

TEST REPORT # T1024-1c

DATE: September 10, 2015

CLIENT: **Excell Railing Systems Ltd.**
#306 12886 Anvil Way
Surrey, BC, Canada
V3W 8E7
Contact: Blair Holliday

SAMPLE DESCRIPTION: Excell Railing Systems Ltd – Panorama Topless Glass and Aluminum Railing System with posts @ 60 inches (1524 mm) on center

SAMPLING PROCEDURES: Specimen delivered to QAI by the client

DATE OF RECEIPT: July 15, 2015

DATE OF TESTING: September 1, 2015

TESTING REQUESTED: 2010 Canadian National Building Code (NBC) – section 4.1.5.14 & section 9.8.8.2 - Loads on Guards
2012 British Columbia Building Code (BCBC) – section 4.1.5.14 & section 9.8.8.2 -Loads on Guards

TEST RESULTS: See Pages 4 for the test results and conclusion.

CONTENTS: Test Report pages 1 through 5
Appendix A1, B1-2 & C1-3

TEST PERFORMED AT: **QAI Coquitlam, BC**

Tested By
QAI Laboratories Ltd.

Reviewed By
QAI Laboratories Ltd.



Jay Klassen
Special Projects Manager

Kevin Saito, P. Eng.
Division Manager

INTRODUCTION:

QAI Laboratories Ltd. (QAI) has conducted testing for Excell Railing Systems Ltd. on their Panorama Topless Glass Rail System with posts spaced at 60 inches (1524 mm) on center. The railing was delivered to QAI by Excell Railing Systems Ltd. on July 15, 2015. The assembly was tested in accordance with 2010 Canadian National Building Code (NBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards” and 2012 British Columbia Building Code (BCBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards”

SAMPLE DESCRIPTION:

Samples were assembled by the client with the following components:

Post:	Type:	Custom 6005A-T5 Aluminum Extrusion from APEX Aluminum Extrusions (Die # 2071)
	Size:	2.50 in x 2.50 in (64 mm x 64 mm)
	Cap:	Screw-on flat Aluminum top cap plate
	Base Plate:	4 in x 4 in x 3/8 in (100 mm x 10 mm x 9.5 mm) flat plate with 4 mounting holes spaced 3-1/4” apart
	Height:	42 in (1067 mm) or less overall height (above the deck)
	Glass Gasket:	Ridged Vinyl Gasket with soft rubber fins to fit into the glass channel extrusion by PolyChlor Plastic Industries Ltd. (Die # 4533)
	Aluminum Risers:	Custom 6063-T5 Aluminum Extrusion from APEX Aluminum Extrusions (Die # 1953)
	Aluminum Extrusion Filler:	Custom 6063-T5 Aluminum Extrusion from APEX Aluminum Extrusions (Die # 1953)
	Glass Bearing:	Custom 3/8” thick neoprene bearing
Glass Insert:		60” wide x 39” tall - 10mm Tempered Glass
Connections:	Base Plate Fasteners:	4 – 1/4”-20 x 2” Zinc Steel Type F Machine Screws spaced 2-1/8” apart
	Top Plate:	#6 x 1-1/4” Screw

Note: *Base to sub-structure fastener evaluation is beyond the scope of this report. Four 3/8 inch Grade 5 bolts were used to attach the surface mount posts.*

TESTING REQUIREMENTS:

The guard is required to be loaded at a rate to achieve the specified loads between 10 seconds and 5 minutes. The specified loads below are then held for one minute before the load is released. As per the 2010 Canadian National Building Code (NBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards” and 2012 British Columbia Building Code (BCBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards” the following tests were conducted:

One complete railing system, consisting of two posts, was tested at maximum spacing and height to represent the worst-case scenario.

1. The minimum specified horizontal load applied inward or outward at the minimum required height of every required guard shall be:
 - a) 0.75 kN/m or a concentrated load of 1.0 kN applied at any point, whichever governs for locations other than those described in Clauses (a) and (b).
2. Individual elements within the guard, including solid panels and picket, shall be designed for a load of 0.5 kN applied over an area of 100 mm x 100 mm located at any point in the elements so as to produce the most critical effect.

3. The loads required in Sentence (2) need not be considered to act simultaneously with the loads provided for in Sentences (1) and (4).
4. The Minimum specified load applied vertically at the top of every required guard shall be 1.5 kN/m and need not be considered to act simultaneously with the horizontal load provided for in sentence (1).

Note: Clauses (a) and (b) described in 1(c) refer to means of egress and equipment access walkways. This system is not intended for areas of means of egress and for equipment access walkways.

TESTING PROCEDURES:

After each test the system was evaluated for failure, any evidence of disengagements and/or visible cracking from any component.

1) In-fill Load Test:

A load consisting of 187 lbf (0.83 kN) was applied over a 0.108 ft² (0.09293 m²) surface normal to the in-fill in a worst case scenario (i.e. least amount of in-fill support).

2) Uniform Horizontal Load Test

The top edge of the glass infill of the system was subjected to a maximum uniform load of 86 lbf/ft (1.25 kN/m) applied horizontal in an outward direction. Quarter point loading was used as an equivalent to uniform loading.

3) Concentrated Horizontal Load Test

The top edge of the glass infill of the system was subjected to a maximum concentrated horizontal test load of 375 lbf (1.67 kN) applied at the top corner of the glass infill in an outward direction.

4) Uniform Vertical Load Test

The top edge of the glass infill of the system was subjected to a maximum uniform load of 171 lbf/ft (2.5 kN/m) applied vertically down on the top of the glass infill. Quarter point loading was used as an equivalent to uniform loading.

Notes:

- 1) *None of the loads specified above need be considered to act simultaneously.*
- 2) *A live load factor of 1.5 is applied to the above loads in accordance with NBC 2010 - Section 4.1*
- 3) *NBC 2010 – Section 4.3.5.1 states that structural members made with aluminum shall conform to CAN/CSA-S157/S157.1, “Strength Design in Aluminum/Commentary on CSA S157-05, Strength Design in Aluminum.” This standard specifies an aluminum performance factor of 0.9 to be factored in to the loads, when the mode of failure for the railing is ductile failure and a performance factor of 0.67 to be factored in to the loads, when the mode of failure for the railing is brittle.*

5) Newel Post Performance Test

A load is applied at the top of the railing post in the outward direction. The load is applied until failure is achieved. Failure shall be when evidence of visual damage or disengagement occurs.

Note: *If the newel post is shorter than the required 42” railing height, then the ultimate load achieved has to be adjusted for load application at 42” height.*

TESTING RESULTS:

Guard test results are shown in the tables below (refer to Appendix A for detailed test data):

2 post Railing System Test:

System Description	System Height (Inches)	Maximum Post to Post Center Spacing (Inches)	Test	Compliance
Panorama Topless Glass rail – 2.50” Post with Deck Mount	42”	60”	In-Fill Load	Pass
			Horizontal – Uniform Load	Pass
			Horizontal – Adjacent to Post Concentrated Load	Pass
			Vertical – Uniform Load	Pass

**Note: After system testing was completed, the concentrated load test was performed until failure, an ultimate load of 590 lbs was achieved (end post failure).*

Newel Post Performance:

System Description	Post Height (Inches)	Ultimate Failure Load:	Failure Mode:
2.50” Post with Deck Mount	42”	590 lbs	Brittle

CONCLUSION:

QAI Laboratories Ltd. (QAI), with lab facilities located in Coquitlam, British Columbia, performed testing in accordance with the 2010 Canadian National Building Code (NBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards” and 2012 British Columbia Building Code (BCBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards”, on a representative sample of the Excell Railing Systems Ltd.- Panorama Topless Glass Rail System with posts spaced at 60 inches (1524 mm) on center.

The railing system identified in this test report has complied with the loads specified in 2010 Canadian National Building Code (NBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards” and 2012 British Columbia Building Code (BCBC) – section 4.1.5.14 & section 9.8.8.2 “Loads on Guards”.

Test results in this report may not be reproducible in the field. Test results relate only to those products tested.

APPENDIX

Page	Title
A1	Test Data
B1-B2	Testing Pictures
C1-C3	Railing System Drawings and Pictures

Test: **Guard Rail Testing**
 Test Methods: NBC 2010 - Section 4.1.5.14 "Loads on Guards Requirements"

Date: September 1, 2015
 Project No: T1024-1c
 Client: Excell Railing Systems Ltd.

Technician: Jay Klassen

Product: Topless Glass with Aluminum Top Mounted Posts
 Post Spacing: 5.08 ft 1.55 m
 Height: 42 in. 1067 mm

Equipment: LOADCELL8

Test	Failure Mode	Code Required Loads		Required Proof Load			Pass/Fail	Observations
		kN	lbs	kN	lbs	lbs		
In-Fill Load Test (4"x 4")	Ductile	0.5 kN	112 lbs	0.83 kN	187 lbs	Pass	No Change	
Uniform Horizontal Load Test	Ductile	0.75 kN/m	51 lbs/ft	2.15 kN	484 lbs	N/A	No Change	
	Brittle			2.58 kN	581 lbs	Pass		
Concentrated Horizontal Load	Ductile	1.0 kN	225 lbs	1.85 kN	416 lbs	N/A	After all tests were completed, the load was increase until ultimate failure. The post base connection failed at 590 lbs.	
	Brittle			2.22 kN	500 lbs	Pass		
Uniform Vertical Load	Ductile	1.5 kN/m	103 lbs/ft	3.87 kN	871 lbs	N/A	No Change	
	Brittle			4.65 kN	1045 lbs	Pass		

Limit States Design - Live Load:

Safety Factor: 1.5

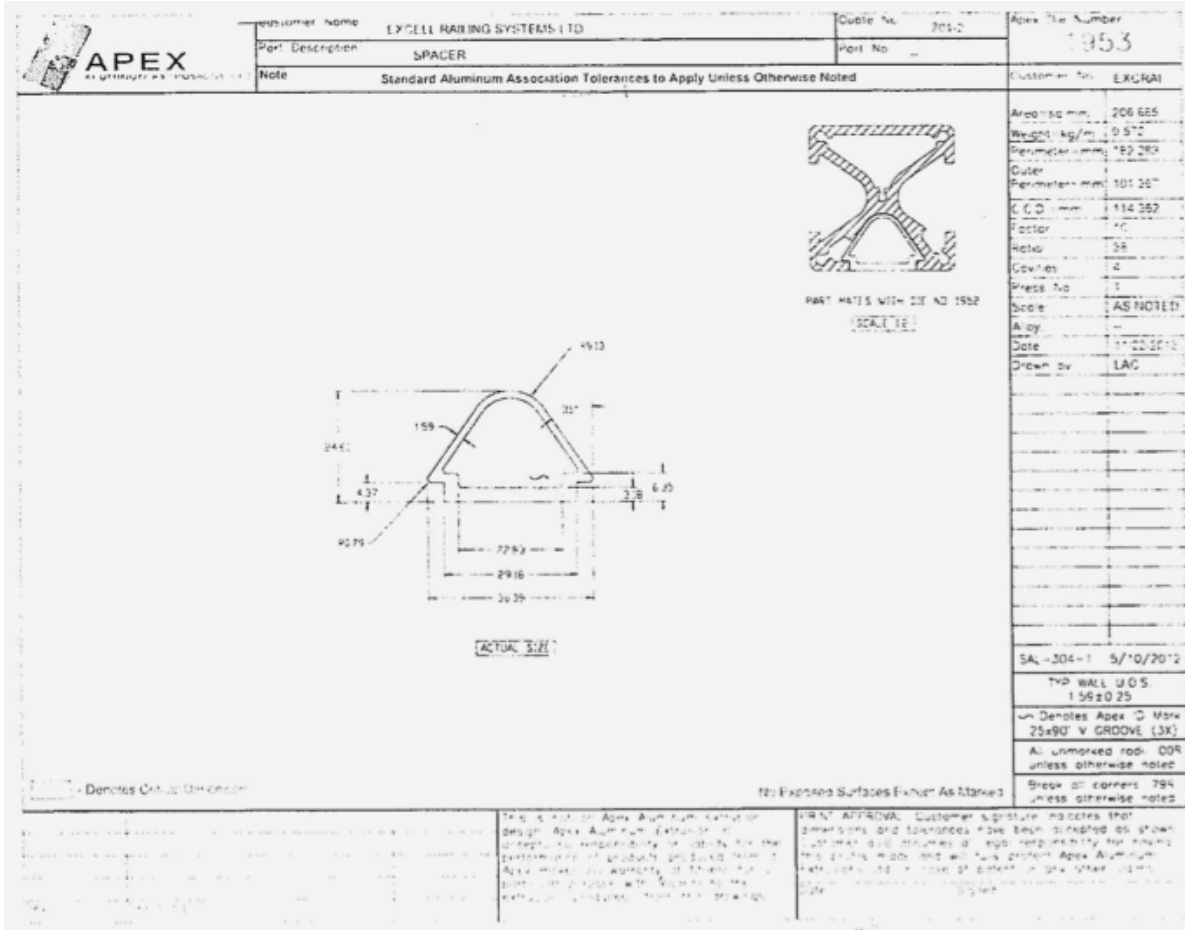
CAN/ULC S157 - Resistance Factor: (Clause C5.5)

Ductile Failure 0.9
 Brittle Failure 0.75
 Fastener Failure 0.67

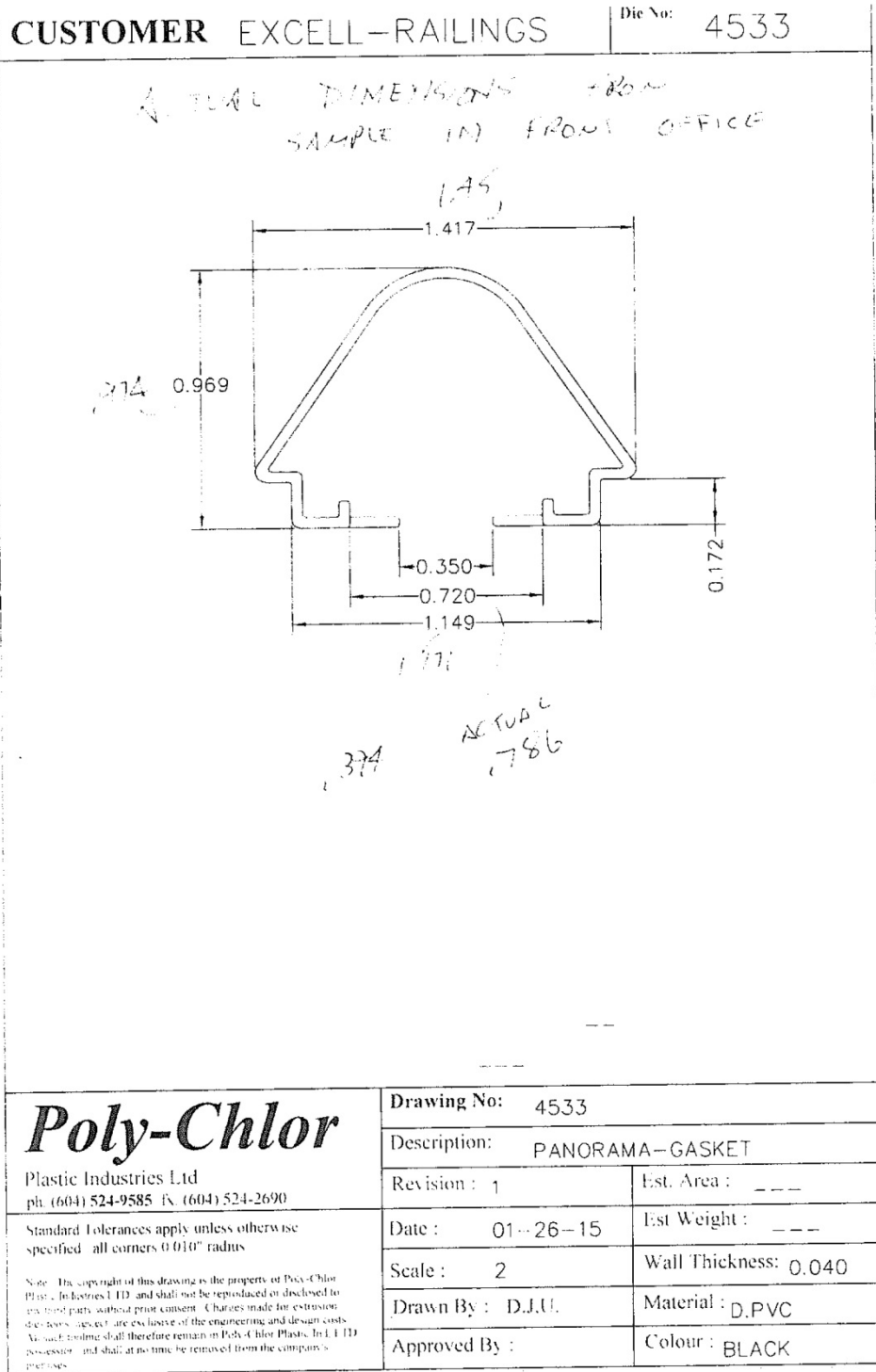
Characteristic Resistance 0.9 Clause 13.3.2.1

*Note: These loads are as specified in the NBC 2010 & BCBC 2012 along with the factored loads (Live Load Safety Factor (section 4.1.3) & Aluminum Performance Factor(CAN/CSA S157/S157.1))





Drawing 2: Drawings of the Excell Railings Systems Ltd. Tee Post Spacer



Drawing 3: Drawing of Glass Gasket. PVC Channel with soft fins.