

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696

**Design-Basis Performance Verification - TitanCore™ Joiner****Applicant:** ArcticAnchor™ USA800 N Rainbow Blvd, Unit
208, Las Vegas, NV 89107Number: TCJ-BK-181125
Date: November 18, 2025**Sample Description:**

Submitted Sample Test	Force/Temperature
Item Name	Joiner
Test Sample Quantity	10 Pieces
Date Sample Received	August 20, 2025
Date Sample Tested	August 22, 2025
Testing Standards	Mechanical: Internal method (fixture-based), applicable standards, and engineering practice.

Product Image:

Detailed report continued on attached pages.

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



CONTENTS

- I. Introduction
- II. Summary
- III. Test Set-Up and Procedure
- IV. Testing Equipment
- V. Mechanical Results: 22 Celsius
- VI. Mechanical Results: -30 Celsius
- VII. HT-HW-80L Thermal Cycling Equipment
- VIII. Authorization - Limitations and Disclaimer

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



I. Introduction

I.A Purpose of Verification

The purpose of this in-house evaluation is to verify the design-basis performance of the ArcticAnchor™ TitanCore™ Joiner under controlled laboratory conditions relevant to snow retention rail assemblies. Testing establishes the joiner's static mechanical load-to-failure strength and documents structural response under quasi-static loading at ambient (22 °C) and cold (–30 °C) conditions.

Because there is no single universal U.S. product certification standard that defines pass/fail requirements for snow retention systems, this document is issued as a Design-Basis Performance Verification / Design Verification Report for internal approval and customer due diligence under the boundary conditions described herein.

I.B Laboratory

Testing was performed at the GeniusQuest Global testing facility. Unless otherwise stated, testing was conducted under controlled laboratory conditions. Equipment identification, capacity, and calibration status are provided in the Testing Equipment section and supporting records where available.

I.C Description of Unit

The test article is the TitanCore™ Joiner, an internal structural connector used to connect two snow retention rail sections into a continuous run. The joiner uses pressure-fit ribs with a fish-scale profile to create a high-interference fit inside the rail cavity, providing alignment continuity and load transfer across the rail-to-rail interface.

I.D Report Organization

Section II provides a summary of key information and results. Section III describes the test setup, boundary conditions, and test procedure. Section IV presents the testing equipment. Conclusions and authorization are provided in Sections V onwards.

II. Summary

II.A Pretest Information

Samples were received as finished parts. Sample quantity and conditioning groups are listed in the results tables. Receipt records, lot/batch traceability (where applicable), and drawing revision records are retained internally as part of the controlled verification file.

II.B Information Log

Mechanical load-to-failure verification was performed using a universal testing machine and a controlled fixture configuration to apply repeatable structural loading to the joiner/rail interface. Results apply only to the specific samples tested under the stated boundary conditions.

II.C Summary of Verification Results

Ultimate load-to-failure results are summarized below for ambient (22 °C) and cold (–30 °C) testing. Recorded break point values are reported from the universal testing machine output for the stated configurations. Raw machine outputs (load versus displacement) are retained internally as part of the controlled verification record.

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



II.D Rapid Thermal Aging (Temperature Cycling) x Summary

Rapid thermal aging was performed to evaluate the Joiner's durability under repeated temperature switching representative of severe service conditions. Specimens were cycled between -30°C and $+55^{\circ}\text{C}$, with the chamber switching setpoints every 8 hours. Three exposure durations were evaluated: 10, 20, and 30 days. Following completion of each exposure duration, specimens were inspected and retained as part of the durability verification record.

Metric	22 °C	-30°C	Change
Mean ultimate load (N)	9,877.53	10,136.01	+2.62%
Minimum listed load (N)	9,782.18	10,045.70	—
Sample count	10	10	—

Notes:

1. The values above correspond to the reported Break Point at each temperature condition in the results sections. TitanCore™ Joiner - ArcticAnchor™.
2. Where the underlying machine output is recorded in newtons, unit conversions are maintained internally for traceability.
3. Cold-conditioned specimens exhibited a higher ultimate load than ambient specimens under the stated fixture configuration.

III. Test Set-Up and Procedure

III.A Intended Field Installation (Design Intent)

In intended field use, the TitanCore™ Joiner is installed inside the snow rail cavity to connect adjacent rail sections into longer continuous runs. The joiner's fish-scale ribs are designed to create a pressure-fit interface that maintains alignment and load transfer across the rail-to-rail joint. This report documents component/system verification under controlled laboratory boundary conditions and, by itself, does not constitute a project-specific roof-system approval.

III.B As-Tested Mounting and Boundary Conditions (Worst-Case Fixture)

Mechanical evaluation was performed using a controlled fixture designed to represent a conservative worst-case load path through the rail-to-rail joint. The fixture rigidly constrains one half of the joint by fully seating and locking it into a holding jig, while applying force to the opposing half via the universal testing machine interface. This configuration concentrates load through a single side of the joint and is intended to challenge the joiner interface under repeatable boundary conditions.

III.C.1 Test Procedure

Each specimen was installed into the fixture and aligned to ensure consistent load application. The load was applied quasi-statically under machine control until failure. Failure was defined as a catastrophic fracture, loss of load-carrying capacity, or another clearly observable structural collapse consistent with the purpose of the test. The maximum load recorded prior to failure is reported as the break point. Post-test photographs were captured, and the observed failure condition was documented in the results section.

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



III.C.2 Test Procedure (Joiner Installed in Rail Assembly)

The joiner was installed inside the snow rail, centered within an 18-inch rail span, with the complete rail system assembled. The joiner location was positioned at mid-span to represent a conservative bending and joint-transfer condition. The load was applied quasi-statically under machine control until a clear structural failure occurred. Failure was defined as catastrophic fracture, loss of load-carrying capacity, or another clearly observable structural collapse consistent with the purpose of the test. **Observed outcome:** In the assembled system configuration, the stands failed before the joiner failed, indicating the joiner joint capacity exceeds the weakest element in the assembled rail system under the stated boundary conditions.

Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



IV. Testing Equipment

2-ton microcomputer universal testing machine (UTM) in a double-column configuration.

Machine Specifications:

Maximum test force:	2000KG
Accuracy level:	Level 1N
Test force range:	0.4%~100%FS
Power resolution:	1/200000
Strength accuracy:	within $\pm 1\%$
Test stroke:	1000mm including fixture
Displacement indication error:	within $\pm 1\%$ of indication
Displacement resolution:	0.1mm



Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



V. Mechanical Results: 22 Celsius

Mechanical Load-to-Failure Summary (Fixture-Based):

Sample No.	N	Weight (g)
1	9,782.18	36.40
2	9,998.13	36.20
3	9,896.81	36.20
4	9,847.52	36.20
5	9,963.12	36.40
6	9,871.83	36.20
7	9,794.68	36.20
8	9,869.25	36.40
9	9,893.67	36.20
10	9,858.12	36.20
Average Break Point (N)	9,877.53	36.26

Before:



After:



Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696

VI. Mechanical Results: -30 Celsius

Mechanical Load-to-Failure Summary (Fixture-Based):

Sample No.	N	Weight (g)
1	10,085.40	36.40
2	10,192.10	36.20
3	10,045.70	36.20
4	10,178.90	36.20
5	10,210.60	36.40
6	10,130.64	36.40
7	10,098.20	36.20
8	10,165.30	36.20
9	10,112.80	36.20
10	10,140.50	36.20
Break Point Average (N)	10,130.64	36.26

Before:



After:



Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



VII. HT-HW-80L Thermal Cycling Equipment

80L Constant Temperature and Humidity Test Chamber. Alternating humidity and heat test method (IEC68-2-30).

Note: IEC68-2-30 is a chamber capability reference; this program uses temperature cycling.

Equipment Performance:

Analysis accuracy:	Temperature $\pm 0.01^{\circ}\text{C}$; Humidity: $\pm 0.1\%$ R.H
Temperature range:	$-40^{\circ}\text{C} \sim +150^{\circ}\text{C}$
Temperature fluctuation:	$\pm 2^{\circ}\text{C}$
Temperature uniformity:	$\pm 2^{\circ}\text{C}$
Humidity range:	20% to 98% R.H
Humidity uniformity:	$\pm 3\%$
Heating rate:	$2^{\circ}\text{C} - 4^{\circ}\text{C}/\text{min}$ (from room temperature to maximum temperature, non-linear no-load)
Cooling rate:	$0.7^{\circ}\text{C} - 1^{\circ}\text{C}/\text{min}$ (from room temperature to the lowest temperature, non-linear no-load)

The environmental chamber was programmed for rapid temperature cycling between -30°C and $+55^{\circ}\text{C}$ with 8-hour setpoint switching for 10-, 20-, and 30-day exposure durations.



Genius Quest Global Limited

6th Floor, Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road
Fenggang Town, Dongguan City Zip-523696



VIII. Authorization - Limitations and Disclaimer

Approved for internal release as an in-house verification report (not third-party certification).



Sam Kwan

Sam Kwan
General Manager Testing Department
Consumer Products/Shenzhen Testing Facility

GeniusQuest Global Limited
6th Floor Building 3, Yanghua Science Technology Park
No. 10 Fenggang Science Technology Road,
Fenggang Town, Dongguan City Zip: 523696
Tel: +8613823128670
www.geniusquest.com

In-house test report. Testing was performed by GeniusQuest Global as an internal laboratory for product development and internal approval purposes. The test equipment used is of the appropriate type and capacity to conduct the procedures described; however, this laboratory is not an accredited or registered third-party testing or certification body. Unless explicitly stated otherwise, the test methods described are internal methods and/or methods based on applicable standards and good engineering practice. Results apply only to the specific samples tested under the stated conditions and are not intended to represent third-party certification. This report shall not be interpreted as a certification, listing, or approval by an independent laboratory or certification body.

End of report.
