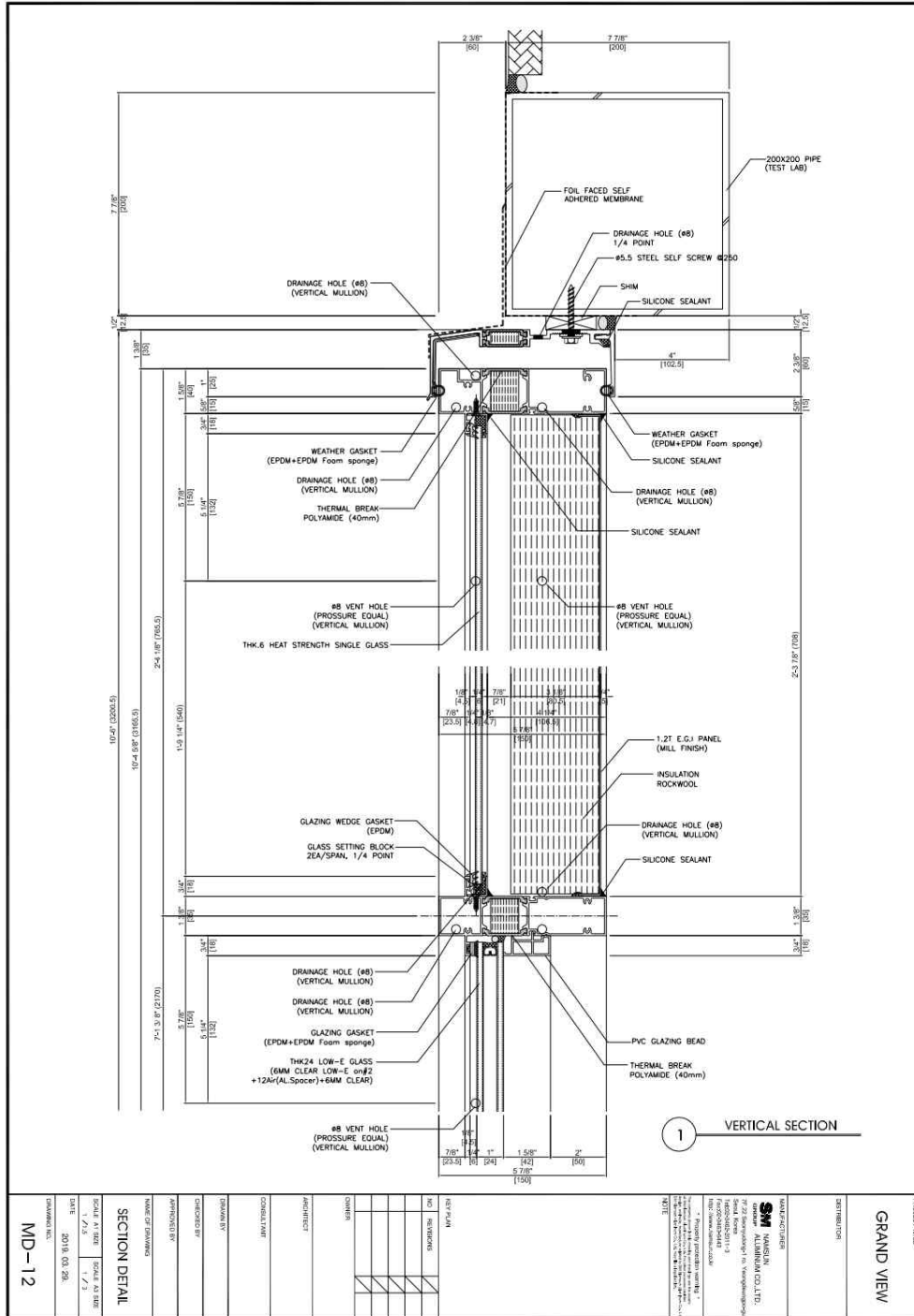


10-12. Detail

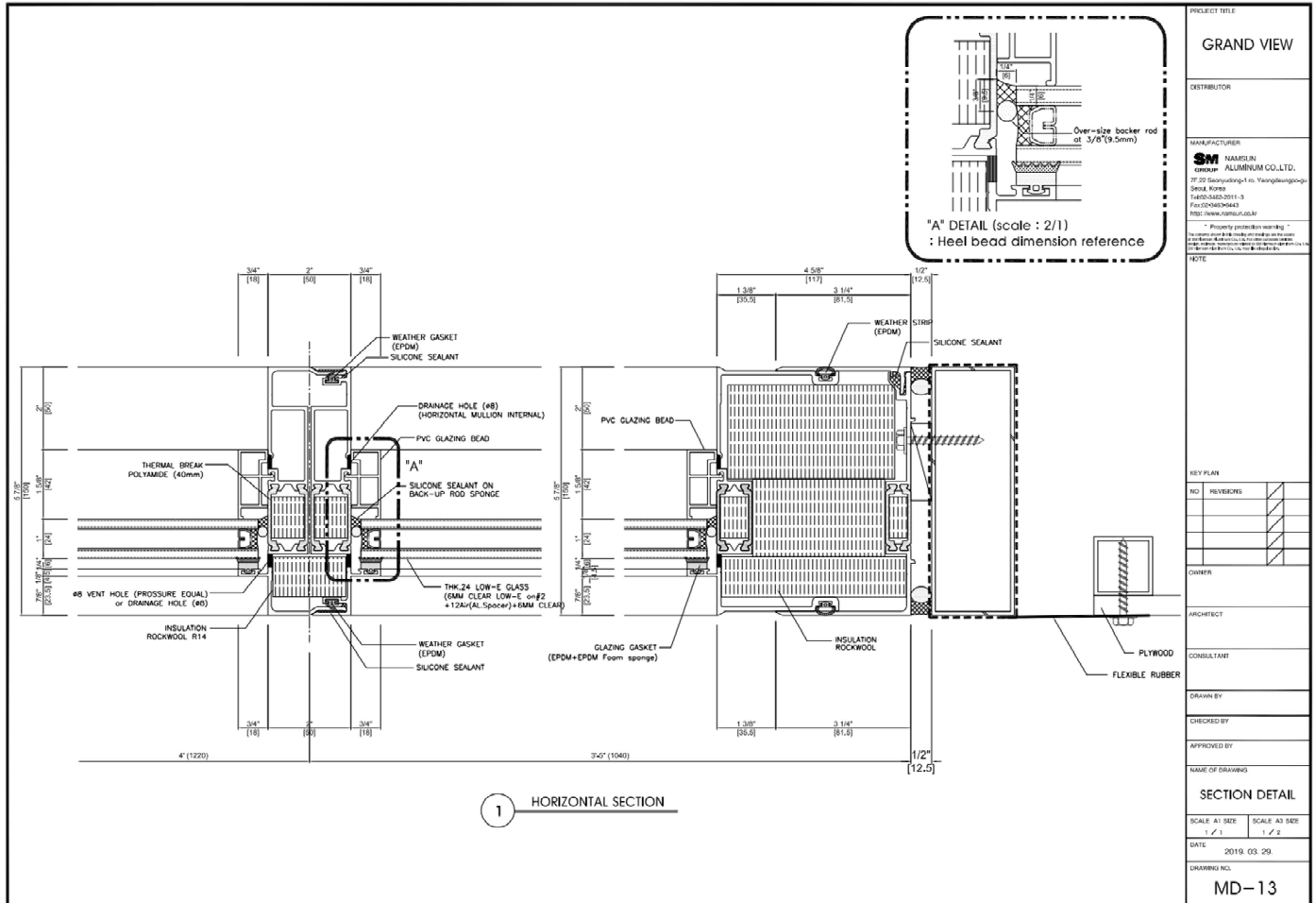




10-13. Detail




10-14. Detail





## 11. Certification



No. 487 (1/2)

### CERTIFICATE OF ACCREDITATION

Name of Laboratory : ATA

Representative : Kim, In Kon

Address of Headquarters : 172-30 Hwangnyongjae-ro Yeonsan-myeon Nonsan-city  
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



---

**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

Jangjun Han



Issue date : April 5th, 2019

Architectural Testing Asia

Technical Manager

Jingu Yu



Architectural Testing Asia

President

Inkon Kim

