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CENDEK RAILINGS LTD.
TEST REPORT

SCOPE OF WORK
REPORT OF PIPE HANDRAIL TESTED IN ACCORDANCE WITH ASTM E935-13E[1], *STANDARD TEST METHODS FOR PERFORMANCE OF PERMANENT METAL RAILING SYSTEMS AND RAILS FOR BUILDINGS*

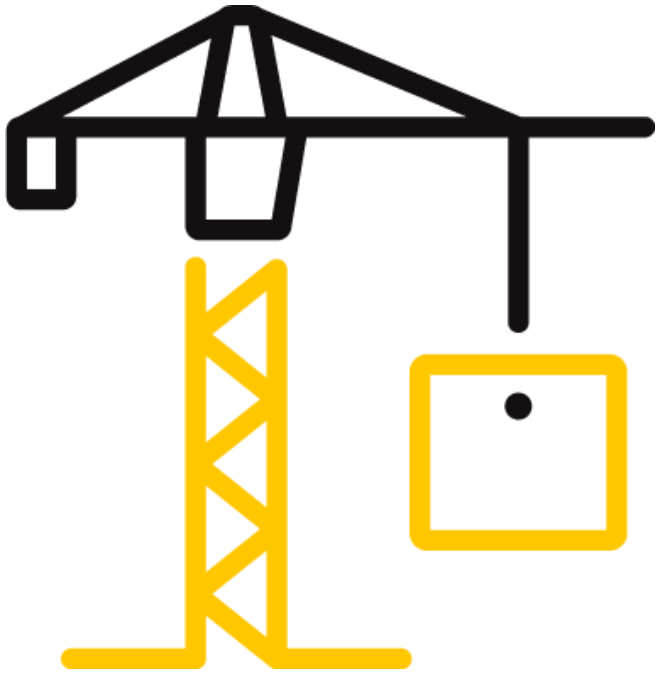
REPORT NUMBER
104813048COQ-002A

TEST DATE
09/24/21

ISSUE DATE
10/05/21

PAGES
21

DOCUMENT CONTROL NUMBER
GFT-OP-10c (09/29/20)



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TEST REPORT FOR CENDEK RAILINGS LTD.
Report No.: 104813048COQ-002A
Date: 10/05/21

REPORT ISSUED TO

CENDEK RAILINGS LTD.
9685 Agur St.
Summerland, BC, V0H 1Z2
Canada

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Cendek Railings Ltd., 9685 Agur St., Summerland, BC, V0H 1Z2, Canada, to perform testing on their Pipe Handrail system in accordance with ASTM E935-13e[1], *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings*. The scope of the testing as requested by Cendek Railings Ltd., was to assess the ability of the handrail system to resist the load requirements of Section 3.4.6.5, 4.1.5.14, and Section 9.8.7.7 of the 2015 NBC, 2012 OBC, and 2018 BCBC. Results obtained are tested values. Testing was conducted at the Intertek test facility in Coquitlam, BC, Canada on September 24, 2021.

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, P.Eng.	**REVIEWED BY:**	Baldeep Sandhu
TITLE:	Sr. Tech – Building & Construction	**TITLE:**	Manager – Building & Construction
SIGNATURE:	 EGBC Permit No.: 1000953	**SIGNATURE:**	
DATE:	10/05/21	**DATE:**	10/05/21

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Report No.: 104813048COQ-002A
Date: 10/05/21

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.
EGBC Permit No.: 1000953
Director, Building & Construction
Intertek

Dan Lungu, P.Eng.
EGBC Permit No.: 1000953
Engineer, Building & Construction
Intertek

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TEST REPORT FOR CENDEK RAILINGS LTD.
Report No.: 104813048COQ-002A
Date: 10/05/21

SECTION 2
SUMMARY OF TEST RESULTS

SYSTEM DESCRIPTION	DIRECTION	TEST	PASS/FAIL
Pipe Handrail	Outward	Uniform Distributed Load	Pass
		Concentrated Load on Handrail at Joint	Pass
		Concentrated Load on Handrail Adjacent to Post Bracket	Pass
		Concentrated Load at Top of Post	Pass
	Downward/ Perpendicular to Handrail	Uniform Distributed Load	Pass
		Concentrated Load on Handrail at Joint	Pass
		Concentrated Load on Handrail at Center Bracket	Pass

Refer to Appendix B for photos of testing.

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Report No.: 104813048COQ-002A
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SECTION 3
TEST LOADS

The handrail specimen was evaluated in accordance with the following:

> **ASTM E935-13e[1]**, *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings*

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 (NBC)

- Section 3.4.6.5 (14) *Handrails*
- Section 4.1.5.14 (7) *Loads on Guards and Handrails*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

2012 Ontario Building Code (OBC)

- Section 3.4.6.5 (12) *Handrails*
- Section 4.1.5.14 (5) *Loads on Guards*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

2018 British Columbia Building Code (BCBC)

- Section 3.4.6.5 (14) *Handrails*
- Section 4.1.5.14 (7) *Loads on Guards and Handrails*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

SECTION 4
MATERIAL SOURCE

The client submitted the handrail system to the Evaluation Center on September 14, 2021 (Coquitlam ID# VAN2109140837-001). 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.

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TEST REPORT FOR CENDEK RAILINGS LTD.
Report No.: 104813048COQ-002A
Date: 10/05/21

ASSET #	DESCRIPTION	MODEL	CAL DUE DATE
P60692	Artech 5k lb S-Type Load Cell	20210-5k	10/22/21
P60610	T&D Temperature and Humidity Indicator	TR-72Ui	05/09/22
D8275	Fisherbrand Stopwatch	14-649-18	12/15/22
02700	Mitutoyo Digital Deflection Gauge	C150 1050	06/08/22
P60026	Mitutoyo Digital Deflection Gauge	C150 1050	07/15/22
P60018	Mitutoyo Digital Deflection Gauge	C150 1050	07/15/22

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 the testing procedures of 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 / 2018 BCBC:
SECTION 3.4.6.5 HANDRAILS
SECTION 4.1.5.14 LOADS ON GUARDS AND HANDRAILS / LOADS ON GUARDS
SECTION 9.8.7.7 DESIGN AND ATTACHMENT OF HANDRAILS

Handrails and their supports shall be designed and constructed to withstand the following loads, which need not to be considered to act simultaneously:

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.

Note 1: A safety factor of 2.24 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=0.67 resistance factor for brittle failure mode, resulting safety factor = 2.24

UNIFORM LOAD TEST

Uniform test loads were applied to the handrail in two (2) orientations – downward and perpendicular to the handrail, and in an outwards direction to the handrail. The test loads were applied 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.

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CONCENTRATED LOAD TEST

The handrail system was subjected to five separate tests where a concentrated load 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.

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TEST REPORT FOR CENDEK RAILINGS LTD.
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SECTION 8
TEST SPECIMEN DESCRIPTION

The sample was identified as the following:

TABLE 1. HANDRAIL CONFIGURATION

PART NAME	PART NUMBER	QTY	PART DIMENSIONS				REPORTED MATERIAL
			LENGTH	WIDTH	HEIGHT	NOMINAL THICKNESS	
Stair Post	5104-POS-27442	1	42.75 in.	2.50 in.	2.50 in.	0.07 in.	6063-T5
Stair Baseplate		1	4.00 in.	4.00 in.	0.25 in.	N/A	6063-T5
180° Pipe Return	4300-PIP-30700	1	N/A	N/A	1.625 in. dia.	0.140 in.	6063-T52
Pipe Elbow	4300-PIP-30532	2	N/A	N/A	1.625 in. dia.	0.140 in.	6063-T52
Pipe Handrail Mount	4300-PIP-30100	4	3.25 in.	3.33 in.	3.75 in.	0.21 in.	6063-T5
Pipe Splice	1800-PIP-10006	3	6.00 in.	0.97 in.	0.97 in.	0.07 in.	6063-T5
Pipe Handrail	1800-PIP-00085	1	83.00 in.	N/A	1.625 in. dia.	0.140 in.	6063-T5
90° Mitred Return	4300-PIP-31690	0	Not included in test sample				
Pipe End Cap	4300-PIP-30400	0	Not included in test sample				

Note 1: For detailed drawings of the test sample and components, refer to Appendix C.

Note 2: 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 Pipe Handrail assembly was attached to a rigid test support using steel plates with four (4) 3/8 in. Grade 5 bolts on the post baseplate and two (2) 1/4 in. Grade 5 bolts on each mounting bracket.

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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 Cendek Railings Ltd. on their Pipe Handrail system per ASTM E935-13e1, *Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.* The scope of the testing as requested by Cendek Railings Ltd., was to assess the ability of the handrail system to resist the loads as prescribed in the following building code articles:

2015 National Building Code of Canada (NBC)

- Section 3.4.6.5 (14) *Handrails*
- Section 4.1.5.14 (7) *Loads on Guards and Handrails*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

2012 Ontario Building Code (OBC)

- Section 3.4.6.5 (12) *Handrails*
- Section 4.1.5.14 (5) *Loads on Guards*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

2018 British Columbia Building Code (BCBC)

- Section 3.4.6.5 (14) *Handrails*
- Section 4.1.5.14 (7) *Loads on Guards and Handrails*
- Section 9.8.7.7 (1) *Design and Attachment of Handrails*

The Cendek Railings Ltd. Pipe Handrail 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. 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 (2 PAGES)

Company	Cendek Railings	Technician(s)	Kevin Penner / Chris Chang
Project No.	G104813048	Reviewer	Baldeep Sandhu
Models	Pipe Handrail	Start/End Date	September 24, 2021
Product Name	Same as above	Sample ID	VAN2109140837-001
Standard	**2015 NBC / 2018 BCBC, Section 3.4.6.5(14), 4.1.5.14(7), 9.8.7.7(1)** **2012 OBC, Section 3.4.6.5(12), 4.1.5.14 (5), 9.8.7.7(1)**		

Test Data Package

Table of Contents

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Test:	**Design and Attachment of Handrails**	Project:	G104813048
Date:	24-Sep-21	Eng/Tech:	Kevin Penner
Client:	Cendek Railings	Reviewer:	Baldeep Sandhu
Product:	**Pipe Handrail**	Location:	Coquitlam, BC, Canada

Post Spacing: 4.56 ft 1.39 m (between bracket spacing)

Method:
2015 National Building Code of Canada,
- 3.4.6.5 *Handrails* (14), 4.1.5.14 *Loads on Guards and Handrails* (7), 9.8.7.7 *Design and Attachment of Handrails* (1)

2012 Ontario Building Code
- 3.4.6.5 *Handrails* (12), 4.1.5.14 *Loads on Guards* (5), 9.8.7.7 *Design and Attachment of Handrails* (1)

2018 British Columbia Building Code
- 3.4.6.5 *Handrails* (14), 4.1.5.14 *Loads on Guards and Handrails* (7), 9.8.7.7 *Design and Attachment of Handrails* (1)

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

Equipment:
Artech 5000 lbf Load Cell (Intertek ID# P60692, cal due October 22, 2021)
T&D TR-72Ui Temperature and Humidity Logger (Intertek ID# P60610, cal due May 9, 2022)
Stopwatch (Intertek ID# D8275, cal due December 15, 2021)
Mitutoyo Digital Deflection Gauge (Intertek ID# 02700, cal due June 8, 2022)
Mitutoyo Digital Deflection Gauge (Intertek ID# P60026, cal due July 15, 2022)
Mitutoyo Digital Deflection Gauge (Intertek ID# P60018, cal due July 15, 2022)

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)	Deflections (mm)	Pass/Fail
Outward	Uniform Distributed Load (per m)	1	0.7	1.57	0.38	1.09	2.18	25.44	**Pass**
	Point Load on Handrail at Joint	5	0.9	2.01	-	-	2.01	66.47	**Pass**
	Point Load on Handrail Adjacent to Post Bracket	6	0.9	2.01	-	-	2.01	41.80	**Pass**
	Top of Post	7	0.9	2.01	-	-	2.01	93.40	**Pass**
Downward / Perpendicular to Handrail	Uniform Distributed Load (per m)	2	0.7	1.57	0.38	1.09	2.18	28.99	**Pass**
	Point Load on Handrail at Joint	3	0.9	2.01	-	-	2.01	47.14	**Pass**
	Point Load on Handrail at Center Bracket	4	0.9	2.01	-	-	2.01	24.60	**Pass**

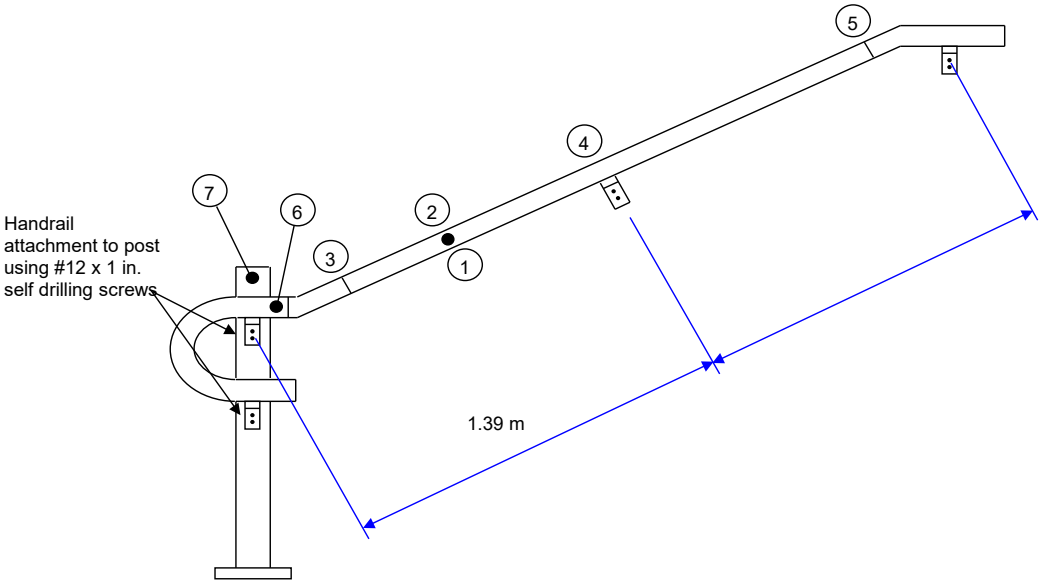

Figure 1. Location of Tests
(Not to Scale)

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APPENDIX B – PHOTOS (2 PAGES)

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TEST REPORT FOR CENDEK RAILINGS LTD.
Report No.: 104813048COQ-002A
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Figure 1 – Test Setup and Apparatus

Figure 2 – Horizontal Uniform Load Test

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Figure 3 – Vertical Uniform Load Test

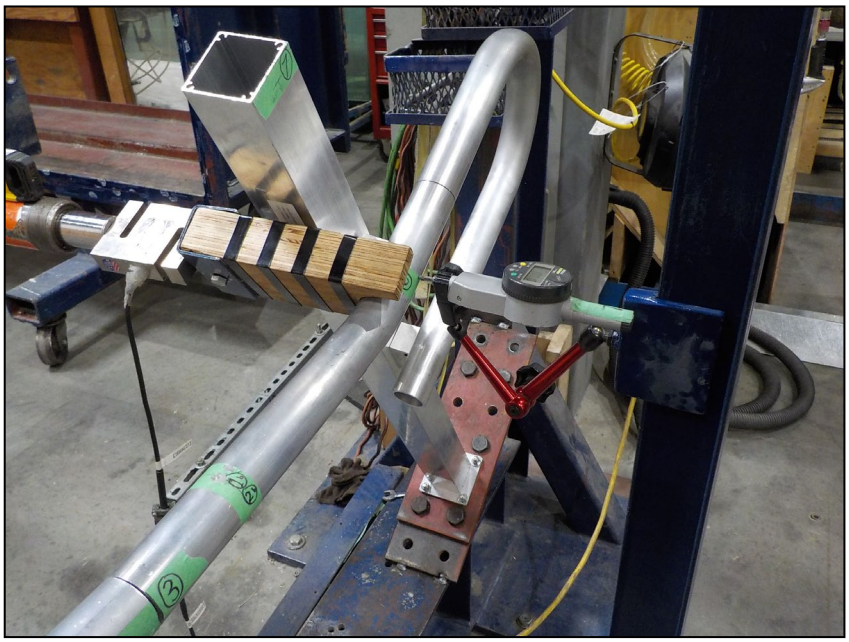

Figure 4 – Horizontal – Adjacent to Post Bracket Concentrated Load

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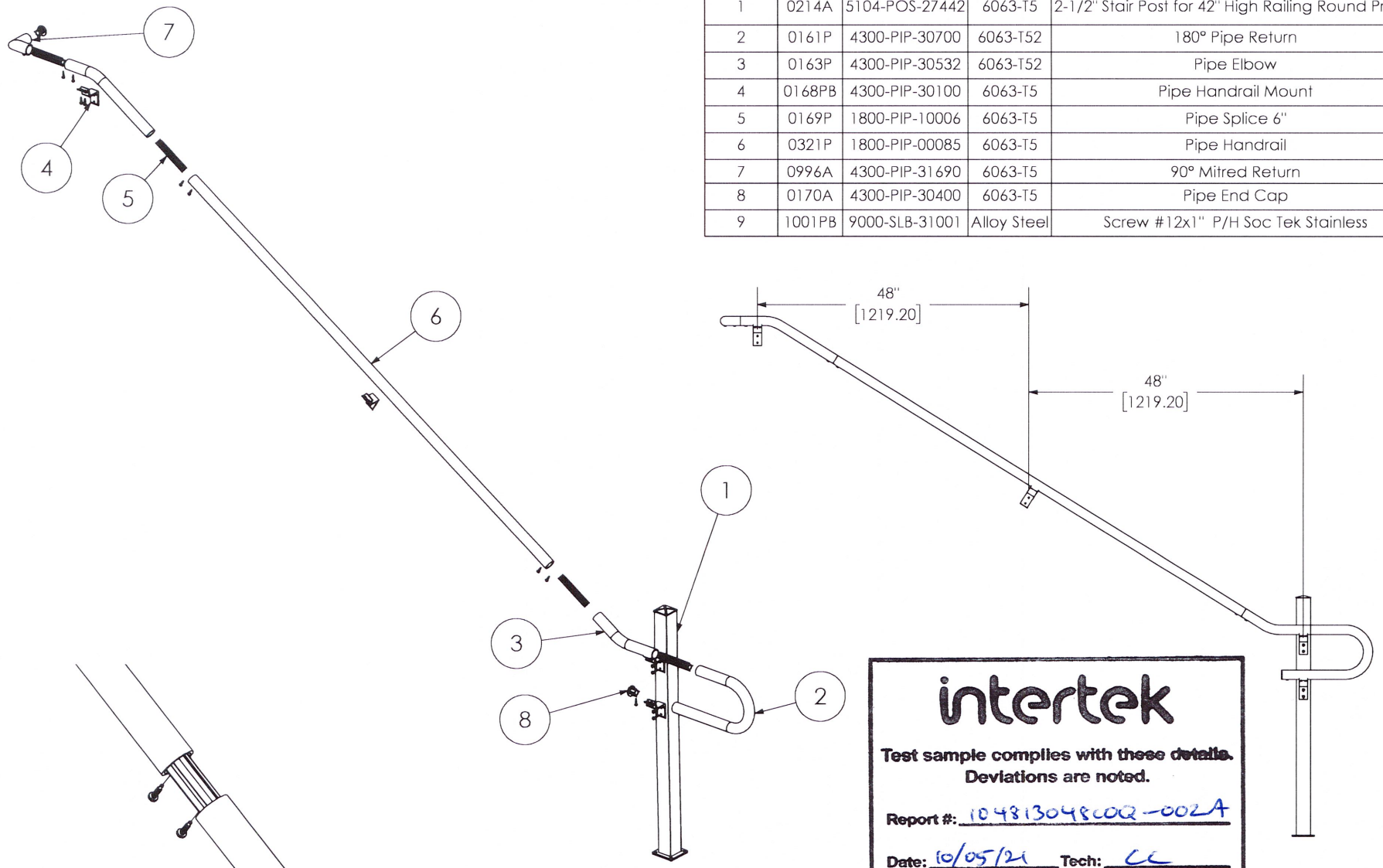
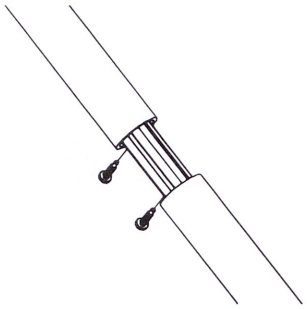
APPENDIX C – DRAWINGS (3 PAGES)

ITEM NO.	Eng No.	Part No.	Material	DESCRIPTION
1	0214A	5104-POS-27442	6063-T5	2-1/2" Stair Post for 42" High Railing Round Profile
2	0161P	4300-PIP-30700	6063-T52	180° Pipe Return
3	0163P	4300-PIP-30532	6063-T52	Pipe Elbow
4	0168PB	4300-PIP-30100	6063-T5	Pipe Handrail Mount
5	0169P	1800-PIP-10006	6063-T5	Pipe Splice 6"
6	0321P	1800-PIP-00085	6063-T5	Pipe Handrail
7	0996A	4300-PIP-31690	6063-T5	90° Mitred Return
8	0170A	4300-PIP-30400	6063-T5	Pipe End Cap
9	1001PB	9000-SLB-31001	Alloy Steel	Screw #12x1" P/H Soc Tek Stainless





TYPICAL JOINT
One splice &
Two #12x1 Tek Screws

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Test sample complies with these details.
Deviations are noted.

Report #: 104813048COQ-002A

Date: 10/05/21 Tech: CC

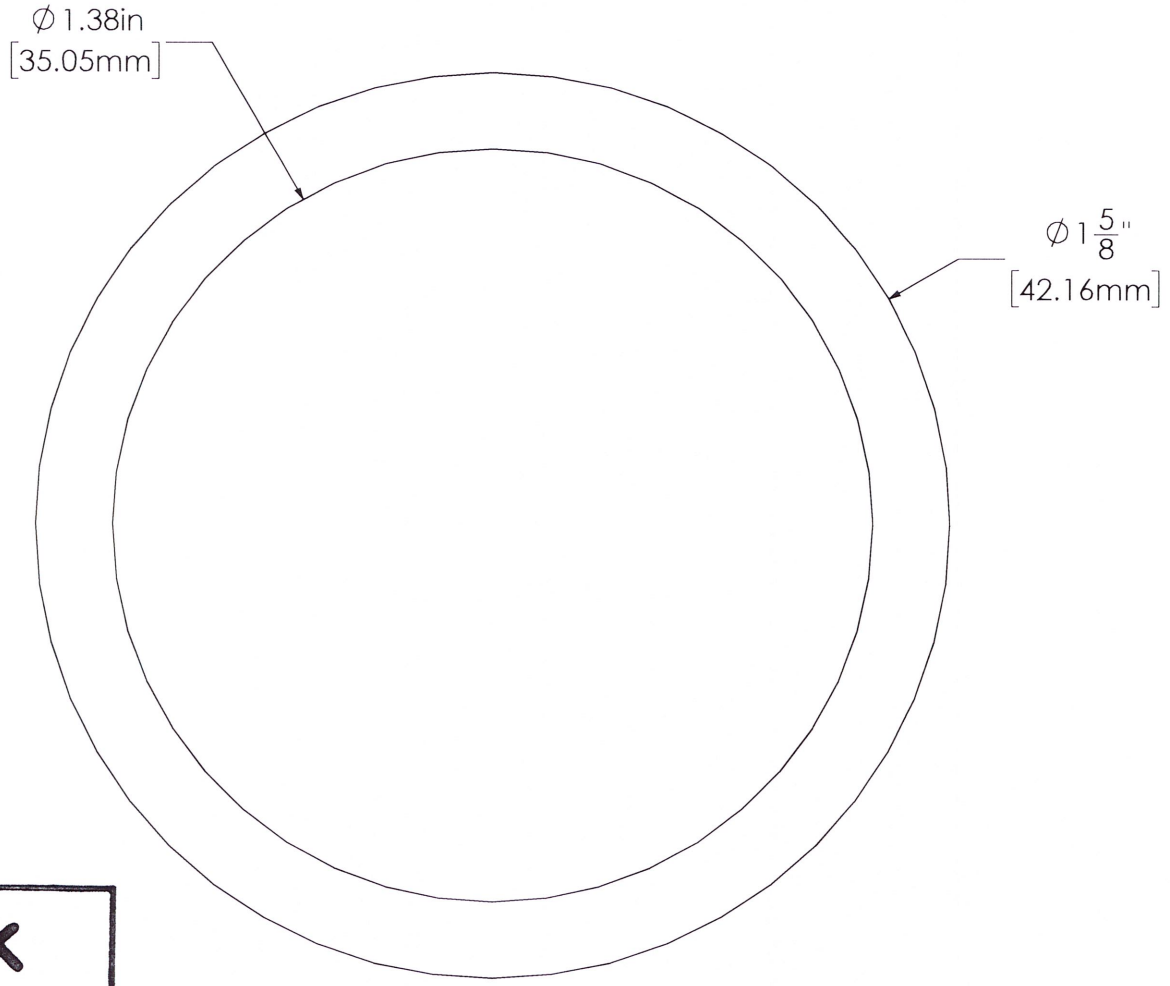
CenDek Railings Ltd.

DRAWN BY	Eng1
CREATED	7/27/2021
MATERIAL	
DIE NO.	

ALL DIMENSION IN INCHES/mm

DESCRIPTION
Pipe Handrail System

Part No.
Eng No. 2616A
Weight lbs
SHEET 1 OF 1
Rev -



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Test sample complies with these details.
Deviations are noted.

Report #: 104813048COQ-002A

Date: 10/05/21 Tech: CC

CenDek Railings Ltd.

DRAWN BY	Admin
CREATED	1/17/2018
MATERIAL	6063-T5
DIE NO.	

ALL DIMENSION IN INCHES/mm

DESCRIPTION
Pipe Handrail

Part No.

Eng No. 0321P

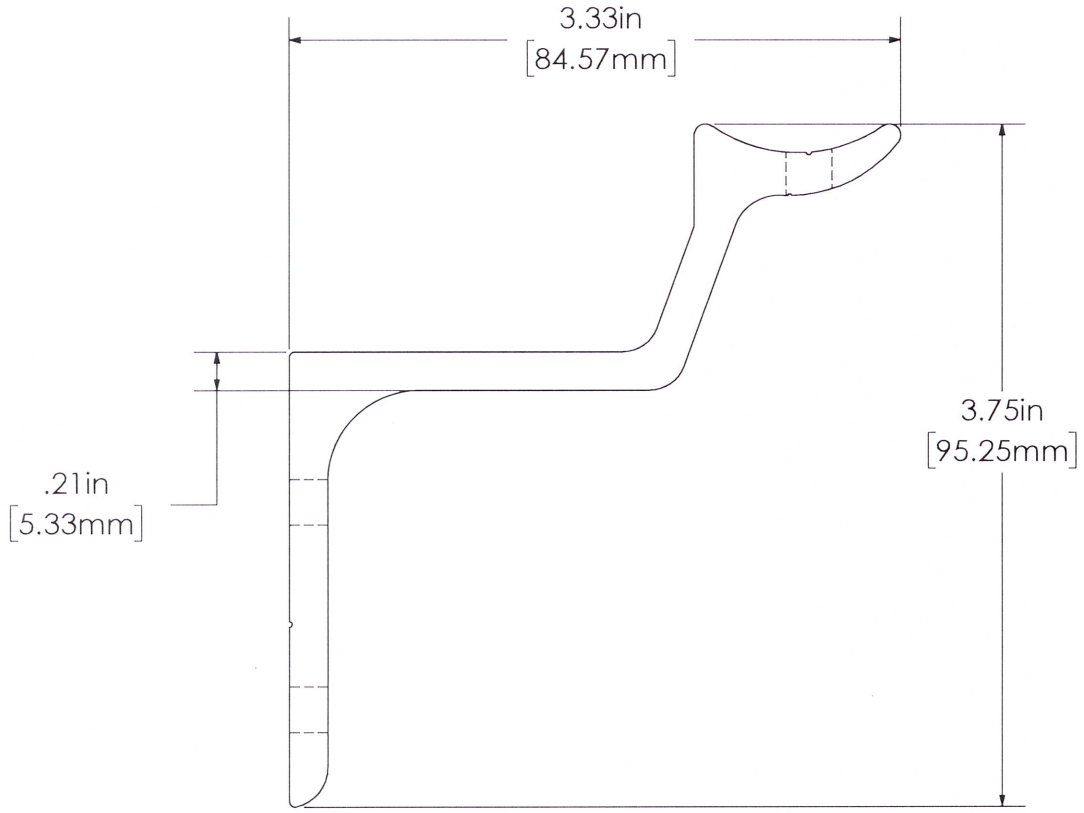
Weight 5.54 lbs/ft

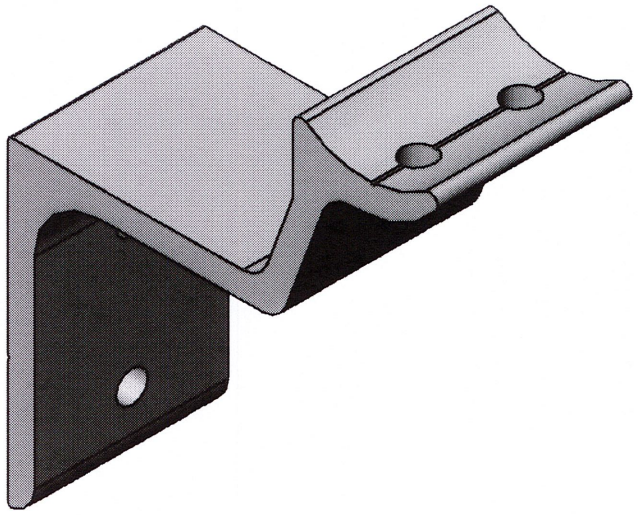
SHEET 1 OF 1

Rev -

REVISIONS

REV.	DESCRIPTION	DATE	INITIAL





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Test sample complies with these ~~details~~.
Deviations are noted.

Report #: 10481304800Q-002A

Date: 10/05/21 **Tech:** LL

CenDek Railings Ltd.

DRAWN BY	Admin
CREATED	1/17/2018
MATERIAL	6063-T5
DIE NO.	

ALL DIMENSION IN INCHES/mm

DESCRIPTION
Pipe Handrail Mount

Part No. 4300-PIP-30100	Eng No. 0168PB	
Weight 0.21 lbs	SHEET 2 OF 2	Rev -

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SECTION 12

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	10/05/21	N/A	Original Report Issue