TEST REPORT

REPORT NUMBER: 101855957COQ-001
ORIGINAL ISSUE DATE: November 7, 2014

EVALUATION CENTER

INTERTEK TESTING SERVICES NA LTD.
1500 BRIGANTINE DRIVE
COQUITLAM, BC V3K 7C1

RENDERED TO

CENTURY ALUMINUM / DEKSMART RAILINGS
DIVISION OF BEAVER HOME IMPROVEMENTS LTD.
9685 AGUR STREET
SUMMERLAND, BC V0H 1Z2
CANADA

PRODUCT EVALUATED:
Pipe Handrail

EVALUATION PROPERTY:
Load Requirements

Report of Pipe Handrail for compliance with the requirements of the following criteria:

- **2010 *National Building Code of Canada***
  - **Section 3.4.6.5, *Handrails* (12)**
  - **Section 9.8.7.7, *Design and Attachment of Handrails* (1)**
- **2012 *Ontario Building Code***
  - **Section 3.4.6.5, *Handrails* (12)**
  - **Section 9.8.7.7, *Design and Attachment of Handrails* (1)**
- **2012 *British Columbia Building Code***
  - **Section 3.4.6.5, *Handrails* (12)**
  - **Section 9.8.7.7, *Design and Attachment of Handrails* (1)**

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2 Introduction

Intertek Testing Services NA Ltd. (Intertek) has conducted a test program for the Pipe Handrail submitted by Century Aluminum/Deksmart Railings. The evaluation was carried out to determine whether the handrail would resist the required loads as specified in the following Building Codes:

- 2010 National Building Code of Canada (NBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*
- 2012 Ontario Building Code (OBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*
- 2012 British Columbia Building Code (BCBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*

This evaluation was conducted in the month of November 2014.

3 Test Samples

3.1. SAMPLE SELECTION

The client submitted the handrail system components to the Evaluation Center on October 24, 2014. The product was identified as Coquitlam ID# VAN1411070916-001.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The railing system was identified as the Pipe Handrail. A drawing of the handrail and components can be found in Appendix B. The details of the handrail system are outlined below in Table 1:

Table 1. Railing Details

Description		Thickness	Material
Pipe Handrail	1-5/8” OD Schedule 40 Pipe Handrail	0.140”	6063-T54
	90° Elbow 1-5/8” OD Schedule 40	0.140”	6063-T54
	180° 1-5/8” OD Schedule 40	0.140”	6063-T54
	32°/35° Elbow 1-5/8” OD Schedule 40	0.140”	6063-T54
	Handrail Bracket	0.210”	6063-T54
	End Cap	0.125”	6063-T54
	Internal Splice	0.077”	6063-T54
	#10 x 3/4" TEK Screws	-	-
	#12 x 1” TEK Screws	-	-

Note: The installation of the handrail to the wall connection was not within the scope of this report, and is subject to evaluation and approval by the building official. The handrail brackets at wall locations were bolted directly to a steel test frame using 1/4 in. grade 5 bolts and washers.

At the bottom termination of the handrail, two (2) handrail brackets were attached to a supplied 2-1/2 in. post using four (4) #12 x 1 in. self drilling screws.

4 Testing and Evaluation Methods

The test specimens were 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. As per Section 3.4.6.5 and 9.8.7.7 of the 2010 NBC, 2012 OBC, and 2012 BCBC, the following tests were conducted:

4.1 2010 NBC / 2012 OBC / 2012 BCBC

SECTION 3.4.6.5, HANDRAILS (12)

Handrails and their supports shall be designed and constructed to withstand the loading values obtained from the nonconcurrent application of,

a) a concentrated load not less than 0.9 kN applied at any point and in any direction for all handrails, and
b) a uniform load not less than 0.7 kN/m applied in any direction to handrails not located within dwelling units.

SECTION 9.8.7.7, DESIGN AND ATTACHMENT OF HANDRAILS (1)

Handrails and any building element that could be used as a handrail shall be designed and attached in such a manner as to resist,

a) a concentrated load at any point of not less than 0.9 kN, and
b) for handrails other than those serving a single dwelling unit, a uniformly distributed load of 0.7 kN/m.

Notes: A safety factor of 2.24 is applicable to the above loads for both Sections 3.4.6.5 and 9.8.7.7.

4.2 UNIFORM LOAD TEST

A uniform load of 1.57 kN/m (107.6 plf) was applied in two orientations – downward and perpendicular to the handrail, and in an outwards direction to the handrail. The loads were applied between the bracket span of 1.2 m (3.94 ft.) using quarter point loads. After release of the load, the system was evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

4.3 CONCENTRATED LOAD TEST

The handrail system was subjected to five separate tests where a concentrated load of 2.0 kN (453 lbs) was applied:

- downwards on the handrail at a joint,
- downwards at the mid-span handrail bracket,
- outwards on the handrail at a joint,
- outwards on the handrail adjacent to post bracket, and
- outwards at the top of post.

After release of the load, the system was evaluated for failure, any evidence of disengagements of any component and visible cracks in any component.

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

The product test results are shown in Table 2. A copy of the test data is located in Appendix A.

Table 2. Test Results

Orientation	Property	Result	Requirement	Pass/Fail
Outward	Uniform Distributed Load	1.57 kN/m	≥ 1.57 kN/m	Pass
	Point Load on Handrail at Joint	2.01 kN	≥ 2.01 kN	Pass
	Point Load on Handrail Adjacent to Post Bracket	2.01 kN	≥ 2.01 kN	Pass
	Top of Post	2.01 kN	≥ 2.01 kN	Pass
Downward / Perpendicular to Handrail	Uniform Distributed Load	1.57 kN/m	≥ 1.57 kN/m	Pass
	Point Load on Handrail at Joint	2.01 kN	≥ 2.01 kN	Pass
	Point Load on Handrail at Center Bracket	2.01 kN	≥ 2.01 kN	Pass

6 Conclusion

The Century Aluminum/Deksmart Pipe Handrail product identified in this test report has complied with the load requirements as specified in the following Building Codes:

- 2010 National Building Code of Canada (NBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*
- 2012 Ontario Building Code (OBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*
- 2012 British Columbia Building Code (BCBC)
  - Section 3.4.6.5, *Handrails* (12)
  - Section 9.8.7.7, *Design and Attachment of Handrails (1)*

The product test results are presented in Section 5 of this report.

INTERTEK TESTING SERVICES NA LTD.

Reported by: _____
Chris Chang, P.Eng.
Engineer, Building Products

Reviewed by: _____
Dan Lungu, P. Eng.
Engineer, Manufactured Housing

Reviewed by: _____
Kal Kooner, P. Eng.
Manager, Building Products

APPENDIX A: Test Data (2 pages)

Company	Century Aluminum / Deksmart Railings	Technician(s)	Kevin Penner / Chris Chang
Project No.	G101855957	Reviewer	Riccardo DeSantis
Models	Pipe Handrail	Start/End Date	November 6, 2014
Product Name	Same as above	Sample ID	VAN1411070916-001
Standard	**2010 NBC/2012 OBC/2012 BCBC, Section 3.4.6.5 and 9.8.7.7**		

Test Data Package

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Test:	**Design and Attachment of Handrails**	Project:	G101855957
Date:	6-Nov-14	Eng/Tech:	Kevin Penner
Client:	Century Aluminum / Deksmart Railings	Reviewer:	Riccardo DeSantis
Product:	**Pipe Handrail**		

Post Spacing: 3 15/16 ft 1.20 m (between bracket spacing)

Method: 2010 National Building Code of Canada, 3.4.6.5 Handrails (12) & 9.8.7.7 Design and Attachment of Handrails (1)
2012 Ontario Building Code, Handrails (12) & 9.8.7.7 Design and Attachment of Handrails (1)
2012 British Columbia Building Code, Handrails (12) & 9.8.7.7 Design and Attachment of Handrails (1)

Safety Factor: 2.24 (corresponds to resistance factor of 0.67)

Equipment: Artech 1000 lbf Load Cell (Intertek ID# P60688, cal due November 2014)
Vaisala Temp/RH Indicator (Intertek ID# 9-0176, cal due July 2015)
Stopwatch (Intertek ID#P60625, cal due July 2015)

Time/Temp/RH: 8:30AM / 22.0°C / 53.0%

Description	Test	Location	Design Load (kN)	Factored Load (kN)	Calculated Moment (kNm)	Equivalent Quarter-Point Load (kN)	Required Proof Load (kN)	Pass/Fail
Outward	Uniform Distributed Load (per m)	1	0.7	1.57	0.28	0.94	1.88	**Pass**
	Point Load on Handrail at Joint	5	0.9	2.01	-	-	2.01	**Pass**
	Point Load on Handrail Adjacent to Post Bracket	6	0.9	2.01	-	-	2.01	**Pass**
	Top of Post	7	0.9	2.01	-	-	2.01	**Pass**
Downward / Perpendicular to Handrail	Uniform Distributed Load (per m)	2	0.7	1.57	0.28	0.94	1.88	**Pass**
	Point Load on Handrail at Joint	3	0.9	2.01	-	-	2.01	**Pass**
	Point Load on Handrail at Center Bracket	4	0.9	2.01	-	-	2.01	**Pass**

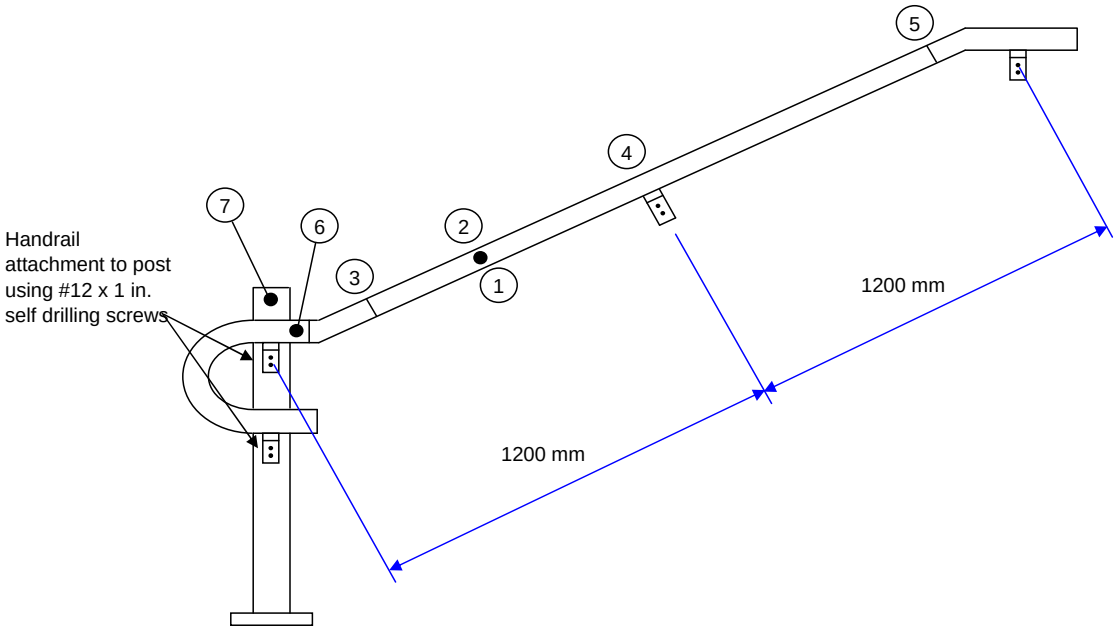
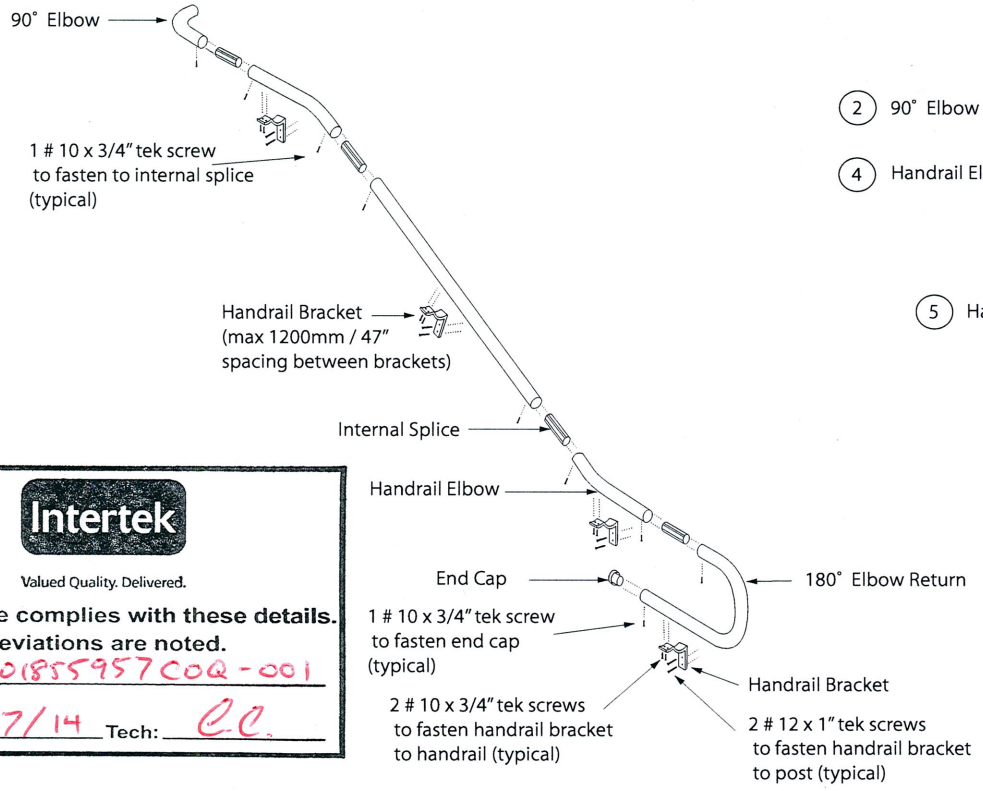


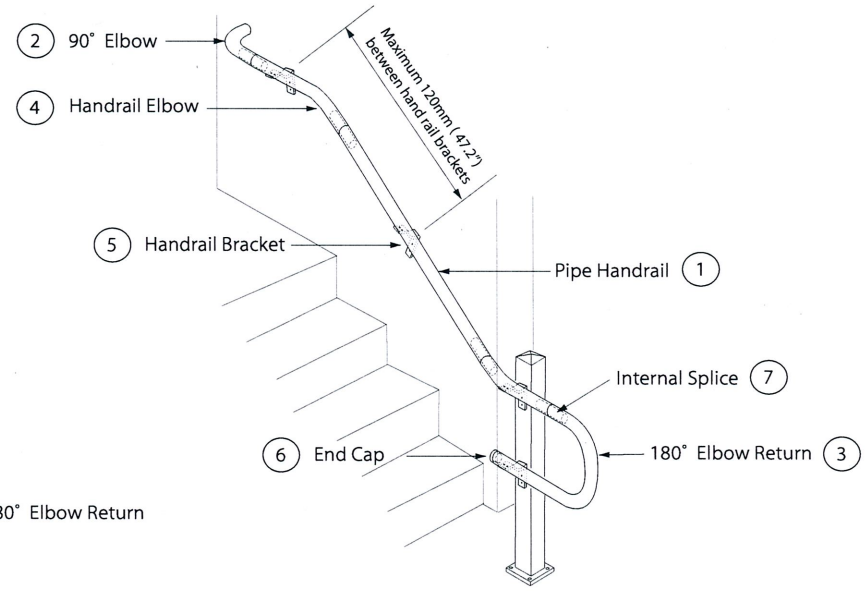
Figure 1. Location of Tests
(Not to Scale)

APPENDIX B: Drawings (1 page)

Pipe Handrail



Typical Pipe Handrail Installation
(disassembled)



Typical Pipe Handrail Installation
(assembled)

Intertek
Valued Quality. Delivered.

Test sample complies with these details.
Deviations are noted.

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Date: Nov 7/14 **Tech:** CC

Notes: 1. This handrail system complies with the requirements of Part 9 and Part 4 of the 2010 Canadian Building Code (NBC), 2012 British Columbia Building Code (BCBC) and the 2012 Ontario Building Code (OBC).
The handrail fastening to wall detail is not within the scope of this document.

	Material - Aluminum	Thickness	Alloy
1	1- 5/8" OD Schedule 40 Pipe Handrail	.140	6063-T54
2	90° Elbow 1-5/8" OD Schedule 40	.140	6063-T54
3	180° Elbow 1-5/8" OD Schedule 40	.140	6063-T54
4	32°/35° Elbow 1-5/8" OD Schedule 40	.140	6063-T54
5	Handrail Bracket	.210	6063-T54
6	End Cap	.125	6063-T54
7	Internal Splice	.077	6063-T54

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10/07/14