CM® SHACKLES

DESIGNED AND BUILT FOR SUPERIOR PERFORMANCE

COLUMBUS McKINNON CORPORATION

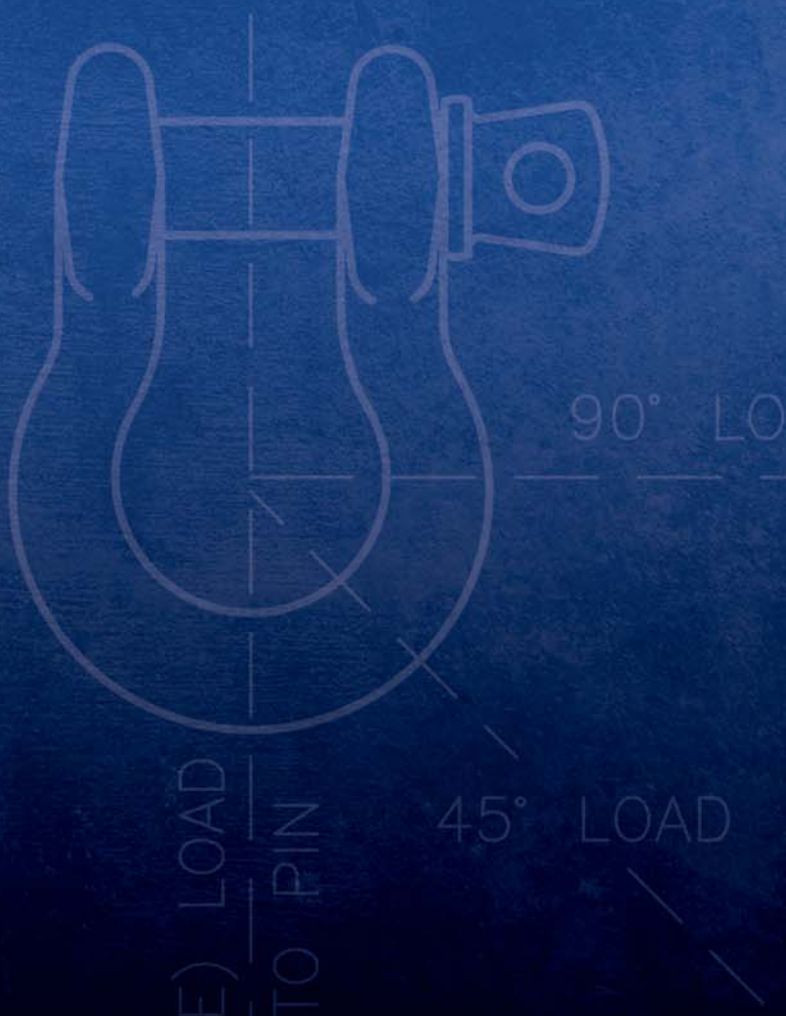
THE HARDEST WORKING SHACKLES IN THE INDUSTRY

Many times over the years, we have been asked if CM rigging products are as good as, the same as, or equal to the competition.

Through all of this, we felt that it was time to put our responses down on paper so they can be made available to channel partners, end-users, our sales force and anyone who may field those questions.

At Columbus McKinnon, we are confident that our products are of the highest quality on the market today and strive to continue improving them.

So, our response to those questions would be that we are not only as good as the competition, we are better.



CERTIFICATION

Columbus McKinnon has been an ISO 9001:2008 certified company since April 27, 1994.

SHACKLE SPECIFICATIONS

All CM shackles are made from special bar quality material and comply with ASTM A322, ASTM A576 or ASTM A921.

CM shackles meet or exceed:

- U.S. Government Specification RR-C-271
- ASME B30.26
- ANSI B18
- EN 13889
- ISO 2415

DNV type approved.

Galvanized shackles meet ASTM A153 and B675. Pins and bolts meet SAE J429 and ASTM A354.

All shackles are marked with an alpha-numeric trace code. See “Identification” below for details.

For an additional cost, we can provide:

- material certification
- magnetic particle inspection
- proof, ultimate, charpy, deformation and fatigue testing

CM testing equipment is calibrated to National Institute for Standards and Testing (NIST). Certifications are available online for all shackles. Shackle design factors for alloy is 5:1, for carbon 5:1 and for Super Strong Shackles 6:1. Columbus McKinnon is ISO 9001:2008 certified.

IDENTIFICATION

CM rigging products can be identified by their unique markings. Every piece is forged with the CM logo, its application size in imperial and/or metric units, USA, and when required its specified strength requirements or working load limit (WLL).

Most CM products carry an alpha-numeric traceability code. Implemented in July 1980, this trace code system enables us to identify and track products once they ship from our plant, as well as determining:

- Date the product was forged
- Type of steel
- Chemistry of the steel
- Heat treating parameters
- In-process hardness testing results
- Strength data testing

Other markings may include “Forged”, “Alloy”, “High Test” and “Transport.”

DESIGN & DEVELOPMENT

CM products are designed to meet internal, customer, contractual, and regulatory requirements. The CM Engineering Department has CAD stations to facilitate design and development activities. New product design and tooling is subject to computerized Finite Element Analysis (FEA). All drawings are filed electronically.

Columbus McKinnon has the capability to develop original product design based on the customer’s application. Specials are designed to meet customer requirements and require customer approval before the design is finalized. Tooling that is required is purchased by the customer and remains their proprietary property throughout the life of the product.

In addition to product design, Columbus McKinnon also performs tooling and machine design to manufacture and process their products.

ENGINEERING ANALYSIS

Columbus McKinnon has the capability to apply fracture mechanics, to predict product life expectancy and multi-axial fatigue analysis to solve engineering problems related to safety-critical applications.

MATERIAL PROPERTIES

All forged products are made exclusively from domestically produced Special Bar Quality (SBQ) steel having fine grain, reduced sulfur and phosphorus. Silicon inclusions and oxide inclusions are minimized to enhance forging performance characteristics.

Steel used in our products may include, but is not restricted to, the following:

- Carbon Steel 1037, 1020, 1040, 1080, 1141
- Microalloy Steel
- Alloy 4130, 4140, 8630, 8640
- Stainless Steel 304, 316, 347, 22-13-5
- Forging Bronze CD642
  Aluminum Silicon Bronze

PROCESSING

The process to manufacture CM rigging products utilizes state-of-the-art forging equipment. The entire forging process is closely monitored to ensure consistent quality.

The heat treatment process is computer controlled and monitored to ensure that maximum performance parameters will be met. Each lot of product is checked to verify that the desired hardness range has been obtained.

TESTING REQUIREMENTS

CM products having strength requirements are sample tested to ensure hardness, ductility and requisite loading parameters.

All testing and measuring equipment used to approve in-process and final testing release is calibrated on a periodic basis. The calibration is traceable to NIST.

APPLICATION & WARNINGS

Many CM products have application and warning information attached or packaged with the product. Catalogs and brochures provide warning, application, usage, ratings, product codes, and identification relative to products.

CM also provides the “CM Lifting, Pulling, and Binding Product Manual” for information on safe and proper use of products. All literature is available for free download on our website at www.cmworks.com.

CM OFFERS A FULL LINE OF SHACKLES

Columbus McKinnon carries a full line of shackles from 3/16" to 2". This includes both carbon and alloy, anchor and chain shackles with round pins, screw pins, or bolts with nut and cotter. Finish can be powder-coated, galvanized or self-colored. (See CM Chain and Attachments catalog CMRP for specific sizes, configurations, materials and finish.)

Pins and bolts for carbon and alloy shackles are made from alloy steel. They are heated, quenched and tempered to ensure superior performance.

Alloy and carbon bolt, nut and cotter anchor shackles in sizes of 2-1/2", 3" or 3-1/2" are also available.

CM shackles are manufactured using a variety of forging processes best suited for each specific design.

CARBON SHACKLES

CM industrial/government rated carbon shackles are designed with a 5 to 1 design factor. These shackles are only available with a hot-dipped galvanized finish.

Shackle diameters of 3/16" to 2" are manufactured from Microalloy steel with optimal hardness for strength and ductility.

All CM carbon shackles are designed to meet the dimensional, performance and marking requirements of Federal Specification RR-C-271 (Regular Strength).

ALLOY SHACKLES

CM alloy shackles are designed with a 5 to 1 design factor and have a strength rating that is about 50% higher than a comparable sized carbon shackle. Shackle finishes available are powder-coated CM Orange, galvanized or self-colored.

Shackle diameters of 3/8" to 2" are manufactured to meet the dimensional requirements of Federal Specification RR-C-271D, “Chain and Attachments, Welded and Weldless”, Type B (High Strength). 1-1/2" to 2" screw pin and round pin shackles only meet the specifications dimensionally.

SUPER STRONG SHACKLES

CM Super Strong shackles are carbon-type shackles that have strength ratings that are 17% to 50% stronger than comparable sized carbon shackles. As a result, they are designed with a 6:1 design factor. They are available in sizes from 3/16" to 1-3/4". Shackle finishes available are powder-coated, hot-dipped galvanized or self-colored.

Shackle diameters of 3/16" to 1-3/4" are manufactured from Microalloy steel with optimal hardness for strength and ductility.

All CM Super Strong shackles meet or exceed the dimensional and performance requirements of RR-C-271. Because they *exceed* requirements and are marked with higher strengths, they cannot be represented as *meeting* RR-C-271.

CM INDUSTRIAL/GOVERNMENT SHACKLES VERSUS CM SUPER STRONG SHACKLES

Questions often arise about the difference between our Industrial/Government shackles and the Super Strong shackles.

An Industrial/Government shackle is a Super Strong shackle de-rated to meet – not exceed – the Federal Specification RR-C-271.

That means it has the same dimensions and perform characteristics as a Super Strong shackle but is stamped with specifications to meet government requirements.

Example:

1" Super Strong shackle will be stamped 10 Ton WLL

1" Industrial/Government shackle will be stamped 8 1/2 Ton WLL

CHARPY IMPACT TEST

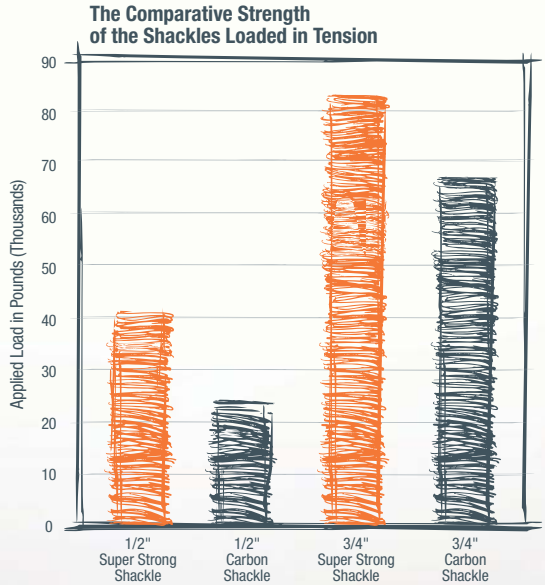
The Charpy V-Notch Test was developed during World War 2 to test the penetration resistance of steel armor. It has since evolved into a method to test for toughness of steel in critical structures such as buildings or bridges.

In this test, a bar is mounted horizontally with the notch facing away from an impact weight suspended on a pendulum. When the weight is released, it swings down and breaks through the bar. An indicator measures how far the pendulum continues to swing after breaking the bar. The momentum of the pendulum then is the measure of the resistance of the material to breaking or penetration.

CM Super Strong shackles, with the lower hardness values, will consistently pull more than a competitor's carbon shackles of the same diameter. CM Super Strong shackles were designed to improve overall load strength and ductility without an increase in shackle diameter.

CM alloy shackles will meet the Charpy Impact Test requirements. Results of this testing show that CM alloy shackles greatly exceed the minimum strength requirements.

RESULTS OF COMPARISON TESTING OF CM SUPER STRONG SHACKLES VERSUS STANDARD CARBON SHACKLES



"Clearly the CM Big Orange®* shackles exhibited superior strength and more ductility than the carbon steel shackles of the same nominal section size. While all of the shackles performed above their ratings, the CM Big Orange shackle performance was superior.

The CM Big Orange®* shock test results indicated severe deformation occurred but no fracture was present. The carbon steel parts fractured in two tests and were severely cracked in a third test. These results indicate that the CM Big Orange shackle assembly is stronger and more ductile than the carbon steel shackle of the same size. For these reasons, the CM Big Orange shackle provides more extensive deformation prior to fracture. In conclusion, this test demonstrates the superiority of the CM Big Orange shackles when compared to the carbon steel shackles under the shock loaded conditions."

— Verified by John Bloodsworth, P.E.
Q.C. Metallurgical Laboratory, Inc.

* CM Big Orange® shackles are now referred to as CM Super Strong shackles.

TRAINING

COLUMBUS McKINNON CORPORATION

KNOW HOW...KNOW WHY

Columbus McKinnon is a global leader in providing expertise and training in the proper use and inspection of rigging and overhead lifting equipment. With a range of comprehensive programs and seminars conducted at venues throughout North America, as well as on site at private companies and industries, Columbus McKinnon courses include:

- Hoist Maintenance
- Load Securement
- Crane & Hoist Inspection
- Mobile Crane Operator
- Rigging
- Safe Hoisting
- Crane Operator Training
- Rigging Gear Inspection

In addition, classes are available at the new state-of-the-art **Hoist & Rigging Training Center of Excellence** in the Center for Occupational Health and Automobile Manufacturing (COHAM) lab located at The Ohio State University. The COHAM lab is a hands-on learning center which allows attendees to understand how to properly use and inspect overhead lifting equipment. This leading edge training program is designed to increase workplace productivity and safety in a ergonomically friendly training environment.

In addition to the strong knowledge base exemplified by comprehensive training programs, Columbus McKinnon is one of the only manufacturers supplying complete lifting systems to satisfy unique material handling requirements of users in a variety of environments. From jib cranes and hoists to chain slings, clamps, and related attachments; systems include products that are matched specifically to the lifting needs of the application. Products may also be modified in order to ensure that the proper system is in place for the job.

Whether your needs call for a single Super Strong shackle or a completely engineered system to outfit your production facility, Columbus McKinnon provides the products and expertise to keep your workforce productive and safe.

COLUMBUS McKINNON CORPORATION

FAMILY OF BRANDS

CM · ABELL-HOWE · BUDGIT Hoists · CHESTER HOIST · COFFING HOISTS · Yale HOISTS · SHAW-BOX

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