VISTA RAILING SYSTEMS INC.
TEST REPORT

SCOPE OF WORK
REPORT OF 6 FT. VISTA ALUMINUM GLASS RAILING SYSTEM TESTED IN ACCORDANCE WITH SELECTED SECTIONS OF ASTM E2353-16, *STANDARD TEST METHODS FOR PERFORMANCE OF GLAZING IN PERMANENT RAILING SYSTEMS, GUARDS, AND BALUSTRADES*

REPORT NUMBER
104521099COQ-001

TEST DATE
12/03/20

ISSUE DATE
12/07/20

PAGES
17

DOCUMENT CONTROL NUMBER
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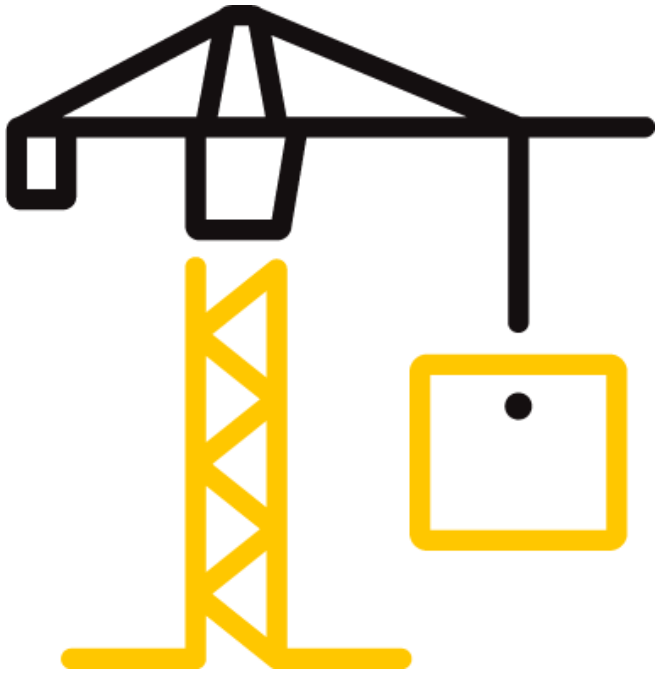

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TEST REPORT FOR VISTA RAILING SYSTEMS INC.
Report No.: 104521099COQ-001
Date: 12/07/20

REPORT ISSUED TO

VISTA RAILING SYSTEMS INC.
23282 River Road
Maple Ridge, BC, V2W 1B6
Canada

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Vista Railing Systems Inc., 23282 River Road, Maple Ridge, BC, V2W 1B6, Canada, to perform testing on the 6 ft. Vista Aluminum Glass Railing System in accordance with selected sections of ASTM E2353-16, *Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades*. The scope of the testing as requested by Vista Railing Systems Inc., was to assess the ability of the guard system to resist the load requirements of Section 9.8.8.2 of the 2015 NBC and 2012 OBC. Results obtained are tested values. Testing was conducted at the Intertek test facility in Coquitlam, BC, Canada on December 3, 2020.

Unless differently required, Intertek reports apply the "Simple Acceptance" rule also called “Shared Risk approach,” of ILAC-G8:09/2019, Guidelines on Decision Rules and Statements of Conformity.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C:

COMPLETED BY:	Chris Chang	**REVIEWED BY:**	Baldeep Sandhu
TITLE:	Sr. Tech – Building & Construction	**TITLE:**	Manager – Building & Construction
SIGNATURE:		**SIGNATURE:**	
DATE:	12/07/20	**DATE:**	12/07/20

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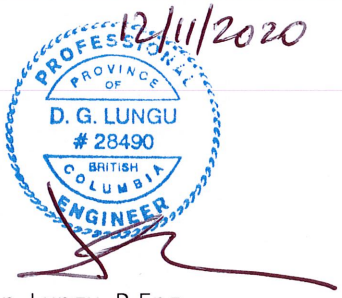
Engineer's Disclaimer:

- Intertek Engineers do not assume professional responsibility of Engineer of Record.
- Compliance to Building Codes must be approved by the Engineer of Record or Authority Having Jurisdiction.
- Intertek Engineer's seal and signature is limited to the review of applicable code required loads, review of test setup, and witnessing of laboratory testing.
- Additional disclaimers are shown in Notes of Section 7 and Section 8

Engineers Approval Stamp

Kal Kooner, P.Eng.
Director, Building & Construction
Intertek



Dan Lungu, P.Eng.
Engineer, Building & Construction
Intertek

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SECTION 2
SUMMARY OF TEST RESULTS

SYSTEM DESCRIPTION	TEST	PASS/FAIL
6 ft. Vista Aluminum Glass Railing System	In-fill Load	Pass
	Vertical Uniform Load Test	Pass
	Horizontal Uniform Load Test	Pass
	Horizontal – Mid-Span Concentrated Load	Pass
	Horizontal – Adjacent to Post Concentrated Load	Pass
	Horizontal – Top of Post Concentrated Load	Pass

Refer to Appendix B for photos of testing.

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SECTION 3
TEST LOADS

The guard specimen was evaluated in accordance with selected sections of the following:

> **ASTM E2353-16**, *Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades,* Section 12.1.1 *Static Load Testing*

The required test loads were based on the Specified Loads per the following Building Code articles with the Safety Factors applied as indicated in this report:

> **2015 National Building Code of Canada**, Section 9.8.8.2 *Loads on Guards*
> **2012 Ontario Building Code**, Section 9.8.82 *Loads on Guards*

The guard specimen was also evaluated per Section 9.8.8.3 – *Height of Guards*, Section 9.8.8.5 – *Opening In Guards,* and Section 9.8.8.6 – *Design To Prevent Climbing.*

Per the client's request, the *Shot Bag Impact Test* per Section 12.2 and the *Pendulum Impact Test* per Section 12.3 were not conducted per ASTM E2353.

SECTION 4
MATERIAL SOURCE

The client submitted the railing system to the Evaluation Center on December 1, 2020 (Coquitlam ID# VAN2012030756-001). The sample was received in good condition and was suitable for testing unless noted otherwise. The sample was not independently selected for testing.

SECTION 5
EQUIPMENT

Calibration of test equipment was performed by Intertek B&C in accordance with ISO 17025 requirements.

ASSET #	DESCRIPTION	MODEL	CAL DUE DATE
P60692	Artech 5k lb S-Type Load Cell	20210-5k	10/22/21
P60554	T&D Temperature and Humidity Indicator	TR-72Ui	09/10/21
1510	Sper Scientific Stopwatch	810035	05/11/21
52650	Mitutoyo 8 in. Digital Caliper	CD-8	06/04/21
02780	Mitutoyo 2 in. Digital Deflection Gauge	C150 1050	01/14/21

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SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Kevin Penner	Intertek B&C
Chris Chang	Intertek B&C
Kal Kooner	Intertek B&C
Dan Lungu	Intertek B&C

The above observer(s) witnessed part of the test program.

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SECTION 7
TESTING PROCEDURE

The evaluation was conducted in accordance with Section 12.1.1 *Static Load Testing* of ASTM E2353-16, *Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades,* with reference to ASTM E935-13e1, *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.* The test specimen was loaded at a rate to achieve the specified loads between 10 seconds and 5 minutes. The specified test loads were held for one minute before the load was released. For each test, deflection measurements were taken at the point of load application. Testing was conducted with reference to the specified load requirements of the following:

2015 NBC / 2012 OBC
SECTION 9.8.8.2 – LOADS ON GUARDS

1) The minimum specified horizontal load applied inward or outward at the minimum required height of every guard shall be 0.5 kN/m or a concentrated load of 1.0 kN applied at any point.

2) Individual elements within the *guard*, including solid panels and pickets, shall be designed for a concentrated load of 0.5 kN applied over an area of 300 mm x 300 mm located at any point in the element or elements to engage 3 balusters where possible.

3) The minimum specified load applied vertically at the top of every required *guard* shall be 1.5 kN/m.

4) None of the loads specified above need be considered to act simultaneously.

Note 1: A safety factor of 1.67-2.5 was applied to the above loads, based on an assumed failure mode and tested material. The safety factor was calculated by dividing the live load factor of 1.5 by the material resistance factors below, as defined in the CAN/CSA S157, *Strength Design in Aluminum* standard.

- ø=0.90 resistance factor for bending failure mode, resulting safety factor = 1.67
- ø=0.75 resistance factor for ductile failure mode, resulting safety factor = 2.0
- ø=0.67 resistance factor for brittle failure mode, resulting safety factor = 2.24
- ø=0.60 resistance factor for glass, resulting safety factor = 2.5

Note 2: The following sections of ASTM E2353 were not conducted in this evaluation:

- Section 9.3 *Sampling;* the test samples were 2 post systems instead of 3 post systems
- Section 12.2 *Shot Bag Impact Test*
- Section 12.3 *Pendulum Impact Test.*

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IN-FILL LOAD TEST

A test load was applied using a 300 mm x 300 mm square block on the center of the railing system normal to the in-fill. After release of the load, the systems were evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

UNIFORM LOAD TEST

Uniform test loads were applied vertically to the top of the guardrail system and horizontally to the top of the guardrail system. The test loads were applied using quarter point loads. After release of the load, the systems were evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

CONCENTRATED LOAD TEST

Concentrated test loads were applied horizontally outwards at the midspan of the top of the guard, at the top rail adjacent to the post connection to verify the connection capacity, and at the top of post.

After completion of the above load tests, the horizontal top of post in the outwards direction was loaded until failure. The maximum load was recorded and reported in the test data sheets of Appendix A.

SECTION 9.8.8.3 – HEIGHT OF GUARDS

The guard formed a protective barrier not less than 1070 mm (42 in.) high.

SECTION 9.8.8.5 – OPENINGS IN GUARDS

An opening of 64 mm (2.5 in.) under the bottom rail and 51 mm (2 in.) between vertical elements prevented a sphere 4 in. (100 mm) in diameter to pass.

SECTION 9.8.8.6 – DESIGN TO PREVENT CLIMBING

No member, attachment or opening located between 140 mm and 900 mm above the level protected by the guard facilitated climbing.

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SECTION 8
TEST SPECIMEN DESCRIPTION

The sample was identified as the following:

TABLE 1. RAILING CONFIGURATION

PART NAME	PART NUMBER	QTY	PART DIMENSIONS				REPORTED MATERIAL
			LENGTH	WIDTH	HEIGHT	NOMINAL THICKNESS	
Base Plate	PB7468	2	4.00 in.	4.00 in.	0.25 in.	-	Aluminum
Post		2	42.12 in.	2.00 in.	2.00 in.	0.072 in.	Aluminum
Top Rail	PB2104	1	72.0 in.	2.300 in.	2.498 in.	0.059 in.	Aluminum
Bottom Rail	PB2102	1	72.0 in.	0.952 in.	1.530 in.	0.059 in.	Aluminum
Infill	PB1465	1	68.0 in.	36.0 in.	0.25 in.	-	Tempered Glass
Support Leg	PB7408	1	1.00 in.	1.625 in.	2.62 in.	0.120 in.	Aluminum
Top Rail Glass Gasket	PB2108	1	72.0 in.	0.670 in.	1.080 in.	0.050 in.	Black PVC
Channel Glass Gasket	PB1465	1	72.0 in.	0.558 in.	1.056 in.	0.050 in.	Black PVC

The railing had one (1) support leg under the bottom rail at mid-span. The support leg was rigidly fixed to the test frame by screwing the front side with a #8 x 1-1/2 in. long deck screw into nominal 2x4 SPF lumber, which was then clamped to the steel test frame. For detailed drawings of the test sample and components, refer to Appendix C.

Note 3: The supporting structure attachment was outside the scope of this evaluation, and is subject to evaluation and approval by the Engineer of Record and Authority Having Jurisdiction (AHJ). The guard assembly was attached to a rigid test support using steel plates with four (4) 3/8 in. Grade 5 bolts on each post.

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SECTION 9
TEST RESULTS

A full set of test results is included in Appendix A.

SECTION 10
CONCLUSION

Intertek Testing Services NA Ltd. (Intertek) has conducted testing for Vista Railing Systems Inc. on the 6 ft. Vista Aluminum Glass Railing System per selected sections of ASTM E2353-16, *Standard Test Methods for Performance of Glazing in Permanent Railing Systems, Guards, and Balustrades*. The scope of the testing as requested by Vista Railing Systems Inc., was to assess the ability of the guard system to resist the loads as prescribed in the following building code articles:

- 2015 National Building Code of Canada, Section 9.8.8.2 *Loads on Guards*
- 2012 Ontario Building Code, Section 9.8.8.2 *Loads on Guards*

The Vista Railing Systems Inc. 6 ft. Vista Aluminum Glass Railing System identified and evaluated in this report has met the load requirements using the safety factors as defined in Section 7, Note 1 of this report. The guard specimen also met the requirements of Section 9.8.8.3 – *Height of Guards*, Section 9.8.8.5 – *Opening In Guards,* and Section 9.8.8.6 – *Design To Prevent Climbing.* Overall compliance with the Building Codes must be evaluated and approved by the Engineer of Record and Authority Having Jurisdiction.

The conclusions of this test 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.

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SECTION 11

APPENDIX A – TEST DATA (3 PAGES)

Company	Vista Railing Systems Inc.	Technician(s)	Kevin Penner, Chris Chang
Project No.	G104521099	Reviewer	Baldeep Sandhu
Models	6 ft. Vista Aluminum Glass Railing System	Start/End Date	December 3, 2020
Product Name	Same as above	Sample ID	VAN2012030756-001
Standard	**2015 NBC/2012 OBC, Section 9.8.8.2, 9.8.8.3, 9.8.8.5, 9.8.8.6**		

Test Data Package

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Test:	**Loads on Guards - Section 9.8.8.2**					Project:	G104521099
Date:	3-Dec-20					Eng/Tech:	Kevin Penner
Client:	Vista Railing Systems Inc.					Reviewer:	Baldeep Sandhu
Product:	**6 ft. Vista Glass Railing System**					Location:	Coquitlam, BC, Canada
Post Spacing:	6.17	ft	1.88	m			
Height of Guard:	42.1	in	1070	mm			
Opening in Guard:	2.00	in	51	mm	(between glass and post)		
	2.50	in	64	mm	(under bottom rail)		

Method: 2015 National Building Code of Canada, 9.8.8.2 Loads on Guards and Handrails
2012 Ontario Building Code, 9.8.8.2 Loads on Guards

Safety Factor: 1.67 (based on a resistance factor Ø = 0.9 for aluminum)
2.24 (based on a resistance factor Ø = 0.67 for connection)
2.50 (based on a resistance factor Ø = 0.6 for glass)

Equipment: Artech 5000 lbf Load Cell (Intertek ID# P60692, cal due October 22, 2021)
T&D TR-72Ui Temperature and Humidity Logger (Intertek ID# P60554, cal due September 10, 2021)
Stopwatch (Intertek ID# 1510, cal due May 11, 2021)
Mitutoyo Digital Caliper (Intertek ID# P60005, cal due June 4, 2021)
Mitutoyo Deflection Gauge (Intertek ID# 02780, cal due 01/14/21)

Time/Temp/RH: 9:45AM / 23.0°C / 50.0%

Direction	Test	Design Load (Inward/ Outward) (lbf)	Factored Load	Calculated Moment (lbf-ft)	Equivalent Quarter-Point Load (lbf)	Required Proof Load (lbf)	Deflections (in.)	Pass/Fail
Outward	Individual Elements (over 11.8 in. x 11.8 in.)	112	281	-	-	281	1.732	**Pass**
	Vertical Uniform Load (per ft)	103	171	814	528	1056	0.761	**Pass**
	Horizontal Uniform Load (per ft)	34	57	271	176	352	2.186	**Pass**
	Midspan Horizontal Concentrated Load	225	375	-	-	375	2.550	**Pass**
	Adjacent to Post Concentrated Load	225	503	-	-	503	8.124	**Pass**
	Top of Post Concentrated Load	225	375	-	-	375	4.779	**Pass**
	Top of Post Concentrated Load	503 lbs ultimate load; one screw head in baseplate support broke						

Direction	Test	Design Load (Inward/ Outward) (kN)	Factored Load	Calculated Moment (kNm)	Equivalent Quarter-Point Load (kN)	Required Proof Load (kN)	Deflections (mm)	Pass/Fail
Outward	Individual Elements (over 300 mm in. x 300 mm)	0.5	1.25	-	-	1.25	44.0	**Pass**
	Vertical Uniform Load (per m)	1.5	2.5	1.10	2.35	4.70	19.3	**Pass**
	Horizontal Uniform Load (per m)	0.5	0.83	0.37	0.78	1.57	55.5	**Pass**
	Midspan Horizontal Concentrated Load	1	1.67	-	-	1.67	64.8	**Pass**
	Adjacent to Post Concentrated Load	1	2.24	-	-	2.24	121.4	**Pass**
	Top of Post Concentrated Load	1	1.67	-	-	1.67	0.0	**Pass**
	Top of Post Concentrated Load	2.2 kN ultimate load; one screw head in baseplate support broke						

Test:	**Dimensional Checks**		Project:	G104521099
Date:	3-Dec-20		Eng/Tech:	Chris Chang
Client:	Vista Railing Systems Inc.		Reviewer:	Baldeep Sandhu
Product:	**6 ft. Vista Glass Railing System**		Location:	Coquitlam, BC, Canada
Post Spacing:	6.17 ft	1.88		m
Height of Guard:	42.1 in	1070		mm
Method:	2015 National Building Code of Canada 2012 Ontario Building Code 9.8.8.3 Height of Guards 9.8.8.5 Openings in Guards 9.8.8.6 Design of Guards to Not Facilitate Climbing / Guards Designed Not to Facilitate Climbing			
Equipment:	T&D TR-72Ui Temperature and Humidity Logger (Intertek ID# P60554, cal due September 10, 2021) Tape Measure (Intertek ID# P60494, cal due September 8, 2021)			
Time/Temp./RH:	9:45AM / 23.0°C / 50.0%			

Description		Test Result	Requirement	Pass/Fail
9.8.8.3 Height of Guards		1070 mm	≥ 1070 mm	**Pass**
9.8.8.5 Openings in Guards	Between glass and post	51 mm	< 100 mm	**Pass**
	Under bottom rail	64 mm	< 100 mm	**Pass**
9.8.8.6 Design to Prevent Climbing		No member, attachment, or opening located between 140-900 mm facilitated climbing	No member, attachment, or opening located between 140-900 mm shall facilitate climbing	Pass

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APPENDIX B – PHOTOS (2 PAGES)

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Figure 1 – In-fill Load Test

Figure 2 – Uniform Load (Horizontal)

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Figure 3 – Concentrated Load (Mid-span Top Rail)

Figure 4 – Concentrated Load (Adjacent to Post Connection)