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مرجعكم: ٢٠٢٤/٠٨/١٤

الموضوع: اجراء اختبارات نفاذية المياه - تسرب الهواء - التشوه الإنشائي

الجهة الطالبة: شركة الوميتالو

نوع العينة: شباك منزلق

تحية طيبة وبعد،،

إيماءً الى الموضوع عاليه، مرفق التقرير الفني النهائي بالنتائج ، هذا وقد سددت الرسوم المقررة علي دفعتين الدفعة الاولى قدرها ٦٦٠١٠ (ستة وستون ألف وعشرة جنيهاً شاملة ضريبة القيمة المضافة) بالقسيمة رقم ٠٢٦٠٨٨٦ بتاريخ ٢٠٢٤/٠٨/١٤ والدفعة الثانية قدرها ٦٦٠١٠ (ستة وستون ألف وعشرة جنيهاً شاملة ضريبة القيمة المضافة) بالقسيمة رقم ٠٢٦١٧٧٩ بتاريخ ٢٠٢٤/٠٩/٠٤.

وتفضلوا بقبول فائق الاحترام،،

مدير المعهد
أستاذ دكتور /
محمود علي حسن

نائب رئيس مجلس الإدارة
لشئون البحوث والدراسات
طارق محمد بهاء الدين
٢٠٢٤/٠٩/٠٤
٤٧٨٧٢

أستاذ دكتور/

Client Name: ALU METALO.

Tests Name: Air Leakage, Water Penetration, and Structural Performance.

Delivery Date: 14/08/2024

Testing Date: 05/09/2024

Supplier Code: BPI/H/CO.353

System Code: SLIM-X LITE

Tested System: Sliding Window System

Air Leakage, Water Penetration, and Structural Performance Test Report for SLIM-X LITE Sliding Window System

Client:

ALU METALO



September 2024

1 - Executive Summary

The aim of these tests is to evaluate the sliding window system performance under the climatic conditions such as wind load and rain falls. This evaluation includes air Leakage, water Penetration, and structural Performance. For the evaluation, **ALU METALO** Company supplied and erected a sliding window System coded as **(SLIM-X LITE)**.

This process successfully enables the company to assess the performance and demonstrates that the sliding window system assembly meets or exceeds the requirements of the following standards.

- **ASTM E 283-19**, "Standard test method for determining rate of air leakage through exterior windows, curtain walls, and doors under specified pressure difference across the specimen".
- **ASTM E 331-00 (2016)**, "Standard test method for water penetration of exterior windows, curtain walls, and doors by uniform static air pressure difference".
- **ASTM E 330-02**, "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference"

2 – Sliding Window Description

The tested sliding window system **(SLIM-X LITE)** composed of two identical sashes. Each sash was composed of a fixed Aluminum frame and a single clear glazed area. The glass thickness is 6 mm. The dimensions of the system were 3.55 m width * 2.55 m height, and the total wall area was 9.05 m². A shop drawing of the sliding window is shown in **Figure (1)**

3 – Test chamber

For the evaluation of the tested sample, a test rig chamber was fabricated in the water and air Lab., Housing & Building National Research Center. The test chamber is of total dimensions 4.5 m width x 3.5 m height and 0.6 m depth. The test chamber Supplied with water spray nozzles. The required static pressure differentials were achieved using a 5 hp motor driven centrifugal air blower connected to the chamber using 9 cm diameter flexible circular duct.

A reversible sliding valve system is connected to control the rate of air flow and the applied static pressure. The window is supported at the external side of the test chamber. The test chamber is provided with instruments to measure the applied static pressure (Pa), the volumetric air flow rate (L/s) inside the chamber and the volumetric water flow rate (L/min) during the experiment.



4- Test Procedures and Calculations:

4.1. Air Leakage (Infiltration) Test:

The air leakage test was carried out in accordance with the procedure outlined in **ASTM E 283-19**. For determination of the system (chamber) air leakage, the joints of the window frame were first covered with a mil sheet of Polyethylene film. The extraneous air leakage was then determined by exhausting a measured flow (Q_e) of air from the test chamber to achieve an appropriate pressure differential (ΔP) across the chamber wall. At the given ΔP , the measured Air flow was recorded and deemed extraneous or system leakage Q_e . The mil sheet was then removed. The total window / extraneous air leakages, Q_t was then measured and recorded. The window - frame leakage at the applied (ΔP), Q_{cw} was then calculated from the relation:

$$Q_{cw} = Q_t - Q_e \quad (1)$$

Where, Q_{cw} : air leakage through the tested window, (L/s).

Q_t : air leakage through the tested window and extraneous (chamber) leakage, (L/s).

Q_e : extraneous (chamber) air leakage, (L/s).

Then, the rate of air leakage for the window per total area Q_A can be calculated using the equation:

$$Q_A = Q_{cw} / A, \text{ (L/s.m}^2\text{)} \quad (2)$$

Where, A: total unit sample area (m^2).

A photo of the sample during the air test is shown in **Figure (2)**.

4.2. Water Penetration Test:

To determine the water penetration characteristics of the unit widow system, the test was carried out in accordance to the procedure outlined in **ASTM E331-00(2016)**. Through using this procedure, a test was conducted using applied pressure difference across the tested unit widow system. At a design static pressure differential continuous water spray was applied to the exterior face of the unit widow system at a minimum rate of $3.4 \text{ L/m}^2\text{.min}$ for a period of 15 minutes. **Figure (3)** shows the sliding widow system during the water penetration test.



4.3. Structural Performance Tests*:

These tests were performed according to the ASTM E 330-02.

These tests are divided into two tests:

- Maximum deflection of the window at the applied air pressure inside the test chamber,
- The permanent deflection (deformation) of the window frame after removing the applied pressure.

4.3.1 Uniform Load Deflection Test:

Three dial gauges were supported vertically in the middle and at the two ends of the system to measure the deflection of the window frame with the applied pressure. **Figure (4)** shows the sliding window system during the structural performance test.

According to the test requirements indicated in AAMA MCWM-1-89, no deflection in excess of $L/175$ of any member's span during the imposed Positive air pressure load.

For this unit sliding window (SLIM – X LITE), the deflection must not exceed $2550/175 = 14.57$ mm.

* This test is not accredited.



5. Tests Results:

Test results for Air Leakage, Water Penetration, and structural performance of window system (SLIM-X LITE)

Series	Test Name	Applied pressure	Results	
			Allowable limits	Calculated results
1	Air leakage	300 Pa	1.52 (L/s.m ²)	0.05 (L/s.m ²)
2	Water Penetration	300 Pa	no water leakage within 15 min.	no water leakage
3	structural performance	1000 Pa	14.57 mm	6.24 mm

Notes:

- These tests were conducted at indoor air temperature and humidity of 22°C & 40% R.H.
- It is recommended to perform on-site tests.
- The sample was delivered to the laboratory by the entity requesting the test
- The attached results apply only to the sample submitted to HBRC, and it is not valid for the approval of any quantitative production / and practices / supplies / as well as export and is not considered as a conformity certificate
- This report is valid for six months. It is not allowed to reproduce this report except with the written consent of the HBRC.
- The laboratory is bound by the terms of the international standard for accreditation of laboratories ISO 17025 of 2017 in terms of confidentiality of data, transparency and neutrality with customer

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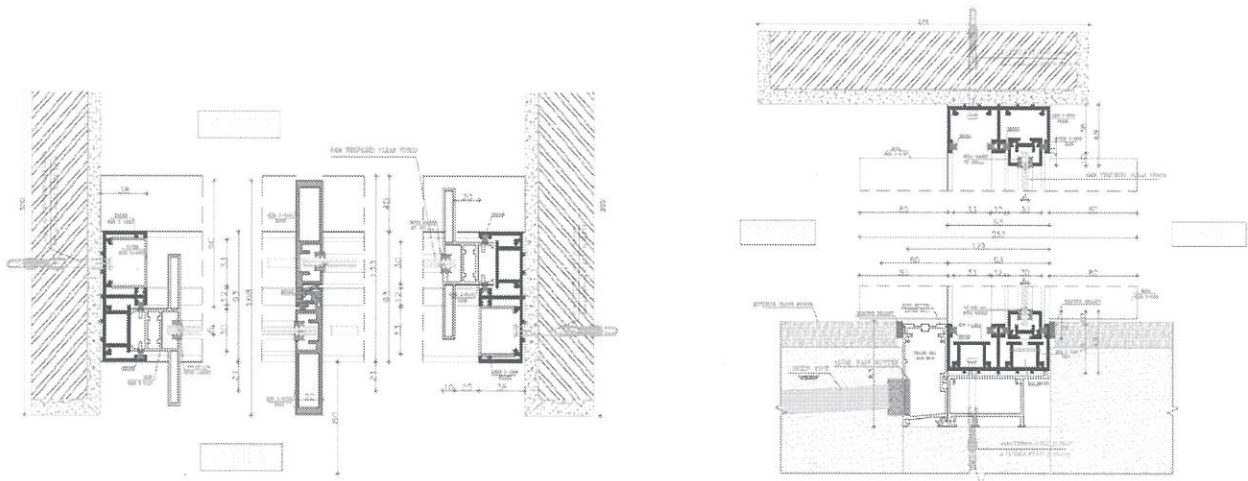
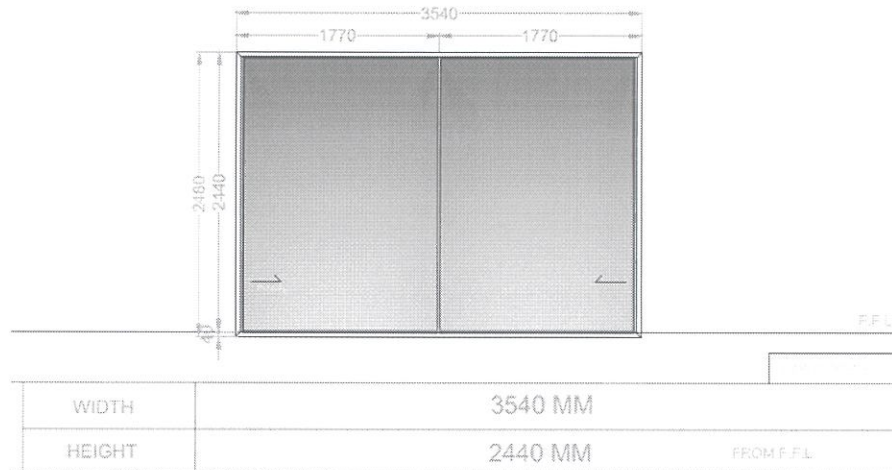


Figure (1): Shop drawing of SLIM-X LITE sliding window system





Figure (2): A photograph of SLIM-X LIFE sample during air infiltration test





Figure (3): A photograph of SLIM-X LITE sample during water penetration test





Figure (4): Photo of SLIM-X LITE sliding window system during structural performance test

