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NUVO IRON
TEST REPORT

SCOPE OF WORK
STATIC LOAD TESTING ON STEEL PICKET RAIL GUARD SYSTEM WITH SWIVEL-END BRACKETS PER ASTM E935-21 “STANDARD TEST METHODS FOR PERFORMANCE OF PERMANENT METAL RAILING SYSTEMS AND RAILS FOR BUILDINGS”

REPORT NUMBER
106117267TOR-002

TEST DATE(S)
04/18/25

ISSUE DATE
04/28/25

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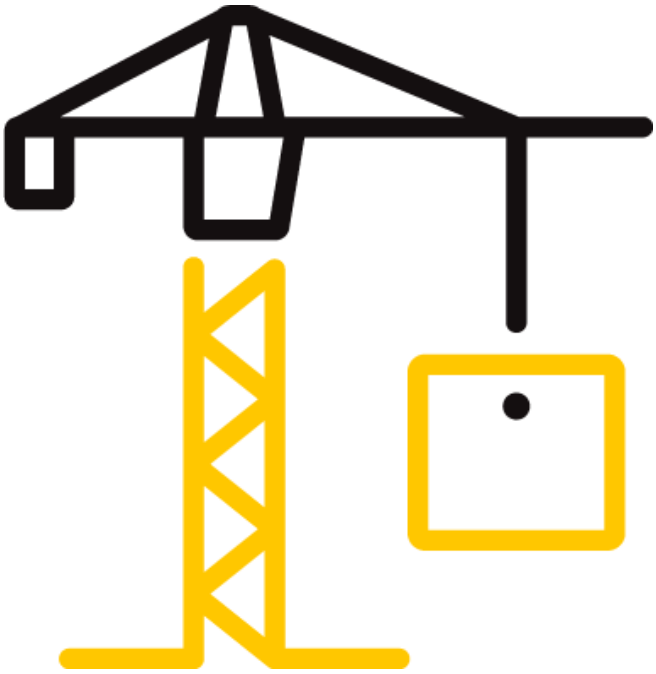

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TEST REPORT FOR NUVO IRON

Report No.: 106117267TOR-002
Date: 04/28/25

REPORT ISSUED TO

NUVO IRON
13371 Coleraine Drive
Caledon, ON L7E 3B6
Canada

SECTION 1

SCOPE

Intertek Testing Services NA, Ltd. dba Intertek Building & Construction (B&C) was contracted by **Nuvo Iron**, to conduct static load testing on their steel picket railing system with swivel-end brackets in accordance with **ASTM E935-21**, Standard *Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.*

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.

Intertek B&C will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, representative samples of test specimens (where required by Certification or Accreditation bodies), or other pertinent project documentation, will be retained for the entire test record retention period.

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For INTERTEK B&C:

COMPLETED BY:	Abdul Shahnawaz	**REVIEWED BY:**	Tyrone Williams, P.Eng.
TITLE:	Lab Technician Building & Construction	**TITLE:**	Lab supervisor Building & Construction
SIGNATURE:		**SIGNATURE:**	
DATE:	04/28/25	**DATE:**	04/28/25

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SECTION 2
SUMMARY OF TEST RESULTS

The Nuvo Iron steel picket railing system with swivel-end brackets demonstrated resistance to the prescribed loads for guards and guard in-fill components specified in:
2020 National Building Code of Canada (NBC) and **2024 Ontario Building Code (OBC)** – Section 4.1.5.14 ("Loads on Guards and Handrails"), Sentences 1c, 3, 4, and 6.
2024 International Building Code (IBC) – Sections 1607.9.1, 1607.9.1.1, and 1607.9.1.2.
2024 International Residential Code (IRC) – Section R301.5 ("Live Load"), Sentences f and I, and Table R301.5 (Guards and Guard in-fill components).
No failures, disengagements, or structural cracks were observed during or after load testing

SECTION 3
TEST METHOD(S)

The samples were evaluated in accordance with the following:

- **2020 National Building Code of Canada (NBC)** and **2024 Ontario Building Code (OBC)** – Section 4.1.5.14 ("Loads on Guards and Handrails"), Sentences 1c, 3, 4, and 6.
- **2024 International Residential Code (IRC)** – Section R301.5 ("Live Load"), Sentences f and i, and Table R301.5 (Guards and Guard in-fill components).
- **2024 International Building Code (IBC)** – Sections 1607.9.1, 1607.9.1.1, and 1607.9.1.2.
- **ASTM E935-21** *"Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings".* Section 10 & 11

SECTION 4
MATERIAL SOURCE/INSTALLATION

The sample was assembled and submitted by the client. The guard rail was installed and tested at the Intertek test facility in Mississauga, ON.

SECTION 5
EQUIPMENT

Equipment Calibration		
Instrument/Equipment	**Asset #**	**Calibration Due Date**
Load Cell w/Display	280-01-0773	Oct-31-2025
Measuring Tape	280-01-0730	Nov-04-2025
Digital Caliper	273-01-1263	Nov-04-2025
Stopwatch	280-01-1254	Nov-04-2025
Digital Deflection gauge	280-01-0836	Nov-04-2025

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SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Tyrone Williams	Intertek B&C

SECTION 7
TEST PROCEDURE

IN-FILL OPENING TEST
Specified load was applied in between two adjacent infill pickets or vertical elements in opposite directions in the in-plane direction of the guard, whereupon the space opening of pickets was measured.

IN-FILL LOAD TEST
Test Loads were applied over 300 x 300 mm (12 x 12 in.) and/or 100 x 100 mm (4 x 4 in.) square platen normal to the geometric center of the infill. Specified and factored loads were applied and held for one (1) minute, whereupon deflection of the infill at the point of maximum deflection was recorded.

UNIFORM LOAD TEST
The top rail was subjected to vertical and horizontal quarter point loads applied by means of a load distributing bar. Specified and factored loads were applied and held for one (1) minute, whereupon deflection of the top rail at mid-span was recorded.

CONCENTRATED LOAD TEST
Concentrated test loads were applied separately and sequentially at the following critical locations: horizontally and vertically on the top rail at mid-span between posts, on the top rail adjacent to a post, and on top of a single post. Specified and factored loads were applied over a 100 x 100 mm (4 x 4 in.) square platen and held for one (1) minute, whereupon deflection was recorded at the point of application of the load. The load applied on the rail adjacent to the post was applied to the opposite post from which the top-of-post-test was performed on.

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

Failure as defined in **ASTM E935-21**: *"the loss of load carrying capacity or the inability to meet the required load carrying capacity specified in the applicable performance standard, depending on the purpose of the test."*

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SECTION 8
TEST SPECIMEN DESCRIPTION

The test assembly consisted of a single-bay guardrail system, comprising two (2) surface-mounted steel posts, along with top and bottom square hollow section (SHS) rails and SHS steel picket infill.

The posts were spaced 1885 mm apart (on center), welded to base plates, and internally reinforced at their bases with steel pipes. The SHS pickets were spaced at 111 mm on center, resulting in a 95 mm opening between adjacent pickets, with the starting pickets positioned 77 mm from their nearest post. The SHS top and bottom rails were spaced 990 mm apart vertically (on center) and inserted into swivel end brackets. Rails were secure to the brackets using two (2) countersunk self-tapping screws, measuring 4.76mm x 12.7 mm. Each bracket was then secured to the posts with two (2) countersunk screws, measuring 4.14 mm x 52.1 mm.

The entire assembly was anchored to a steel substrate using four (4) hex-head bolts with washers and nuts per post, each bolt measuring 12.7 mm x 38.1 mm. The overall height of the guardrail, measured from the substrate surface to the top of the top rail, was 1065 mm.
rail.

Table 1: Steel Picket Railing System Components

Parts	QTY	Part Dimensions (mm)				Reported Material
		Length	Width	Height	Nominal Thickness	
Base Plate	2	100	100	-	5.96	Steel
Post	2	1117	50	50	1.56	Steel
Post Reinforcement pipe	2	47.74 (diameter)		183	1.45	Steel
Top Rail	1	1750	25	25	1.59	Steel
Bottom Rail	1	1750	25	25	1.58	Steel
Picket (Infill)	16	966	16	16	1.28	Steel
Swivel Bracket	4	32	62	32	3.73	Cast Iron (bracket part) Aluminium (Swivel part.)

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SECTION 9
TEST RESULTS

Table 2: Steel Picket Rail System - **NBC/OBC TEST RESULTS**

Direction of Load	Test		Specified loads kN	Deflection at Specified load (mm)	Safety Factor	Required Factored Load kN	Results
Symmetrical Guard. Load applied in one direction	Horizontal load applied on elements within the Guard over a width of 100 mm x height of 100 mm		0.5	18.72	2.24	1.12	Load Resisted
	Evenly Distributed Vertical load applied at the Top of the Guard (mid Span)/Quarter Point Equivalent load		1.5kN/m	10.80	1.67	2.51kN/m	Load Resisted
	Evenly Distributed Horizontal Load Applied at the Top of the Guard(mid-Span)/Quarter Point Equivalent load		0.75kN/m	43.97	1.67	1.25kN/m	Load Resisted
	Horizontal load applied at the minimum required height of the guard	Top Rail (mid Span)	1.0	45.12	2.00	2.0	Load Resisted
		Adjacent to Post	1.0	23.53	2.24	2.24	Load Resisted
		Top of Post	1.0	22.68	2.24	2.24	Load Resisted

Test	Specified load kN	Opening at Specified load (mm)	Opening limit	Results
Infill Opening Test- load applied on two adjacent vertical elements in opposite directions in the in-plane direction of the guard.	0.1	98.15	< 100 mm	Pass

No failures, disengagements, or structural cracks were observed during or after load testing.

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Table 3: Steel Picket Rail System with Post Brackets- **IRC/IBC TEST RESULTS**							
Direction of Load	**Test**		**Test Load lbf**	**Deflection at Test Load (mm)**	**Safety Factor**	**Required Factored Load lbf**	**Pass/Failed**
Symmetrical Guard. Load applied in one direction	Infill Load Test- Applied to the Geometric Center of the infill area of a baluster or panel railing system, distributed over a square area of 0.1 m sq.		50	8.62	2.50	125	Load Resisted
	Infill Load Test- Applied to the Center Bottom of the infill area of a baluster or panel railing system, distributed over a square area of 0.1 m sq.		50	6.68	2.50	125	Load Resisted
	Concentrated Vertical Load Test- Applied to the top of the railing (Mid-Span)		200	6.03	2.50	500	Load Resisted
	Evenly Distributed Vertical Load- Applied at the top of the Guard (mid Span) Quarter Point Equivalent load.		50lb/ft	4.67	2.50	125lb/ft	Load Resisted
	Evenly Distributed Horizontal Load- Applied at the Top of the Guard (mid Span) Quarter Point Equivalent load.		50lb/ft	43.82	2.50	125lb/ft	Lost Resisted
	Concentrated Horizontal load Test - applied at the minimum required height of the guard	Top Rail (mid Span)	200	39.71	2.50	500	Load Resisted
		Top Rail (Adjacent to post)	200	20.51	2.50	500	Load Resisted
		Top of Post	200	19.07	2.50	500	Load Resisted

No failures, disengagements, or structural cracks were observed during or after load testing.

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SECTION 10
CONCLUSION

Intertek Testing Services NA Ltd. (Intertek) has conducted static load testing for Nuvo Iron, their steel picket railing system with swivel-end brackets to assess the ability of the guard system to resist the prescribed loads in the **2020 National Building Code of Canada (NBC), 2024 Ontario Building Code (OBC)**, **2024 International Residential Code (IRC),** and **2024 International Building Code (IBC).**

The Nuvo Iron steel picket railing system with swivel end brackets detailed in this report has shown resistance to the loads specified in the following:

- **2020 National Building Code of Canada, (NBC) & 2024 Ontario Building Code (OBC)** – Section 4.1.5.14 - *"Loads on Guards and Handrails"*. Sentences 1c, 3, 4 & 6.

- **2024 International Residential Code (IRC)** – Section R301.5 – "*Live Load*", sentence f, I, and Table R301.5 *(Use- Guards and Guard in-fill components).*

- **2024 International Building Code (IBC) –** Sections 1607.9.1, 1607.9.1.1 and 1607.9.1.2.

This test report does not constitute Intertek product certification. Authority to Mark musted be issued separately for certification.

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SECTION 11
PHOTOGRAPHS

Photo No. 1
Geometric Centre Infill Load Test.

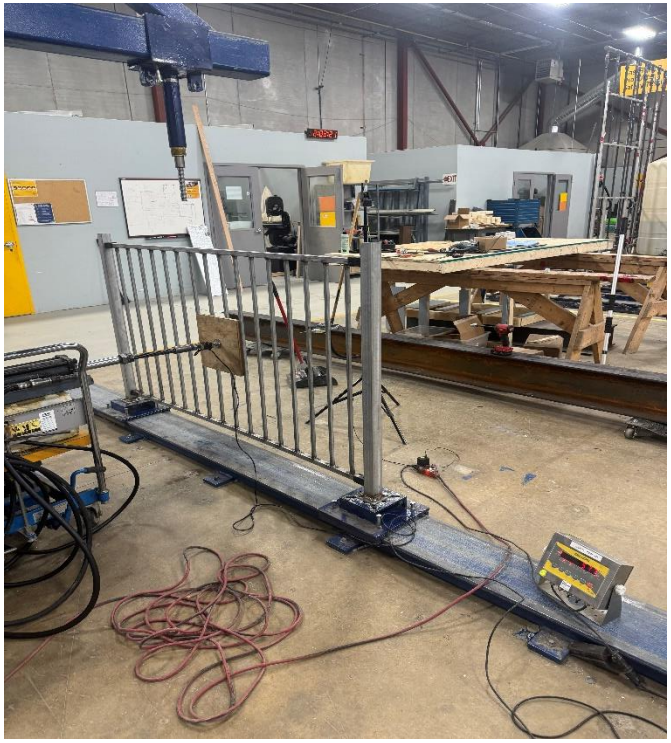

Photo No. 2
Centre Bottom Infill Load Test.

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Photo No. 3
Vertical Uniform Load Test.

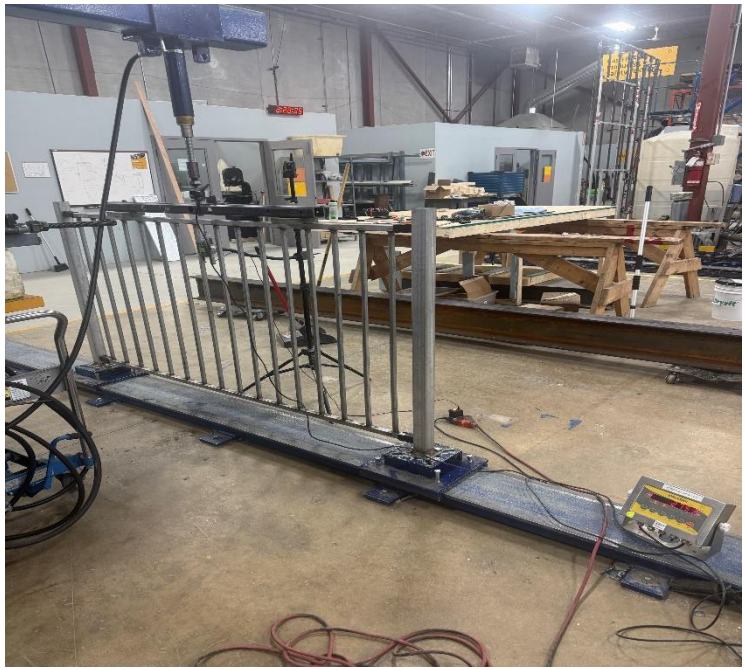

Photo No. 4
Horizontal Concentrated Load Test

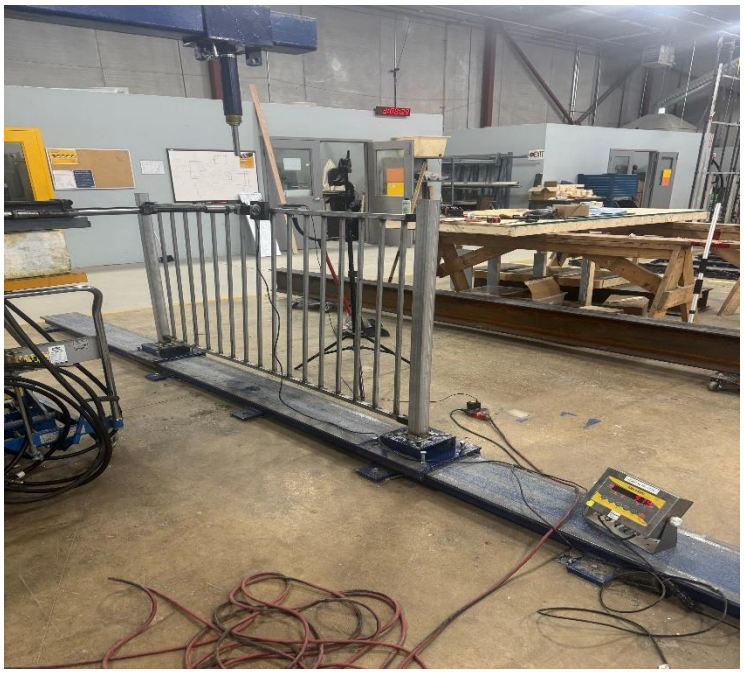

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Photo No. 5
Horizontal Uniform Load Test.

Photo No. 6
Horizontal Concentrated Top-of-Post Test.

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Photo No. 7
Swivel Bracket.

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SECTION 12
REVISION LOG

REVISION #	DATE	SECTION	REVISION
0	04/28/25	N/A	Original Report Issue