NATE

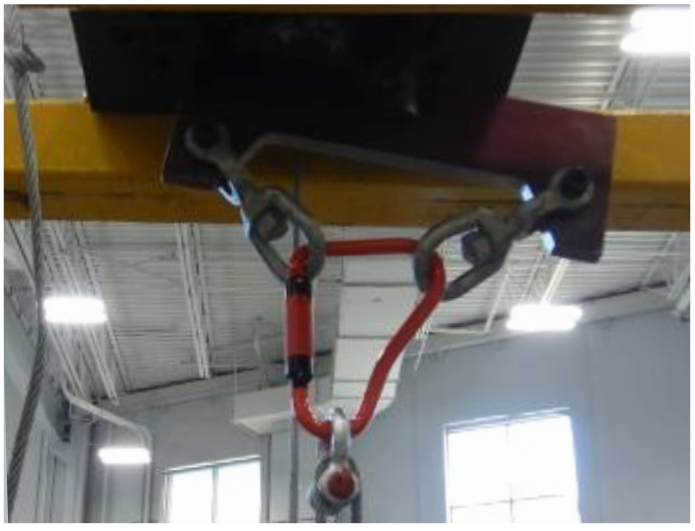
THE COMMUNICATIONS INFRASTRUCTURE CONTRACTORS ASSOCIATION

NATE SEMC

SAFETY EQUIPMENT MANUFACTURERS COMMITTEE

2024 NATE SEMC QUICK RIGGING CONNECTORS

TESTING REPORT



Acknowledgment

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Introduction

Over the years, incidents, fatalities, and confusion surrounding the use of carabiners in the telecom industry have raised significant safety concerns. To address this, the NATE OSHA Relations Committee conducted a survey among NATE members to assess current practices and product usage. The survey revealed that material-handling carabiners are widely used across the industry, with over 75% of respondents reporting usage, primarily for gross loads under 500 lbs.

To clarify the distinction between carabiners designed as Personal Protective Equipment (PPE) per ANSI/ASSP Z359, for dropped objects per ANSI/ISEA 121, and those intended for material handling; this paper will refer to connectors designated for material handling as Quick Rigging Connectors (QRCs). Section 10 of the ANSI/ASSP A10.48-2023 would classify QRCs as non-standard rigging equipment and require that prior to use in rigging applications the component manufacturer or a qualified engineer provide documentation defining all applicable inspection, maintenance, and/or use requirements and limitations.

Additionally, the ANSI/ASSP A10.48-2023 standard added requirements for non-standard rigging components to be designed for load rendering and side loading forces with a minimum 5:1 safety factor. The additional design requirement's purpose is to ensure consistency with standard rigging components covered in the ASME B30 standards to account for load upending, manipulation, and shifting. These variable loading demands on rigging components are especially pronounced in telecommunications where hoisting applications reach high elevations and are fully exposed to the elements. End users of QRC's previously marketed as load handling are encouraged to verify the components meet current ANSI/ASSP A10.48-2023 standard requirements for these loading scenarios and to confirm appropriate WLL's prior to continued use.

A three-day comprehensive testing event was conducted at the University of Dayton Research Institute (UDRI) in a climate-controlled indoor facility. The event encompassed 15 scenarios and over 100 individual tests using both new and used equipment. Real-world field applications were simulated through precise configurations, utilizing a calibrated electro-mechanical screw-driven frame to ensure accuracy and repeatability. The testing aimed to provide valuable insights to NATE members, industry stakeholders, end users, and manufacturers. The results are intended to enhance safety standards, raise awareness, and influence future testing methodologies.

The Safety Equipment Manufacturers Committee (SEMC) collaborated with industry stakeholders to identify the most commonly used QRCs. Four manufacturers were selected, offering steel QRCs in various sizes, construction types, and styles. Detailed specifications for the tested QRCs are included at the end of this document. All QRCs underwent testing and were certified by their manufacturers for material-handling applications. The SEMC established a target working load limit of 500 lbs. with a 5:1 safety factor.

Currently, there are no specific industry standards or testing protocols for QRCs. The testing described in this document was developed to align with the general principles of the ASME B30 series but was not conducted under official ASME standards and should not be interpreted as such. The tests were designed to replicate real-world scenarios commonly encountered in the telecommunications industry. The results, observations, and accompanying photos in this paper illustrate potential outcomes from using QRCs in these typical applications.

Pre-Inspection Process

Each QRC underwent a thorough pre-inspection process. This included photographing the QRC, conducting Hardness Rc tests, measuring the gate opening, and verifying proper gate operation. The purpose of the pre-inspection was to establish baseline measurements and data for comparison following each test.

Testing Protocol

To ensure the validity of real-world testing, each test was conducted using both a new QRC and one that had been previously tested. For reference, please note the QRC identification numbers, as some QRCs were used in multiple tests.

Static Testing

The purpose of the static testing is to verify a 500 lb. Working Load Limit (WLL) with a 5:1 safety factor across various QRC/load orientations.

Test A/A1

(A) Static load test in direct tension.

(A1) Same test pulled to failure.

Purpose

All static testing was conducted to verify that the QRCs meet a WLL of 500 lbs. with a 5:1 design safety factor. The testing scenario replicated a single load attachment at the end of a load line, with the weight applied axially, aligned along the spine of the QRC.

Test Setup

Static load tests were performed using a calibrated electro-mechanical screw-driven frame, operating at a displacement rate of one inch per minute. Test A involved an inline pull to 2,500 lbf., held for 5 seconds, simulating "as-intended" use conditions. Test A1 was pulled all the way to failure.

Static Testing

Test A Results

Product Info		Pre-Inspection	Post 2500 lb. Test
QRC Number	Test	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)
PS-01	A	1.1830	1.1830
PS-02	A	1.6850	1.1700
PS-03	A	1.1995	1.1955
PS-04	A	1.1895	1.1895
PS-05	A	1.1735	1.1735
PS-31	A	2.9235	2.9305
PS-32	A	2.9230	2.9200
PS-33	A	2.9550	2.9500
PS-34	A	2.9465	2.9410
PS-35	A	2.9635	2.9565
SMC-01	A	1.2865	1.2845
SMC-02	A	1.2880	1.2835
SMC-03	A	1.3010	1.3100
SMC-04	A	1.3125	1.3100
SMC-05	A	1.2860	1.2925
US-01	A	1.2150	1.2210
US-02	A	1.2055	1.2010
US-03	A	1.2310	1.2165
US-04	A	1.2050	1.2140
US-05	A	1.2005	1.2045
US-31	A	2.9415	2.9440
US-32	A	2.9500	2.9510
US-33	A	2.9490	2.9675
US-34	A	2.9575	2.9615
US-35	A	2.9475	2.9460
YO-01	A	1.1775	1.1795
YO-02	A	1.1830	1.1850
YO-03	A	1.2005	1.2110
YO-04	A	1.2035	1.2070
YO-05	A	1.1625	1.1640

Test A1 Results

Product Info		Ultimate Load	
QRC Number	Test	Failure Load (lbf.)	Slot Opening for Gate Attachment (in)
PS-01	A1	11,713	n/a
PS-15	A1	11,465	n/a
PS-16	A1	12,541	n/a
PS-17	A1	11,882	n/a
PS-31	A1	8,830	n/a
PS-45	A1	8,452	2.8410
PS-46	A1	8,316	2.9225
PS-47	A1	8,319	2.8440
SMC-01	A1	9,819	1.4590
SMC-15	A1	9,821	1.4715
SMC-16	A1	9,872	1.4545
SMC-17	A1	10,094	1.4760
US-01	A1	12,353	1.3615
US-15	A1	12,475	1.4000
US-16	A1	12,701	1.3695
US-17	A1	12,548	1.4075
US-31	A1	13,673	2.7480
US-45	A1	14,031	2.8635
US-46	A1	13,574	2.7250
US-47	A1	13,876	2.6580
YO-01	A1	10,434	1.3815
YO-15	A1	11,376	1.4310
YO-16	A1	11,775	1.4315
YO-17	A1	11,753	1.3640

Static Testing

Test B/B1

(B) Inside/out static load test applied to gate.

(B1) Same test pulled to failure.

Purpose

The static test was conducted to verify that the QRCs can support a 500 lb. WLL with a 5:1 design safety factor against the QRC gate. This scenario simulates a tri-axial loading condition, where one sling unintentionally applies load to the gate from the inside.

Test Setup

Static load tests were conducted using a calibrated electro-mechanical screw-driven frame at a displacement rate of one inch per minute. Test B involved applying 2,500 lbf. directly to the gate, while Test B1 continued until failure.

Static Testing

Test B Results

Product Info		Pre-Inspection		Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-01	B			1.1880	X	X
PS-02	B			1.1660		
PS-06	B	X	1.1720	1.1770		
PS-07	B	X	1.2170	1.2140		
PS-08	B	X	1.1870	1.1860		
PS-31	B			2.9265		
PS-32	B			2.9320		
PS-36	B	X	2.9500	2.9520		
PS-37	B	X	2.9410	2.9420		
PS-38	B	X	2.9385	2.9350		
SMC-01	B			1.2895	X	
SMC-02	B			1.2980		
SMC-06	B	X	1.3085	1.3120		
SMC-07	B	X	1.3120	1.3120		
SMC-08	B	X	1.2985	1.3100		
US-01	B			1.2175		
US-02	B			1.2025		
US-06	B	X	1.1990	1.1995		
US-07	B	X	1.2080	1.1935		
US-08	B	X	1.1820	1.2160		
US-31	B			2.9365		
US-32	B			2.9545		
US-36	B	X	2.9480	2.9545		
US-37	B	X	2.9740	2.9740		
US-38	B	X	2.9400	2.9440		
YO-01	B			1.1795		
YO-02	B			1.1870		
YO-06	B	X	1.1755	1.1805		
YO-07	B	X	1.1955	1.1980		
YO-08	B	X	1.2880	1.2840		

PS-31 The gate was non-functional following the previous test. However, it operated correctly after Test B.

Static Testing

Test B1 Results

Product Info		Post 2500 lb. Test	Ultimate Load		
QRC Number	Test	Slot Opening for Gate Attachment (in)	Failure Load (lbf.)	Failure Mode	Slot Opening for Gate Attachment (in)
PS-06	B1	1.1770	4,100	Nose	n/a
PS-07	B1	1.2140	3,781	Nose	n/a
PS-08	B1	1.1860	4,507	Nose	n/a
PS-36	B1	2.9520	5,703	Nose	n/a
PS-37	B1	2.9420	5,233	Nose	n/a
PS-38	B1	2.9350	5,546	Nose	n/a
SMC-06	B1	1.3120	4,265	Hinge pin	1.3995
SMC-07	B1	1.3120	4,235	Hinge pin	1.3870
SMC-08	B1	1.3100	4,412	Hinge pin	1.4010
US-06	B1	1.1995	4,692	Gate	n/a
US-07	B1	1.1935	4,308	Gate	n/a
US-08	B1	1.2160	4,253	Gate	1.2250
US-36	B1	2.9545	6,172	Nose/Gate	n/a
US-37	B1	2.9740	6,265	Nose/Gate	n/a
US-38	B1	2.9440	6,656	Nose/Gate	n/a
YO-04	B1	1.2070	7,527	Hinge pin	n/a
YO-06	B1	1.1805	7,175	Nose/Hinge pin	n/a
YO-07	B1	1.1980	8,017	Hinge pin	1.3140
YO-08	B1	1.2840	8,268	Hinge pin	1.3160

Static Testing

Test C/C1

(C) Side loaded gate.

(C1) Same test pulled to failure.

Purpose

The static test was conducted to validate that QRCs can support a 500 lb. WLL with a 5:1 design safety factor against the gate. This scenario simulates improper anchoring of the QRC, where the load is applied triaxially side-loaded across the gate.

Test Setup

Static load tests were performed using a calibrated electro-mechanical screw-driven frame at a displacement rate of one inch per minute. Test C involved applying a 2,500 lbf. load transversely across the QRC with the slot opening oriented outward. Test C1 continued until failure.

Static Testing

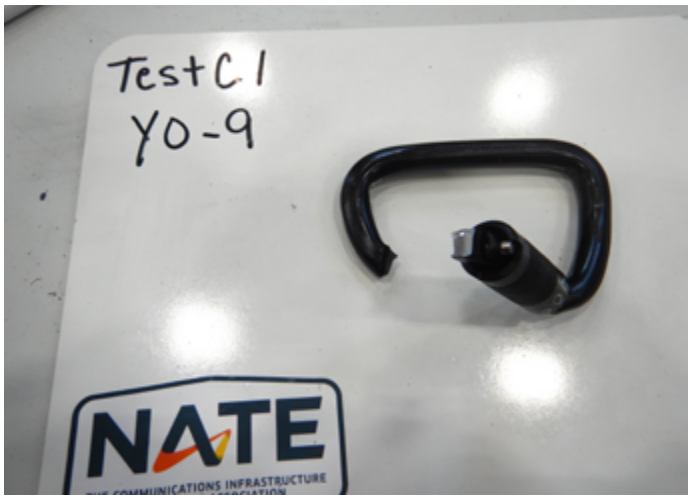
Test C Results

Product Info		Pre-Inspection			Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-01	C				1.1870		
PS-02	C				1.1700		
PS-09	C	X	1.1725		1.1740		
PS-10	C	X	1.1885		1.1840	X	
PS-11	C	X	1.1700		1.1705	X	
PS-31	C			X	2.9260	X	
PS-32	C				2.9185	X	
PS-39	C	X	2.9280		2.9220	X	X
PS-40	C	X	2.8755		2.8870	X	X
PS-41	C	X	2.9410		2.9400	X	
SMC-01	C				1.2900		
SMC-02	C				1.2980		
SMC-09	C	X	1.2865		1.2880		
SMC-10	C	X	1.2890		1.2880		
SMC-11	C	X	1.3090		1.3075		
US-01	C				1.2140	X	X
US-02	C				1.1990	X	X
US-09	C	X	1.2050		1.2175	X	X
US-10	C	X	1.2000		1.2060	X	X
US-11	C	X	1.1990		1.2095	X	X
US-31	C				2.9415		
US-32	C				2.9495	X	
US-39	C	X	2.9350		2.9365	X	
US-40	C	X	2.9385		2.9430	X	X
US-41	C	X	2.9525		2.9615		
YO-01	C				1.1775		X
YO-02	C				1.1840		
YO-09	C	X	1.2115		1.2160		
YO-10	C	X	1.2025		1.1995		
YO-11	C	X	1.1820		1.1825		

Static Testing

Test C1 Results

Product Info		Ultimate Load	
QRC Number	Test	Failure Load (lbf.)	Failure Mode
PS-09	C1	4,780	Hinge pin/Gate
PS-10	C1	4,885	Gate
PS-11	C1	5,925	Hinge pin
PS-39	C1	5,649	Hinge pin
PS-40	C1	4,835	Gate
PS-41	C1	5,275	Gate
SMC-09	C1	4,120	Nose/Gate
SMC-10	C1	4,943	Hinge pin
SMC-11	C1	4,006	Nose
US-09	C1	3,717	Nose
US-10	C1	3,926	Hinge pin
US-11	C1	3,682	Nose pin
US-39	C1	6,507	Gate
US-40	C1	6,226	Gate
US-41	C1	6,519	Gate
YO-09	C1	4,770	Hinge pin
YO-10	C1	5,861	Nose
YO-11	C1	4,390	Gate



Static Testing

Test D/D1

(D) Triaxial load.

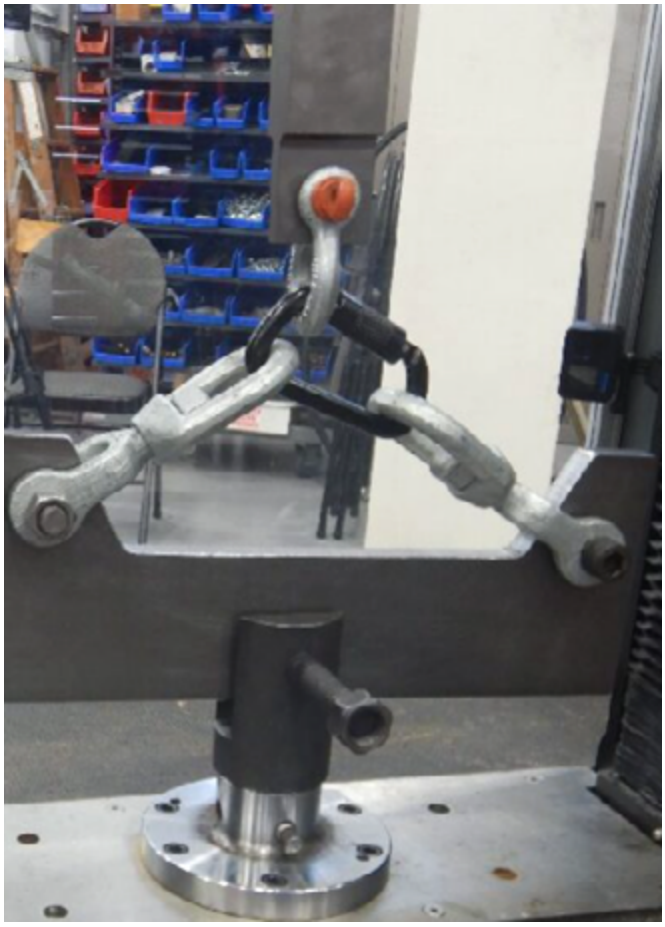
(D1) Same test pulled to failure.

Purpose

The static test was conducted to confirm that QRCs can support a 500 lb. WLL with a 5:1 design safety factor in a triaxial connection. This scenario simulates a tri-axial rigging configuration involving multiple slings attached to the QRC.

Test Setup

Static load tests were performed using a calibrated electro-mechanical screw-driven frame at a displacement rate of one inch per minute. Test D applied a triaxial load of 2,500 lbf., evenly distributed across three attachment points at 120-degree intervals. Test D1 continued until failure.



Static Testing

Test D Results

Product Info		Pre-Inspection			Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-01	D				1.1845		
PS-02	D				1.1690		
PS-12	D	X	1.1920		1.1865		
PS-13	D	X	1.1820		1.1730		
PS-14	D	X	1.1795		1.1730		
PS-31	D				2.9275		
PS-32	D			X	2.9200	X	
PS-42	D	X	2.9180		2.9355		
PS-43	D	X	2.9480		2.9485		
PS-44	D	X	2.9600		2.9590		
SMC-01	D				1.2895		
SMC-02	D				1.3010		
SMC-12	D	X	1.2870		1.2985		
SMC-13	D	X	1.2875		1.2960		
SMC-14	D	X	1.2900		1.3115		
US-01	D				1.2190	X	X
US-02	D				1.1955	X	X
US-12	D	X	1.1885		1.1885		
US-13	D	X	1.2100		1.2065		
US-14	D	X	1.1970		1.2060		
US-31	D				2.9425		
US-32	D				2.9540		
US-42	D	X	2.9500		2.9495		
US-43	D	X	2.9425		2.9430		
US-44	D	X	2.9400		2.9395		
YO-01	D				1.1800	X	
YO-02	D				1.1900		
YO-12	D	X	1.1890		1.1990		
YO-13	D	X	1.1840		1.1985		
YO-14	D	X	1.1765		1.1785		

Static Testing

Test D1 Results

Product Info		Post 2500 lb. Test	Ultimate Load		
QRC Number	Test	Slot Opening for Gate Attachment (in)	Failure Load (lbf.)	Failure Mode	Slot Opening for Gate Attachment (in)
PS-12	D1	1.1865	6,877	Nose pin sheared	1.2845
PS-13	D1	1.1730	7,298	Gate hinge pin	1.2865
PS-14	D1	1.1730	6,455	Nose pin sheared	1.2355
PS-42	D1	2.9355	7,796	Gate	2.9000
PS-43	D1	2.9485	7,580	Gate	2.8985
PS-44	D1	2.9590	7,073	Gate	2.9535
SMC-12	D1	1.2985	3,711	Nose pin	1.3385
SMC-13	D1	1.2960	3,477	Nose	1.3360
SMC-14	D1	1.3115	3,476	Nose	1.3440
US-12	D1	1.1885	6,529	Nose/Gate	1.2690
US-13	D1	1.2065	6,354	Nose pin sheared	1.2630
US-14	D1	1.2060	6,764	Nose pin sheared	1.3020
US-42	D1	2.9495	6,343	Gate	2.9515
US-43	D1	2.9430	6,339	Gate	2.9430
US-44	D1	2.9395	6,267	Gate	2.9450
YO-12	D1	1.1990	7,731	Hinge pin sheared	1.3210
YO-13	D1	1.1985	5,892	Nose/Gate	1.2465
YO-14	D1	1.1785	7,260	Nose	1.2720

Dynamic Testing

The purpose of the dynamic testing is to represent an unintentional loading due to a system, rigging, or use incident that may cause the suspended load to freefall and apply dynamic loading to the QRC.

Test G

500 lb. dynamic drop test using a load cell.

Purpose

Conduct a 500 lb. dynamic drop test on the QRC under “as intended” use conditions to validate the 5:1 WLL, as established in static test setup “A”.

Test Setup

The QRC is configured identically to Test A, with a 500 lb. test weight suspended in-line. The weight is then released to free-fall for a distance of 2 inches, generating a force of 2,500 lbf.

Dynamic Testing

Test G Results

Product Info		Pre-Inspection		Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-02	G			1.1740		
PS-18	G	X	1.1735	1.1900		
PS-19	G	X	1.1915	1.2075		
PS-20	G	X	1.2080	1.2245		
PS-32	G			2.9215	X	
SMC-02	G			n/a	X	X
US-02	G			1.2295		
US-32	G			2.9560	X	
US-49	G	X	2.9440	4.3385	X	X
YO-02	G			1.1945		
YO-20	G	X	1.2020	1.2235		

Test H

500 lb. dynamic drop test on gate.

Purpose

Conduct a 500 lb. dynamic drop test on the QRC gate to validate the 5:1 WLL, as established in static test setup “B.”

Test Setup

The QRC is configured identically to Test B, with a 500 lb. test weight attached via a sling across the gate. The weight is then dynamically loaded and released into a 2-inch free fall, generating a force of 2,500 lbf.

Dynamic Testing

Test H Results

Product Info		Pre-Inspection		Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-02	H			1.1780		
PS-21	H	X	1.1915	1.1920		
PS-22	H	X	1.1920	1.1905		
PS-23	H	X	1.1880	1.1905		
PS-32	H			2.9250	X	
PS-51	H	X	2.9310	2.9460		
PS-52	H	X	2.9490	2.9495		
PS-53	H	X	2.9385	2.9455		
SMC-21	H	X	1.2960	1.3260		
SMC-22	H	X	1.2930	1.3110		
SMC-23	H	X	1.3085	1.3100		
US-02	H			1.2375	X	X
US-21	H	X	1.1950	1.2035		
US-22	H	X	1.1975	1.2030		
US-23	H	X	1.2075	1.2095	X	X
US-32	H			2.9550	X	
US-51	H	X	2.9265	2.9295		
US-52	H	X	2.9475	2.9600		
US-53	H	X	2.9560	2.9555		
YO-02	H			1.1930		
YO-21	H	X	1.1950	1.2025		
YO-22	H	X	1.2005	1.1960		
YO-23	H	X	1.1955	1.2015		

Dynamic Testing

Test I

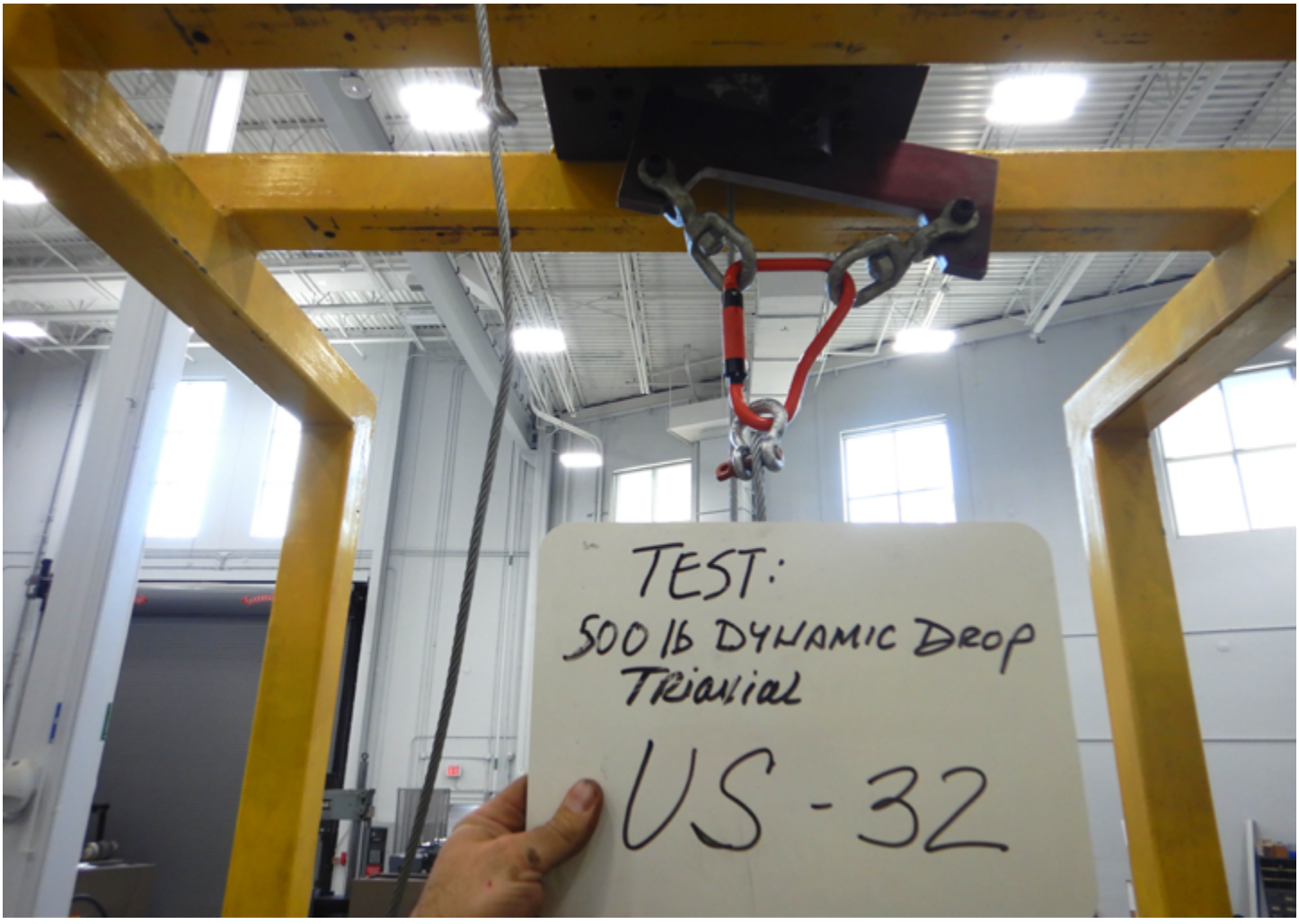
Dynamic triaxial load test.

Purpose

Conduct a 500 lb. dynamic drop test on the QRC with a triaxial attachment to validate the 5:1 WLL.

Test Setup

The QRC is configured identically to Test D, with a 500 lb. test weight attached using a tri-axial sling arrangement at 120-degree intervals. The weight is then released into a 2-inch free fall, generating a force of 2,500 lbf.



Dynamic Testing

Test I Results

Product Info		Pre-Inspection		Post 2500 lb. Test		
QRC Number	Test	New-Untested	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged
PS-02	I			1.1760		
PS-24	I	X	1.1650	1.1685		
PS-32	I			2.9265	X	X
PS-48	I	X	2.9345	3.9595	X	X
PS-54	I	X	2.9290	2.9370		
SMC-24	I	X	1.2970	1.3140		
US-02	I			1.2345	X	X
US-24	I	X	1.1990	1.1985		
US-54	I	X	2.9470	2.9590		
US-56	I	X	2.9430	2.9395		
YO-02	I			1.1600		
YO-24	I	X	1.2025	1.2030		

Static Testing

Test J

Static test of QRC vs. shackle.

Purpose

Compare performance characteristics of QRC vs. shackle rated with similar WLL.

Test Setup

Static load tests were conducted using a calibrated electro-mechanical screw-driven frame operating at a speed of one inch per minute. During the test, a static load was applied to two QRCs attached to a 1,000 lb. WLL shackle in an inline pull-to-failure setup. The purpose was to evaluate the performance of the QRC compared to the standard shackle.

Static Testing

Test J Results

Product Info		Pre-Inspection	Post 2500 lb. Test			Ultimate Load	
QRC Number	Test	Slot Opening for Gate Attachment (in)	Slot Opening for Gate Attachment (in)	Gate Does Not Function	Damaged	Failure Load (lbf.)	Failure Mode
C-01	J	0.4720				4,927	Shackle pin
C-02	J	0.4770				5,967	Shackle pin
C-03	J	0.4930				5,809	Shackle pin
C-04	J	0.4875				5,629	Shackle pin
C-05	J	0.4925				9,857	Shackle pin
CG-01	J	0.4760	0.7135			6,559	Shackle pin
CG-02	J	0.4685		X	X	7,590	Shackle pin
CG-03	J	0.4815				7,523	Shackle pin
CG-04	J	0.4605				7,776	Shackle pin
SMC-19	J	1.2900	1.3250				
SMC-20	J	1.2970	1.3070				
US-19	J	1.1785	1.1935				
US-20	J	1.2065	1.2130				
YO-19	J	1.1835	1.2030				

Mis-Use Test

Open gate top block attachment.

Purpose

This test simulates a scenario where the top block is improperly secured to the structure using an open gate QRC, such as on a leg flange, mast pipe, or open hole.

Test Setup

The nose of a QRC was inserted into the open hole of a structural leg and rigged with a block in a configuration that prevented the QRC gate from closing. A rope was pulled through the block, with one end connected to a load cell at the base of the section and the other side tensioned using a come-a-long. Four progressive loads were applied—300 lbs., 450 lbs., 600 lbs., and 800 lbs.—effectively doubling the load on both the block and the QRC.

Separation before testing.

Mis-Use Test Results

-300 lbs., 600 lbs. on the QRC

-450 lbs., 900 lbs. on the QRC

-600 lbs., 1200 lbs. on the QRC

-800 lbs., 1600 lbs. on the QRC

After testing, the QRC gate was inspected and found unable to engage with the nose of the QRC, while the QRC body also exhibited signs of stretching.

Product Info			Pre-Inspection
QRC Number	Manufacturer	Size	Slot Opening for Gate Attachment (in)
C-01	China	Small	0.4720
C-02	China	Small	0.4770
C-03	China	Small	0.4930
C-04	China	Small	0.4875
C-05	China	Small	0.4925
CG-01	Crosby	Small	0.4760
CG-02	Crosby	Small	0.4685
CG-03	Crosby	Small	0.4815
CG-04	Crosby	Small	0.4605
PS-01	PenSafe	Small	1.1830
PS-02	PenSafe	Small	1.6850
PS-03	PenSafe	Small	1.1995
PS-04	PenSafe	Small	1.1895
PS-05	PenSafe	Small	1.1735
PS-06	PenSafe	Small	1.1720
PS-07	PenSafe	Small	1.2170
PS-08	PenSafe	Small	1.1870
PS-09	PenSafe	Small	1.1725
PS-10	PenSafe	Small	1.1885
PS-11	PenSafe	Small	1.1700
PS-12	PenSafe	Small	1.1920
PS-13	PenSafe	Small	1.1820
PS-14	PenSafe	Small	1.1795
PS-15	PenSafe	Small	1.1890
PS-16	PenSafe	Small	1.1900
PS-17	PenSafe	Small	1.2025
PS-18	PenSafe	Small	1.1735
PS-19	PenSafe	Small	1.1915
PS-20	PenSafe	Small	1.2080
PS-21	PenSafe	Small	1.1915
PS-22	PenSafe	Small	1.1920
PS-23	PenSafe	Small	1.1880
PS-24	PenSafe	Small	1.1650
PS-31	PenSafe	Large	2.9235
PS-32	PenSafe	Large	2.9230
PS-33	PenSafe	Large	2.9550
PS-34	PenSafe	Large	2.9465
PS-35	PenSafe	Large	2.9635
PS-36	PenSafe	Large	2.9500
PS-37	PenSafe	Large	2.9410
PS-38	PenSafe	Large	2.9385
PS-39	PenSafe	Large	2.9280
PS-40	PenSafe	Large	2.8755

(CONTINUED ON NEXT PAGE)

Product Info			Pre-Inspection
QRC Number	Manufacturer	Size	Slot Opening for Gate Attachment (in)
PS-41	PenSafe	Large	2.9410
PS-42	PenSafe	Large	2.9180
PS-43	PenSafe	Large	2.9480
PS-44	PenSafe	Large	2.9600
PS-45	PenSafe	Large	2.9325
PS-46	PenSafe	Large	2.9630
PS-47	PenSafe	Large	2.9390
PS-48	PenSafe	Large	2.9345
PS-51	PenSafe	Large	2.9310
PS-52	PenSafe	Large	2.9490
PS-53	PenSafe	Large	2.9385
PS-54	PenSafe	Large	2.9290
SMC-01	SMC	Small	1.2865
SMC-02	SMC	Small	1.2880
SMC-03	SMC	Small	1.3010
SMC-04	SMC	Small	1.3125
SMC-05	SMC	Small	1.2860
SMC-06	SMC	Small	1.3085
SMC-07	SMC	Small	1.3120
SMC-08	SMC	Small	1.2985
SMC-09	SMC	Small	1.2865
SMC-10	SMC	Small	1.2890
SMC-12	SMC	Small	1.2870
SMC-13	SMC	Small	1.2875
SMC-14	SMC	Small	1.2900
SMC-15	SMC	Small	1.2895
SMC-16	SMC	Small	1.2810
SMC-17	SMC	Small	1.2855
SMC-19	SMC	Small	1.2900
SMC-11	SMC	Small	1.3090
SMC-20	SMC	Small	1.2970
SMC-21	SMC	Small	1.2960
SMC-22	SMC	Small	1.2930
SMC-23	SMC	Small	1.3085
SMC-24	SMC	Small	1.2970
SMC-27	SMC	Small	1.2980
US-01	USang	Small	1.2150
US-02	USang	Small	1.2055
US-03	USang	Small	1.2310
US-04	USang	Small	1.2050
US-05	USang	Small	1.2005
US-06	USang	Small	1.1990
US-07	USang	Small	1.2080

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Product Info			Pre-Inspection
QRC Number	Manufacturer	Size	Slot Opening for Gate Attachment (in)
US-08	USang	Small	1.1820
US-09	USang	Small	1.2050
US-10	USang	Small	1.2000
US-11	USang	Small	1.1990
US-12	USang	Small	1.1885
US-13	USang	Small	1.2100
US-14	USang	Small	1.1970
US-15	USang	Small	1.2010
US-16	USang	Small	1.2190
US-17	USang	Small	1.2005
US-19	USang	Small	1.1785
US-20	USang	Small	1.2065
US-21	USang	Small	1.1950
US-22	USang	Small	1.1975
US-23	USang	Small	1.2075
US-24	USang	Small	1.1990
US-31	USang	Large	2.9415
US-32	USang	Large	2.9500
US-33	USang	Large	2.9490
US-34	USang	Large	2.9575
US-35	USang	Large	2.9475
US-36	USang	Large	2.9480
US-37	USang	Large	2.9740
US-38	USang	Large	2.9400
US-39	USang	Large	2.9350
US-40	USang	Large	2.9385
US-41	USang	Large	2.9525
US-42	USang	Large	2.9500
US-43	USang	Large	2.9425
US-44	USang	Large	2.9400
US-45	USang	Large	2.9460
US-46	USang	Large	2.9535
US-47	USang	Large	2.9415
US-49	USang	Large	2.9440
US-51	USang	Large	2.9265
US-52	USang	Large	2.9475
US-53	USang	Large	2.9560
US-54	USang	Large	2.9470
US-56	USang	Large	2.9430
US-60	USang	Large	2.9610
YO-01	Yoke	Small	1.1775
YO-02	Yoke	Small	1.1830
YO-03	Yoke	Small	1.2005

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Product Info			Pre-Inspection
QRC Number	Manufacturer	Size	Slot Opening for Gate Attachment (in)
YO-04	Yoke	Small	1.2035
YO-05	Yoke	Small	1.1625
YO-06	Yoke	Small	1.1755
YO-07	Yoke	Small	1.1955
YO-08	Yoke	Small	1.2880
YO-09	Yoke	Small	1.2115
YO-10	Yoke	Small	1.2025
YO-11	Yoke	Small	1.1820
YO-12	Yoke	Small	1.1890
YO-13	Yoke	Small	1.1840
YO-14	Yoke	Small	1.1765
YO-15	Yoke	Small	1.1935
YO-16	Yoke	Small	1.1895
YO-17	Yoke	Small	1.2035
YO-19	Yoke	Small	1.1835
YO-20	Yoke	Small	1.2020
YO-21	Yoke	Small	1.1950
YO-22	Yoke	Small	1.2005
YO-23	Yoke	Small	1.1955
YO-24	Yoke	Small	1.2025
YO-28	Yoke	Small	1.1995

This document is provided as informational guidance on the use of equipment in real-world applications. Field operations should be carried out by competent individuals in accordance with manufacturer guidelines and employer requirements. End users are responsible for confirming that the intended use is permitted under applicable contract provisions and complies with the ANSI/ASSP A10.48-2023 standard, as well as federal, state, and local regulations.

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Key Take-Aways from Testing

1. Prior to this collaboration, several components intended for lifting and material handling were not considering load rendering and side loading forces in product documentation and working load limit ratings. Since the testing, several of the primary manufacturers are actively addressing this issue to ensure their products fully comply with requirements of the ANSI/ASSP A10.48-2023 standard for use as a non-standard rigging component.
2. QRCs are non-standard rigging components that must be clearly identifiable for material handling purposes and the manufacturer must provide detailed documentation outlining the intended usage, inspection criteria, maintenance, and WLL.
3. Manufacturers shall factor in the gate's minimum breaking strength when establishing the QRC's WLL.
4. Static and dynamic testing proved that all the QRC's tested supported a 500 lb. lifted load with a 5:1 safety factor in the following configurations:
   a. Direct tension (axial loading)
   b. Against the gate (inside-out)
   c. Transverse across the gate
   d. Triaxial
5. The QRCs that were tested to failure in triaxial loading configurations lost up to 50% of their rated minimum breaking strengths.
6. When applying multiple connections to a QRC the end user shall verify the QRC's capacity and allowable rigging configurations per the manufacturer.
7. When multiple connections are required at a central point in the rigging system, consideration should be given to using alternative rigging components, such as rigging plates, master links, spreader bars, shackles, or clevises in place of QRC.
8. End user must ensure the QRC is properly oriented to prevent displacement when rendering the rigging system.
9. End user must never apply a load to a QRC with an open gate.

For additional information and previous testing reports, please visit bit.ly/NATE_SEMC_Docs.