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EVALUATION CENTER

Intertek Testing Services Ltd., Shanghai Jinqiao Branch
Building T52-8, No. 1201 Gui Qiao Road,
Jinqiao Development Area, Pudong District
Shanghai 201206

RENDERED TO

**SHANGHAI YIRONG DOOR&WINDOW INSTALLATION&DESIGN
CO., LTD.**
**NO.750 WAIQINGSONG ROAD, JIADING DISTRICT, SHANGHAI,
CHINA**

PRODUCT EVALUATED

Aluminum Sliding Window
Model: YR-001

EVALUATION PROPERTY

Deflection Test, Operating Force Test, Air Infiltration Test,
Water Penetration Resistance Test, Ultimate Strength Test, Thermal
Transmittance Test and Cyclonic Missile Impact Test

Report of Testing an Aluminum Sliding Window for compliance with the applicable requirements of the following criteria: AS 2047-1999 "Windows in buildings selection and installation", AS 4420.2-1996 "Windows—Methods of test, Method 2: Deflection test", AS 4420.3-1996 "Windows — Methods of test, Method 3: Operating force test", AS 4420.4-1996 "Windows—Methods of test, Method 4: Air infiltration test", AS 4420.5-1996 "Windows — Methods of test, Method 5: Water penetration resistance test", AS 4420.6-1996 "Windows—Methods of test, Method 6: Ultimate strength test, NFRC 102-2010" and AS 1170.2: 2002 "Wind Actions".

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2 Introduction

Intertek has conducted testing for Shanghai Yirong Door&window Installation&design Co., Ltd. on an Aluminum Sliding Window to evaluate deflection test, operating force test, air infiltration test, water penetration resistance test, ultimate strength test, thermal transmittance test and cyclonic missile impact test. Testing was conducted in accordance with AS 1170.2: 2002, NFRC 102-2010 and AS 2047-1999 specifications and method standard of:

- AS 4420.2-1996 *"Windows—Methods of test, Method 2: Deflection test"*
- AS 4420.3-1996 *"Windows—Methods of test, Method 3: Operating force test"*
- AS 4420.4-1996 *"Windows—Methods of test, Method 4: Air infiltration test"*
- AS 4420.5-1996 *"Windows—Methods of test, Method 5: Water penetration resistance test"*
- AS 4420.6-1996 *"Windows—Methods of test, Method 6: Ultimate strength test"*

This evaluation began on September 20, 2012 and was completed on November 2, 2012.

3 Test Samples

3.1. SAMPLE SELECTION

Samples were submitted to Intertek directly from the client. Samples were not independently selected for testing. Samples were received at the Evaluation Center on September 18, 2012.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

A full scale sample of Aluminum sliding window was provided by the manufacturer that was not weathered nor conditioned.

Table1. Product Information

Product Name	Aluminum sliding window
Manufacturer	Shanghai Yirong Windows And Doors Company No.750, Waiqingsong Road, Shanghai, China
Model	YR-001, 1120x1160
Dimension of Window Frame	1270 mm (wide) × 1233 mm (high) × 100 mm (thick)
Dimension of Window Leaf	1030 mm (wide) × 1013 mm (high) × 86 mm (thick)
Aluminum Profile	Type: YR90 Manufacturer: Zhejiang Dongliang Aluminum Extrusion Company
Glazing	Size: 460x925 two pieces For movable sash: 460mm (wide) × 925 mm (high) Thickness: 4 mm green tinted + 2.28 pvb + 4 mm + 16 Argon + 6 mm clear low-E Supplier: Shanghai Haojing Glass Company

Hardware	Material: GT300 Supplier: Guangdong Jianlang Hardware
Sealing strip	Material: TC3009 Supplier: Shanghai Lijiarong Rubber Production Company
Lock	Material:GT300 Supplier: Guangdong Jianlang Hardware

The sample ID numbers were S1209233.001-S1209233.002. The drawing of the representative sample was included in Appendix A.

4 Testing and Evaluation Methods

4.1. DEFLECTION TEST

The Deflection Test was conducted in accordance with AS 4420.2-1996. The pressure was applied to test specimen in not less than four approximately equal increments until the test pressure was reached; first to the exterior surface (positive) and then to the interior surface (negative). The load duration was held for at least 1 minute at each pressure increment. The test specimen was evaluated for deflection during load, and was evaluated for permanent deflection after differential pressure removed for 2 minutes. No structure members in a completely assembled and glazed window should deflect by an amount greater than span/150 when the specimen was tested at the serviceability design wind pressure specified in Table 2.2 in AS 2047-1999.

4.2. OPERATING FORCE TEST

The Operating Force Test was conducted in accordance with AS 4420.3-1996. For the movable sash of the awning window, the force was applied at the fixed handle position; and forces to initiate the sash in motion and to maintain the motion should be recorded.

4.3. AIR INFILTRATION TEST

The Air Infiltration Test was conducted in accordance with AS 4420.4-1996. The test was performed using positive and negative differential pressures of 75 Pa and 150 Pa. The air infiltration rates through the specimen should be determined. The air infiltration should not exceed the value specified in Table 2.3 in AS 2047-1999.

4.4. WATER PENETRATION RESISTANCE TEST

The Water Penetration Resistance Test was conducted in accordance with AS 4420.5-1996. The test specimen was subjected to water spraying uniformly and continuously over the exterior face of the test specimen at a rate not less than $0.05 \text{ L/m}^2\cdot\text{s}$. At the start of test, the water sprays should operate for 5 minutes with zero air pressure; and then the test pressures specified in Table 24 in AS 2047-1999 was applied and maintained for 15 minutes with the water sprays still operating. During the test sequence, there should be no uncontrolled water penetration observed.

4.5. ULTIMATE STRENGTH TEST

The Ultimate Strength Test was conducted in accordance with AS 4420.6-1996. The ultimate strength test pressure specified in Table 2.5 in AS 2047-1999 was increased smoothly and was applied to the test specimen for 10 seconds in both positive and negative direction. The test specimen should not collapse when subjected to the ultimate strength pressure, and was evaluated for permanent damage after loading.

4.6. THERMAL TRANSMITTANCE TEST

The Thermal Transmittance Test, U_s , was conducted by means of guarded hot-box method in accordance with NFRC 102-2010. The specimen was installed in the surround panel with a configuration that simulated the actual installation. During testing, the Cold room was held at -18°C while the Metering Chamber and Guard Room were held at 21°C . The test measurement were recorded during the testing period and then calculated as soon as the steady-state criteria were met.

4.7. CYCLONIC MISSILE IMPACT TEST

The Cyclonic Missile Impact Test was conducted in accordance with AS 1170.2: 2002. The test window sash sample was taken from the double glazed sliding window (Model: YR-001). The glass type for each sash is laminated glass (4 mm green tinted + 2.28 pvb + 4 mm) + 16 Argon + 6 mm clear low-E. Laminated glass was on the outside, and the 6 mm clear low-e glass was on the inside.

In order to simulate the effect of a missile striking the window sash sample at a speed of 15 metre/second, a 4 kilograms hardwood timber batten 100×50 mm section was to be allowed to fall freely from a height of 11.47 metres on to the horizontally mounted window sash.

The test method was taken from clause 5.3.2 paragraph 2 on page 27 of AS 1170.2: 2002 "Wind Actions".

The test sample was supported on its perimeter frame section. The missile was then allowed to impact at the centre of the sample. Then the sample was inspected to determine if integrity of the outer and interlayer had not been compromised.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The test results are summarized in Table 2 below. A more comprehensive set of test data is included in Appendix B.

Table2. Test Results

Test Description	Test Result	Verdict
Deflection Test	Serviceability design wind pressure: 3000 Pa Window rating: N6	Pass
Operating Force Test	initial movement: 38.5 N sustain movement: 32.3 N	Pass
Air Infiltration Test	+75 Pa: 2.64 L/s·m ² ; -75 Pa: 2.90 L/s·m ² ; +150 Pa: 3.85 L/s·m ² ; -150 Pa: 4.36 L/s·m ² Window type: Non-airconditioned	Pass
Water Resistance Test	Test Pressure: 200 Pa Window rating: N4	Pass
Ultimate Strength Test	Test Pressure: 4500 Pa Window rating: N6	Pass
Transmittance Test	3.23 W/(m ² •K)	
Cyclonic Missile Impact Test	<p>The missile struck the centre of the window sash sample. The interlayer film was not compromised. (This was confirmed visually and with compressed air and water flow) There was no evidence that the integral strength of the fixing and the glass itself were compromised. There was no visible distress and deformation to the members of the framing components. The window sash resisted the force specified in AS 1170.2: 2002.</p>	

Note: The photographs of the cyclonic missile impact test can be referred to Appendix C.


6 Conclusion


The Aluminum Sliding Window identified in this report has been tested in accordance with deflection test, operating force test, air infiltration test, water resistance test, ultimate strength test, thermal transmittance test and cyclonic missile impact test requirements as per AS 2047-1999, NFRC 102-2010 and AS 1170.2: 2002.

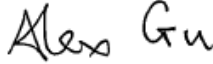
The test specimen met the requirements for window rating of N6 for deflection test, window type of Non-airconditioned for air infiltration, window rating of N4 for water resistance test, and window rating of N6 for ultimate strength test as per AS 2047-1999.

The conclusions of this test report may not be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

INTERTEK


Reported by: _____
Mike Gu
Engineer, Building Products


Reviewed by: _____
Harrison Li
Project Engineer, Building Products


Reviewed by: _____
Alex Gu
Project Engineer, Building Products

7 Appendix A: Sample Drawing

8 Appendix B: Test Data

1. Deflection Test – Test method AS4420.2-1996

- Span length (mullion), $L = 960$ mm
- Maximum allowable deflection = $\text{Span} / 150 = 6.4$ mm
- Test Pressure (Serviceability design wind pressure), $P = 3000$ Pa

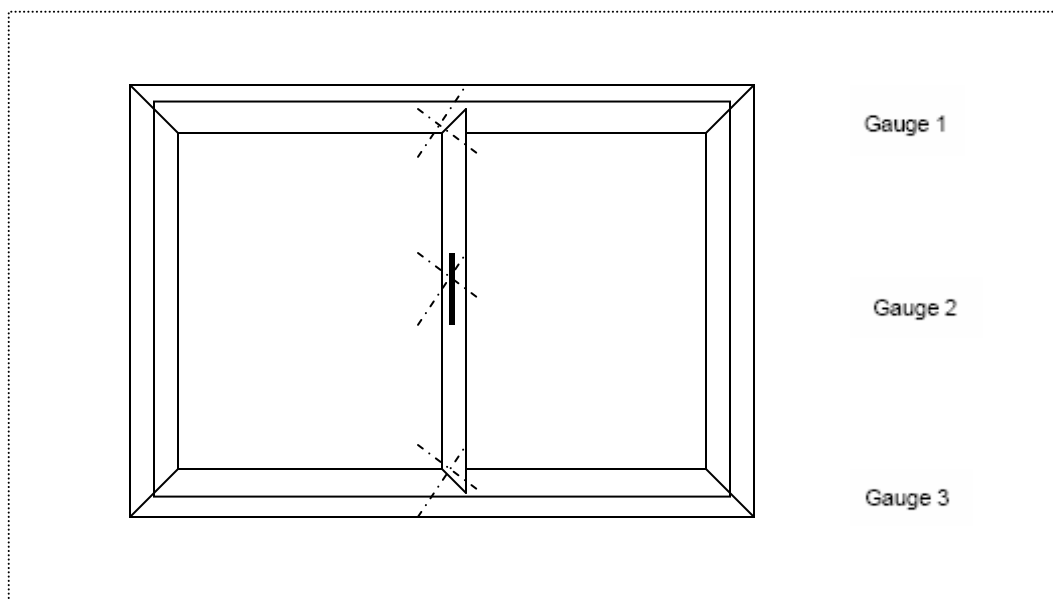


Table 3. Test Data of Deflection Test

Member (mm)		Pressure (Pa)	Deflection (mm)			Maximum Deflection (mm)	Maximum allowable deflection (mm)	Verdict
Item	Span Length		1	2	3			
Sash	960	+P/4 = 750	0.9	1.1	0.7	1.1	4.0	Pass
		+2P/4 = 1500	1.7	2.2	1.5	2.2		
		+3P/4 = 2250	2.4	3.2	2.4	3.2		
		+P = 3000	2.9	4.0	3.1	4.0		
		0	0.0	0.0	0.0	0.0		
Sash	960	-P/4 = 750	1.8	1.7	1.2	1.8	4.6	Pass
		-2P/4 = 1500	2.6	2.8	2.2	2.8		
		-3P/4 = 2250	3.3	3.7	3.0	3.7		
		-P = 3000	3.9	4.6	3.7	4.6		
		0	0.0	0.0	0.0	0.0		

2. Operating force test – Test method AS4420.3-1996

Table 4. Test Data of Operating Force Test

Force	Average	Maximum allowable	Verdict
To initial movement (N)	38.5	110	Pass
To sustain movement (N)	32.3	90	Pass

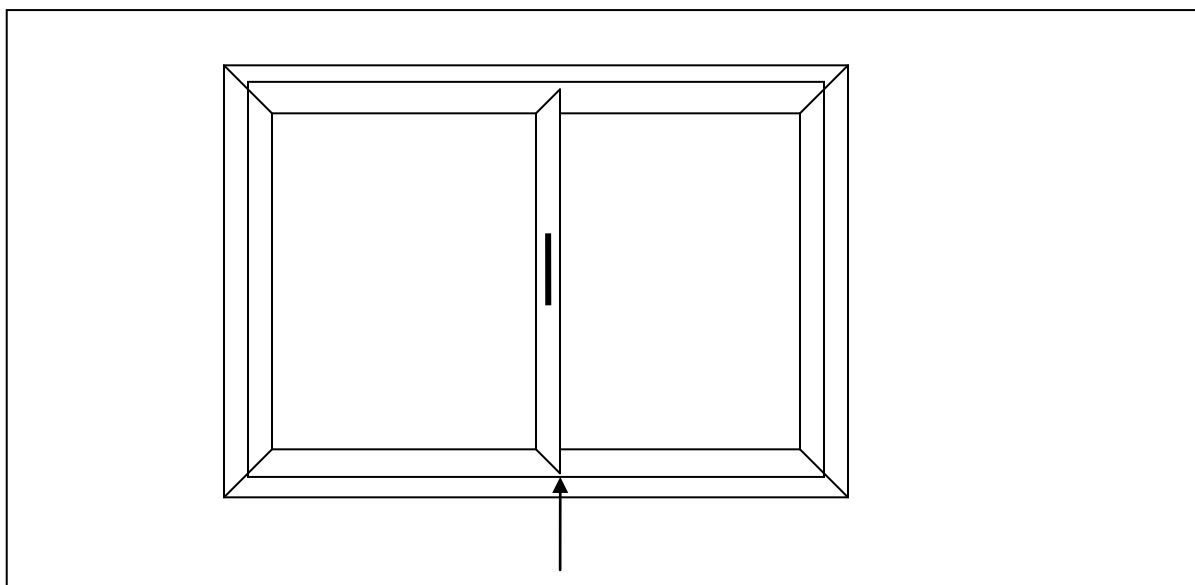
3. Air infiltration test – Test method AS4420.4-1996

- Overall area: 1.257 m²

Table 5. Test Data of Air Infiltration Test

Test pressure of 75 Pa	Infiltration rate (positive direction)	2.64 L/s·m ²
	Exfiltration rate (negative direction)	2.90 L/s·m ²
	Average air leakage rate	2.77 L/s·m ²
	Maximum allowable air infiltration (Window type: Non-airconditioned)	5.0 L/s·m ²
Test pressure of 150 Pa	Infiltration rate (positive direction)	3.85 L/s·m ²
	Exfiltration rate (negative direction)	4.36 L/s·m ²
	Average air leakage rate	4.10 L/s·m ²
	Maximum allowable air leakage (Window type: Non-airconditioned)	8.0 L/s·m ²

4. Water resistance test – Test method AS4420.5-1996



When water sprayed for 1 minute and 20 seconds at 300 Pa, water penetration started at the joint between the sash and frame at middle bottom part.

Test result:

$P_{\max} = 200 \text{ Pa}$

Window Rating: N4

5. Ultimate strength test – Test method AS4420.6-1996

Window rating: N6

Required ultimate strength test pressure: 4500 Pa

Test result:

The window was not collapsed when subjected to ultimate strength of 4500 Pa (N6).

No significant breakage, permanent deformation or operational malfunction after ultimate strength was released.

6. Thermal transmittance test –Test method NFRC102-2010

Category	Parameter	Quantity	Units
Heat Flows	Total Measured metering Box Input(Q_{total})	207.2	W
	Surround Panel Heat Flow (Q_{sp})	43.19	W
	Surround Panel Thickness	150	mm
	Surround Panel Conductance	0.222	W/(m ² •K)
	Metering Box Wall Heat Flow(Q_{mb})	7.11	W
	Net Specimen Heat Loss(Q_{s})	156.9	W
	Specimen, Projected(A_{s})	1.26	m ²
Areas	Metering Box Opening(A_{mb})	6.6	m ²
	Metering Box Baffle(A_{b1})	6.6	m ²
	Surround Panel Interior Exposed(A_{sp})	5.34	m ²
	Average Metering Room Air Temperature	20.46	°C
Test Conditions	Average Cold side Air Temperature	-18.18	°C
	Average Guard/Environmental Air Temperature	20.4	°C
	Measured Cold Side Wind Velocity	0.775	Kph
	Measured Static Pressure Difference Across Test Specimen	6.7	Pa

"B"(CTS)	Emittance of Glass(e_1)	0.85	N/A
	Warm Side Baffle Emittance(e_{b1})	0.88	N/A
	Warm Side Baffle Surface Temperature	15.47	°C
	Measured Warm Side Surface Conductance(h_i)	10.162	W/(m ² •K)
	Measured Weather Side Surface Conductance(h_{ii})	27.845	W/(m ² •K)
	Convection Coefficient(K)	3.77	W/(m ² K ^{1.25})
	Radiative Test Specimen Heat Flow(Q_{r1})	47.49	W
	Conductive Test Specimen Heat Flow(Q_{c1})	109.41	W
	Radiative Heat Flux of Test Specimen(q_{r1})	37.77	W/(m ² •K)
	Conductive Heat Flux of Test Specimen(q_{r2})	87.01	W/(m ² •K)
	Standardized Warm Side Surface Conductance(h_{st1})	7.929	W/(m ² •K)
	Standardized Cold Side Surface Conductance(h_{st11})	30	W/(m ² •K)
	Ust, Standized Thermal Transmittance	2.99	W/(m ² •K)
	Us, Thermal transmittance	3.23	W/(m ² •K)

9 Appendix C: Cyclonic Missile Impact Test Photographs

1. Mass of the hardwood timber batten



2. Section size of the hardwood timber batten



3. Installation of the sample



The impact surface was the laminated glass (outside surface).

4. Impact point (Outside surface)



5. Inspected by compressed air from the outside surface



6. Inspected by water flow from the outside surface



7. After inspecting



10 Revision Page

Revision No.	Date	Changes	Author	Reviewer
0	January 21, 2014	First issue	Mike Gu	Alex Gu
				Harrison Li

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