

DUPLICATE

## REPORT



Your Ref:

Date: 8 September 2014

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Performance test of uPVC sliding door system for

**DECEUNINCK**

TESTED FOR:

**Ege Profil Tic. Ve San, A.S. – Deceuninck**

523 B Block, Mannur Village  
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**WINWALL TECHNOLOGY PTE. LTD.**

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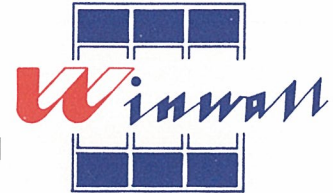
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CERT. NO.: LA-1996-0101-B



## 1. INTRODUCTION

Winwall was engaged by Ege Profil Tic. Ve San, A.S. – Deceuninck (hereinafter call 'Ege') to conduct performance test of one uPVC sliding door (70 Series) specimen for in-house project.

Performance test on the specimen was conducted on 28 August 2014.

The following tests were conducted:

- 1.1 Air Permeability Test (BS EN 1026 - 2000)
- 1.2 Static Water Tightness Test (BS EN 1027 - 2000)
- 1.3 Static water penetration test (ASTM E331-2009)
- 1.4 Wind Resistance Test (BS EN 12211 - 2000)
- 1.5 Proof load test (BS EN 12211 - 2000)

## 2. TEST FACILITY

The testing facility consists of the following:

- 2.1 A steel test chamber.
- 2.2 AGILENT data acquisition system.
- 2.3 NOVOTECHNIK displacement transducers (30 numbers of 100 mm range).
- 2.4 PNR full cone nozzles (700 mm center to center).
- 2.5 CONTITHERM centrifugal blowers of 10 kPa at 4000 CFM capacities.
- 2.6 PODDYMETER manometer (Range : -0.5kPa to 0.5 kPa, -10.0 kPa to 10.0 kPa).
- 2.7 PODDYMETER digital air flowmeter + Orific plate (range 0 – 200 m<sup>3</sup>/hr).
- 2.8 ENDRESS+HAUSER electromagnetic flowmeter.
- 2.9 EXTECH digital manometer (range 50 kPa to 50 kPa).
- 2.10 KIRLOSKAR water pump with 10 HP motor.
- 2.11 ENERPAC 50 tons double acting hydraulic ram with control system.



### 3. TEST SPECIMEN

One uPVC sliding door (70 Series) specimen of overall size of 2.4 m wide by 2.4 m high consisted of sliding window and one fixed glass pane was installed onto the test chamber.

The dimension and the construction details of the specimen are shown in the company's drawings attached for test.

The specimen was constructed such that the indoor face of the test specimen was fitted onto the pressure chamber. The remaining area was sealed with plywood to form an airtight chamber. A water spray rack system was used to wet the entire test specimen during water tightness test. Electronic displacement transducers were mounted onto the selected components to monitor the movement of the specimen under design load. Differential pressure reading was read from the liquid manometer and air flow was measured using orifice plate complete with air flow meter.

Photo 1 shows an exterior view of the sliding door specimen.

### 4. METHODS, SEQUENCE AND REQUIREMENTS OF TESTS

The following items were the sequence and methods of the tests conducted on the window wall specimen as requested by the company. The sequence of the tests was as follows:

- 4.1 Air Permeability Test (BS EN 1026 - 2000)
- 4.2 Static Water Tightness Test (BS EN 1027 - 2000)
- 4.3 Static water penetration test (ASTM E331-2009)
- 4.4 Wind Resistance Test (BS EN 12211 - 2000)
- 4.5 Proof load test (BS EN 12211 - 2000)

#### 4.1 AIR PERMEABILITY TEST (BS EN 1026 – 2000)

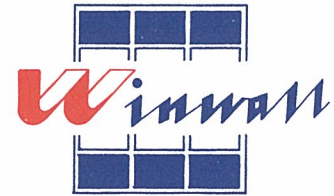
The step pressures applied onto the test specimen were as follows:  
50 Pa, 100 Pa, 150 Pa, 200 Pa, 250 Pa and 300 Pa.

Refer to figure F.1 for schematic drawing for air permeability test set-up.

Procedure:

- a. Three air pressure pulses of 500 Pa were applied on the specimen. Each pulse was maintained for about 5 seconds and reduced to zero pressure.
- b. All operable windows were opened and closed for five times.
- c. The exterior face of the entire specimen was sealed with PE sheet.
- d. The chamber was depressurised gradually by a blower to the maximum test pressure of 300 Pa in steps of 50 Pa. The air leakage of the chamber expressed in  $\text{m}^3/\text{hr}$  (read from the air flow meter) at various step pressures was recorded as  $q_1$ .
- e. The PE sheet was then removed from the specimen and procedure (d) repeated.
- f. The second set of air leakage readings recorded were the air leakage through the chamber and the test specimen at various step pressures. These readings were recorded as  $q_2$ .
- g. The air permeability of the sliding door,  $Q_d$ , in term of unit length, is equal to second set of readings, minus first set of readings at the corresponding pressure steps and divided by total perimeter of the sliding panels,  $L_d$ .  
$$Q_d = (q_2 - q_1) / L_d$$

Requirement: Classify test specimen as per BS EN 12207: 2000 specification.



#### 4.2 STATIC WATER TIGHTNESS TEST (BS EN 1027 - 2000)

Refer to figure F.2 for schematic drawing for water tightness test set-up.

Procedure:

- a. Open and close all operable parts for five times.
- b. Apply three pulses of positive pressure equal to 500 Pa. Each pulse maintained for at least 3 seconds.
- c. Operate the water sprays at zero pressure; adjust total water flow rate to 2.0 litre/mim. m<sup>2</sup> calculate from the area of the specimen under test.
- d. After 15 minutes of water spraying, apply test pressures to the specimen as follows:

|        |            |
|--------|------------|
| 0 Pa   | 15 minutes |
| 50 Pa  | 5 minutes  |
| 100 Pa | 5 minutes  |
| 150 Pa | 5 minutes  |
| 200 Pa | 5 minutes  |
| 250 Pa | 5 minutes  |
- e. The test specimen is checked visually for water leakage during the test duration.
- f. Record test pressure, time and location of any leaks that are observed.
- g. Classify the test specimen to EN 12208: 2000 specification.

Requirements: Classify test specimen as per BS EN12208: 2000 specification.

#### 4.3 STATIC WATER PENETRATION TEST

ASTM E 331-2009

Water penetration of exterior windows, skylight, doors and curtain walls by uniform static air pressure difference.

As specified by the company, the test pressure applied onto the test specimen was positive 200 Pa.

Refer to figure F.2 for schematic drawing for water penetration test set-up.

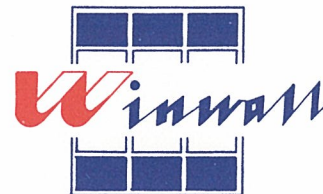
Procedure:

- a. Water was sprayed from an array of nozzles spaced 700 mm centre to centre and approximately 400 mm from the curtain wall specimen surface at a rate of approximately 3.4 litre/min/m<sup>2</sup>.
- b. The test chamber was then pressurized gradually to the required pressure of 200 Pa maintained for 15 minutes.
- c. Water was sprayed continuously during the duration of the test.
- d. The test specimen was visually checked for water leakage during the duration of the test.

Company's requirements:

There shall be no uncontrollable water leakage during the duration of the test. Uncontrollable water leakage is defined as :-

- i) Water appears on the inside face of the specimen and is visible from an occupied space.
- ii) Water appears on the inside face of the specimen and is likely to damage insulation or architectural fixtures.
- iii) Water leakage that is not contained and drained away.
- iv) Water overflows from sill tracks.



#### 4.4 WIND RESISTANCE TEST (BS EN 12211 - 2000)

As specified by the company, the test pressures applied onto the test specimen were positive 1600 Pa and negative 1600 Pa.

Refer to figure F.3 for schematic drawing for wind resistance test set-up.

Procedure:

- a. Ten (10) numbers of displacement transducers were mounted on the test specimen to measure the displacement of the test specimen. Each transducer was checked prior to testing.
- b. Three air pressure pulses of 500 Pa were applied on the specimen. Each pulse was maintained for about 5 seconds and reduced to zero pressure.
- c. The test specimen was then loaded in step of 300 Pa up to 100% of the positive design load (1600 Pa) as indicated in figure F.4 and at each increment, the displacement of the test specimen was captured by a HP data acquisition system and the displacement values were calculated by a in-house software and then shown on the computer monitor and printed out.
- d. The pressure was then unloaded to zero pressure and the residual deformations were measured two minutes later.
- e. The procedures (b) to (d) were repeated for negative pressure of 1600 Pa.

See figure F.5 for locations of displacement transducers on the specimen.

Requirements: Classify test specimen as per BS EN12210: 2000 specifications.

#### 4.5 PROOF LOAD TEST (BS EN 12211 - 2000)

- i Apply positive 2400 Pa (150% of design load) for a minimum 10 seconds.
- ii Note any changes in the condition of the specimen.
- iii Open and close all operable parts 5 times, finally securing them in the closed position.

Repeat steps (i) to (iii) with negative proof load pressure.

## 5. SUMMARY OF TEST RESULTS:

### 5.1 AIR PERMEABILITY TEST

| Test                                                             | Test pressures (Pa): |         |         |         |         |         |
|------------------------------------------------------------------|----------------------|---------|---------|---------|---------|---------|
|                                                                  | 50 Pa                | 100 Pa  | 150 Pa  | 200 Pa  | 250 Pa  | 300 Pa  |
| Air permeability of the sliding windows. (m <sup>3</sup> /hr. m) | 0.95                 | 1.48    | 2.11    | 2.36    | 2.90    | 3.44    |
| BS EN12207: 2000 Classification                                  | Class 3              | Class 3 | Class 3 | Class 3 | Class 3 | Class 3 |

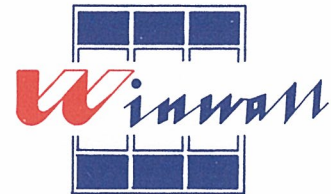
Note: Refer to Appendix A.1 for detail results of the air infiltration test.

### 5.2 STATIC WATER TIGHTNESS TEST

| Test pressures (Pa) | Time maintained (mins) | Observation                                                                                                                                                     | BS EN12208: 2000 Classification |
|---------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 0                   | 15                     | Air driven water bubbling along bottom sliding track was observed during the test.<br><br>No water overflow from the bottom track was observed during the test. | 6A                              |
| 50                  | 5                      |                                                                                                                                                                 |                                 |
| 100                 | 5                      |                                                                                                                                                                 |                                 |
| 150                 | 5                      |                                                                                                                                                                 |                                 |
| 200                 | 5                      |                                                                                                                                                                 |                                 |
| 250                 | 5                      |                                                                                                                                                                 |                                 |

### 5.3 STATIC WATER PENETRATION TEST

| Test pressure (Pa) | Time maintained (mins) | Observation                                                               |
|--------------------|------------------------|---------------------------------------------------------------------------|
| 200 Pa             | 15                     | No water leakage from the specimen was observed during the test duration. |



#### 5.4 WIND RESISTANCE TEST

| Components measured<br>(Transducer no.)                   | Deflection (mm) of specimen |             |             |             |
|-----------------------------------------------------------|-----------------------------|-------------|-------------|-------------|
|                                                           | Test pressures (Pa)         |             |             |             |
|                                                           | +1200<br>Pa                 | +1600<br>Pa | -1200<br>Pa | -1600<br>Pa |
| Deflection (mm) of<br>mullion:<br>(13) – [(12 + 14)/2]    | 10.54 mm                    | 13.96 mm    | -7.97 mm    | -9.75 mm    |
| Deflection (mm) of glass<br>pane:<br>(16) – [(15 + 17)/2] | 5.82 mm                     | 6.85 mm     | -5.13 mm    | -6.16 mm    |
| BS EN12210: 2000 Classification: A4 and B3.               |                             |             |             |             |

- NOTE: a. Refer to Appendix A.2 and A.3 for detail results of displacement readings.
- b. Refer to figure F.5 for locations of displacement transducers measurements on test specimen.
- c. Deflection of aluminium member and other component is calculated based on measured value minus the average of the corresponding two end deflections.

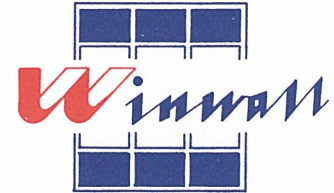
#### 5.5 PROOF LOAD TEST

| Test pressures<br>applied (Pa) | Result                 |
|--------------------------------|------------------------|
| +2400 Pa                       | No structural failure. |
| -2400 Pa                       | No structural failure. |

6. CONCLUSIONS:

The Deceunick uPVC sliding door (70 Series) test specimen has the following classifications:

- |     |                                            |                  |
|-----|--------------------------------------------|------------------|
| i.  | Air permeability test (BS EN 12207: 2000): | Class 3.         |
| ii  | Water tightness test (BS EN 12208: 2000):  | Class 6A.        |
| iii | Water penetration test (ASTM E331: 2009):  | 200 Pa.          |
| iv  | Wind resistance test (BS EN 12210: 2000):  | Class A4 and B3. |

7. WITNESSES (Photo 2):

| <u>Name</u>               | <u>Signature</u>          | <u>Company</u>                           |
|---------------------------|---------------------------|------------------------------------------|
| <u>N. SUNDARA VADIVEL</u> | <u>N. Sundara Vadivel</u> | <u>Geotrix - Consultant for Facades.</u> |
| <u>G.R. ASHOK KUMAR</u>   | <u>G.R. Ashok Kumar</u>   | <u>SPPA UPVC DOORS AND WINDOWS</u>       |
| <u>Amrit Patel</u>        | <u>Amrit Patel</u>        | <u>SOHOM</u>                             |
| <u>HARIRAJ</u>            | <u>Hariraj</u>            | <u>DECEUNINCK</u>                        |
| <u>SATISH KUMAR P.S</u>   | <u>Satish Kumar P.S</u>   | <u>DECEUNINCK</u>                        |
| <u>ADAY DUDEJA</u>        | <u>Aday Dudeja</u>        | <u>DECEUNINCK</u>                        |
| <u>ARUN KUMAR</u>         | <u>Arun Kumar</u>         | <u>DECEUNINCK</u>                        |
| <u>NEPOLIAN</u>           | <u>Nepolian</u>           | <u>DECEUNINCK</u>                        |

TESTED BY

SIMON CHIN YUN FEN

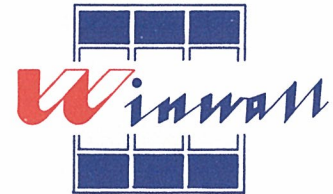
## APPENDIX A

### A.1 AIR INFILTRATION TEST

| Test Pressure (Pa)                                                                      | 50<br>Pa | 100<br>Pa | 150<br>Pa | 200<br>Pa | 250<br>Pa | 300<br>Pa |
|-----------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|
| Air leakage through chamber, $q_1$ (m <sup>3</sup> /hr).                                | 17.5     | 21.0      | 24.5      | 28.0      | 31.9      | 34.8      |
| Air leakage through chamber and sliding door, $q_2$ (m <sup>3</sup> /hr).               | 30.0     | 40.6      | 52.3      | 59.2      | 70.2      | 80.2      |
| Actual air leakage from sliding door, $Q_1$<br>$Q_1 = q_2 - q_1$ (m <sup>3</sup> /hr).  | 12.5     | 19.6      | 27.8      | 31.2      | 38.3      | 45.4      |
| Air permeability of sliding door, $Q_d$ ,<br>$Q_d = Q_1 / L_d$ . (m <sup>3</sup> /hr.m) | 0.95     | 1.48      | 2.11      | 2.36      | 2.90      | 3.44      |

Total frontal area of the specimen ( $A_d$ ) is 4.8 m<sup>2</sup>.

Total opening joint perimeter of sliding door ( $L_d$ ) is 13.2 m.



### A.2 WIND RESISTANCE TEST (POSITIVE PRESSURE)

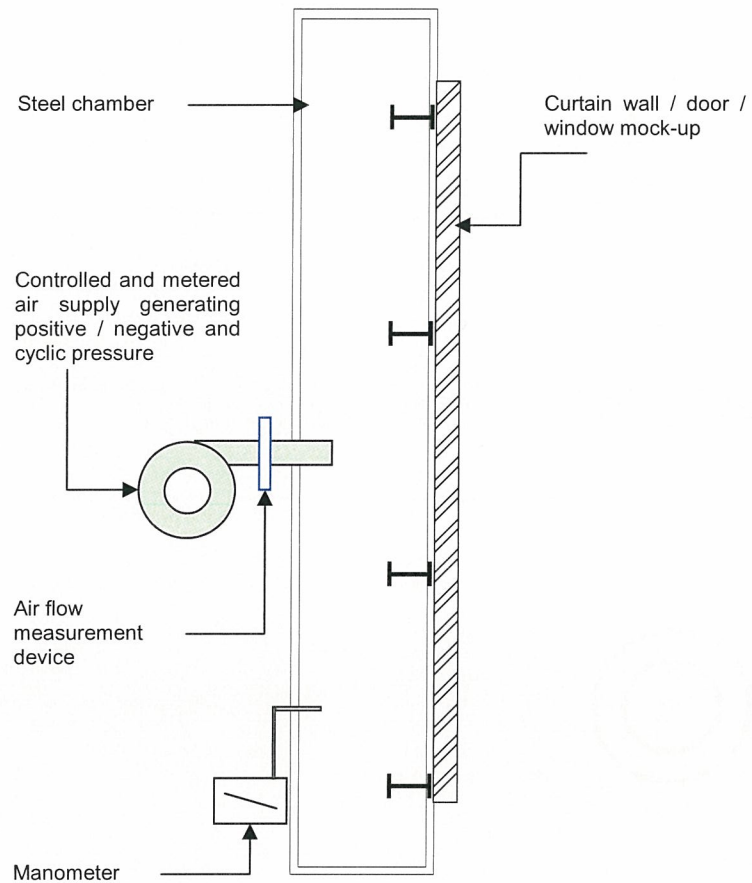
| Locations of displacement transducers | Time maintained (secs) | Displacement (mm) of sliding door specimen under positive pressure |        |        |         |         | Residual deformation 2 minutes after the test pressure was removed |
|---------------------------------------|------------------------|--------------------------------------------------------------------|--------|--------|---------|---------|--------------------------------------------------------------------|
|                                       |                        | 300 Pa                                                             | 600 Pa | 900 Pa | 1200 Pa | 1600 Pa |                                                                    |
| 12                                    | 10                     | 0.55                                                               | 2.08   | 3.43   | 4.75    | 6.79    | 0.02                                                               |
| 13                                    |                        | 2.93                                                               | 6.74   | 10.26  | 13.70   | 18.49   | 0.74                                                               |
| 14                                    |                        | 0.08                                                               | 0.47   | 1.01   | 1.57    | 2.27    | 0.29                                                               |
| 15                                    |                        | 3.90                                                               | 8.95   | 13.39  | 17.84   | 24.11   | 0.91                                                               |
| 16                                    |                        | 5.19                                                               | 11.33  | 16.21  | 20.83   | 26.96   | 1.04                                                               |
| 17                                    |                        | 3.03                                                               | 6.52   | 9.41   | 12.19   | 16.12   | 0.93                                                               |
| 18                                    |                        | 0.28                                                               | 1.32   | 2.31   | 3.34    | 4.94    | 0.27                                                               |
| 19                                    |                        | 1.02                                                               | 2.32   | 3.60   | 4.95    | 6.72    | 0.47                                                               |

See Figure F.5 for the locations of transducers on the specimen.

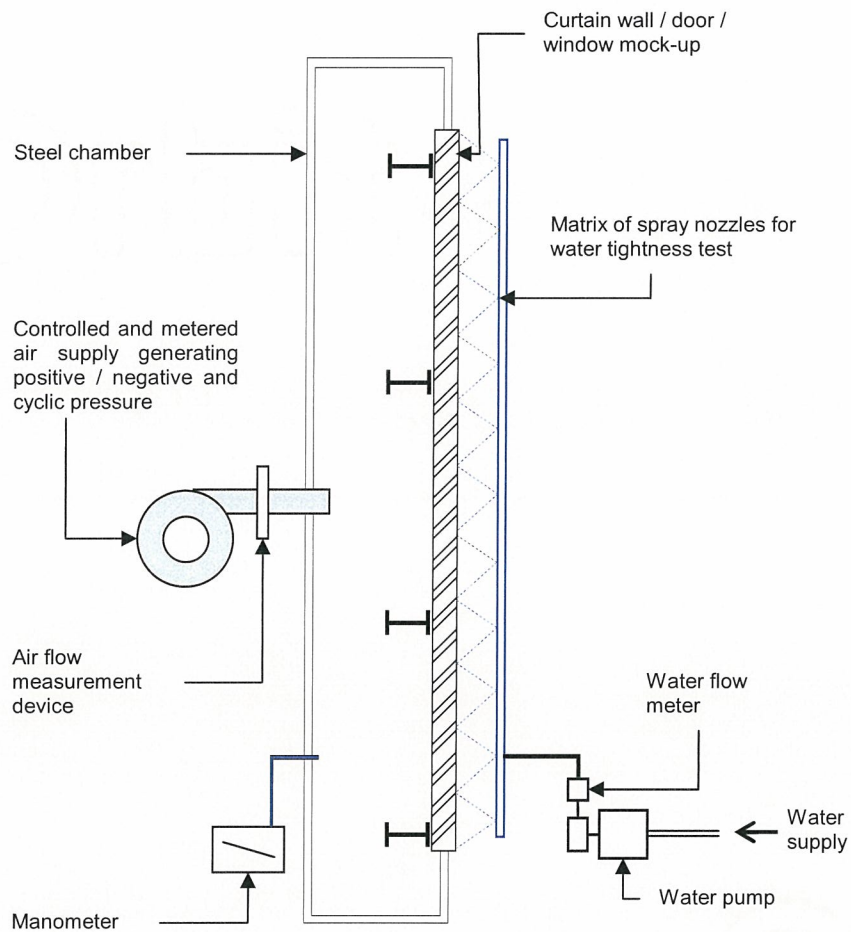
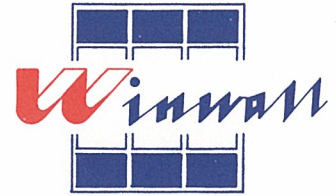
### A.3 WIND RESISTANCE TEST (NEGATIVE PRESSURE)

| Locations of displacement transducers | Time maintained (secs) | Displacement (mm) of sliding door specimen under negative pressure |         |         |          |          | Residual deformation 2 minutes after the test pressure was removed |
|---------------------------------------|------------------------|--------------------------------------------------------------------|---------|---------|----------|----------|--------------------------------------------------------------------|
|                                       |                        | -300 Pa                                                            | -600 Pa | -900 Pa | -1200 Pa | -1600 Pa |                                                                    |
| 12                                    | 10                     | -1.67                                                              | -4.55   | -6.22   | -9.38    | -11.95   | -0.81                                                              |
| 13                                    |                        | -3.48                                                              | -7.18   | -9.96   | -13.63   | -16.98   | -1.10                                                              |
| 14                                    |                        | -0.14                                                              | -0.82   | -1.20   | -1.94    | -2.52    | -0.22                                                              |
| 15                                    |                        | -4.21                                                              | -8.89   | -12.68  | -17.25   | -21.61   | -1.26                                                              |
| 16                                    |                        | -5.18                                                              | -10.60  | -14.92  | -19.65   | -24.41   | -1.18                                                              |
| 17                                    |                        | -2.97                                                              | -6.40   | -8.91   | -11.80   | -14.89   | -0.84                                                              |
| 18                                    |                        | -0.61                                                              | -2.22   | -3.14   | -5.26    | -6.82    | -0.41                                                              |
| 19                                    |                        | -2.47                                                              | -3.94   | -4.79   | -6.01    | -7.14    | -1.29                                                              |

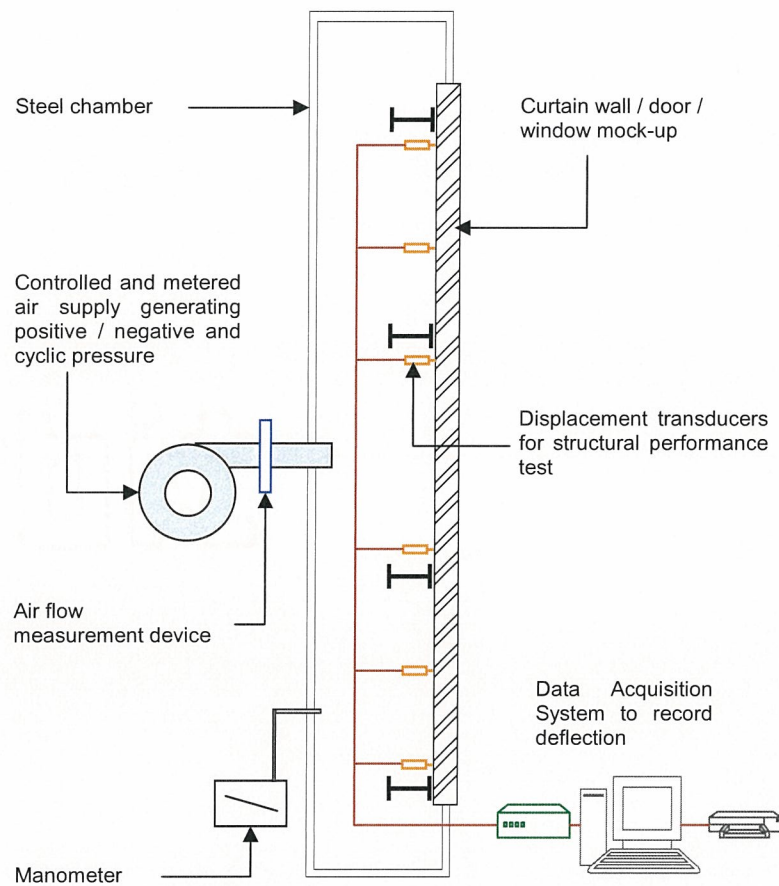
See Figure F.5 for the locations of transducers on the specimen.



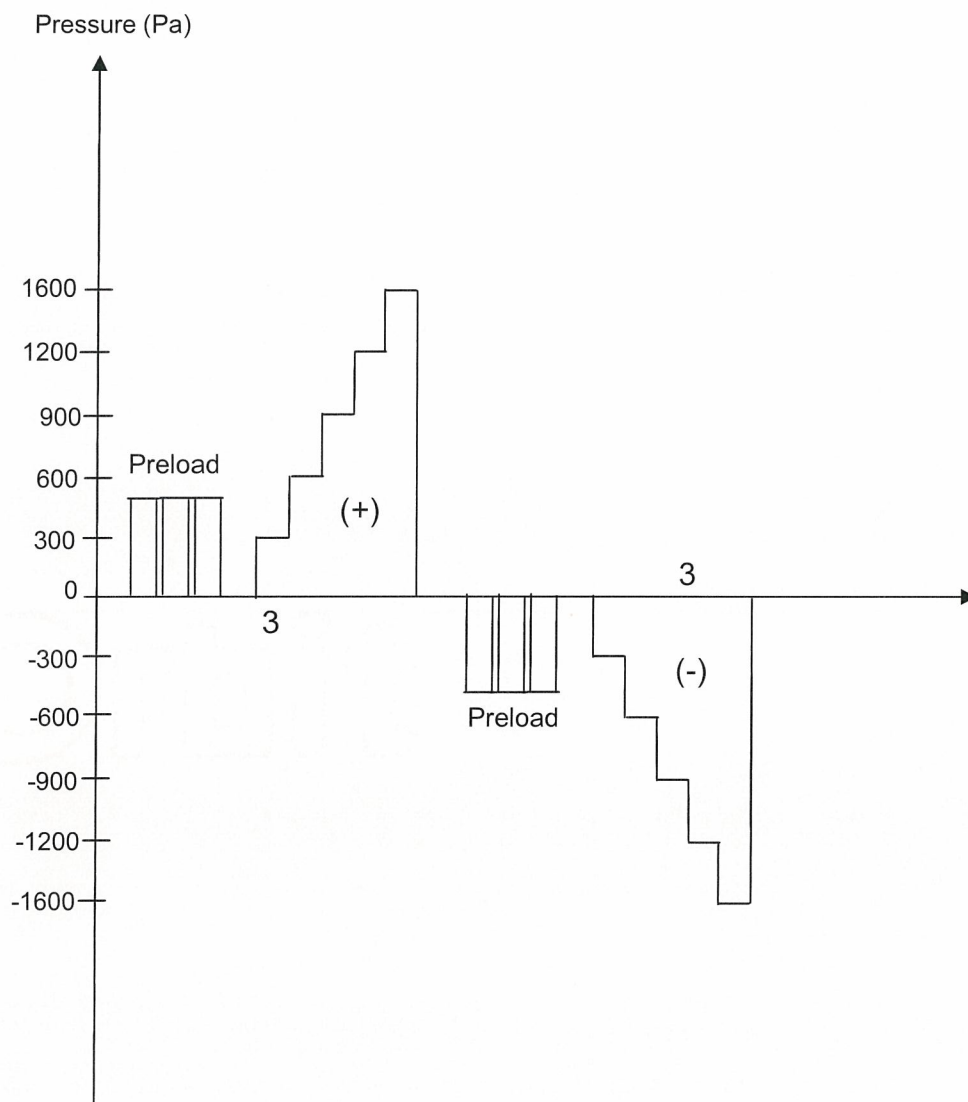
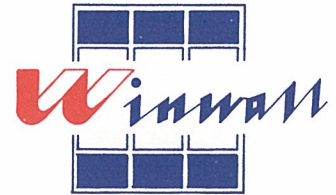
F.1 SCHEMATIC DRAWING FOR AIR PERMEABILITY TEST SET-UP



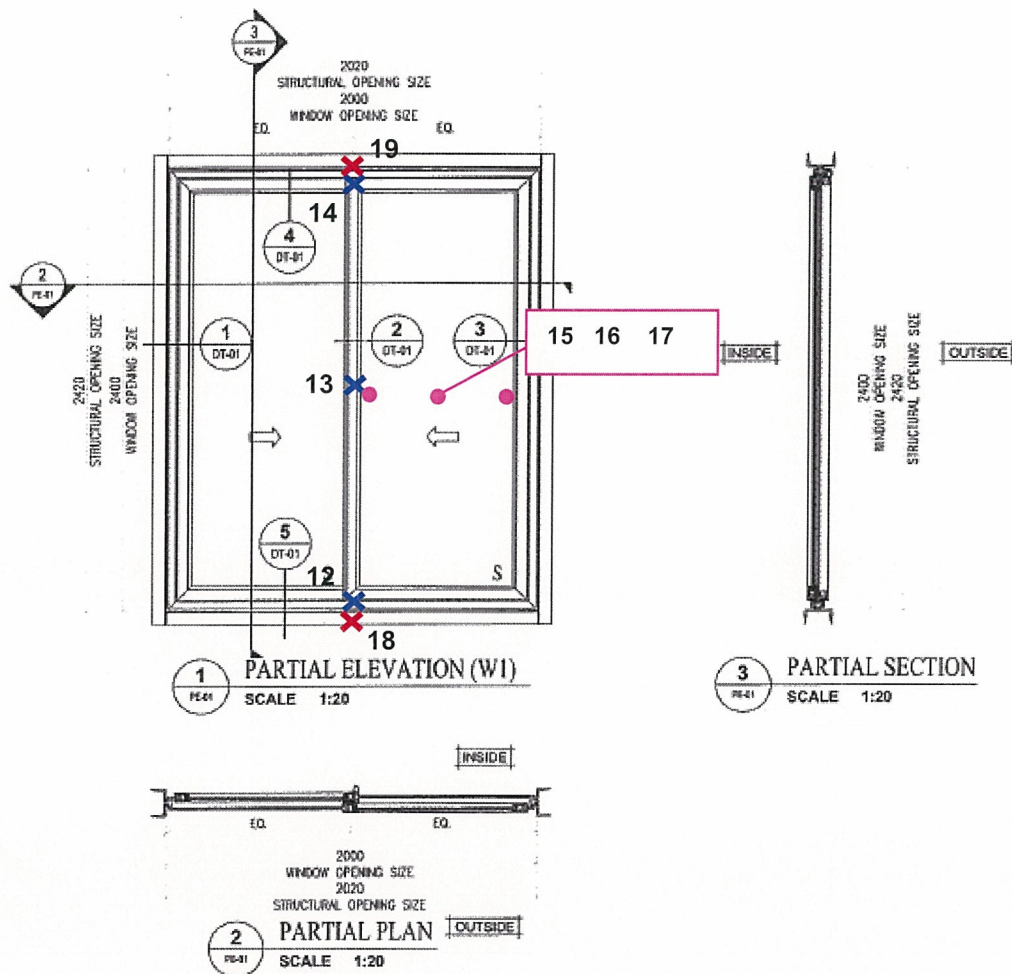
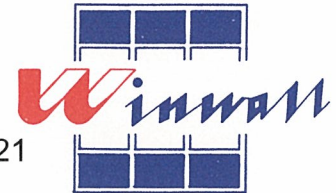
F.2 SCHEMATIC DRAWING FOR WATER TIGHTNESS TEST SET-UP



F.3 SCHEMATIC DRAWING FOR WIND RESISTANCE TEST SET-UP



F.4 WIND RESISTANCE TEST AIR PRESSURE APPLICATION DIAGRAM



- ✕ mullion (12~14)
- Glass (15~17)
- ✕ Outer frame (18, 19)

## F.5 LOCATIONS OF DISPLACEMENT MEASUREMENT ON THE SPECIMEN



Photo 1. An exterior view of the test specimen.