



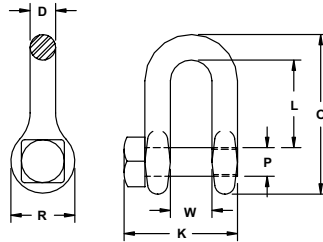
TRAWLING SHACKLE

WORKING LOAD LIMIT: 4,000 TO 20,000 LBS.

Load-rated trawling chain shackles are used for various applications, such as on trawl doors, the rigging of nets, and areas where critical loads are applied.

BENEFITS & FEATURES

- Design factor 6:1
- Micro-alloy steel bodies
- Heat-treated alloy pins
- Square head pins for convenience in wrench tightening and loosening
- Durable orange powder coated finish



Product Code	Working Load Limit (lbs.)	Dimensions (in.)							Weight (lbs.)
		D	P	W	L	O	R	K	
M449G*	4,000	0.44	0.50	0.72	1.50	2.75	1.13	1.91	0.43
M450	6,000	0.50	0.63	0.84	1.69	3.13	1.25	2.06	0.60
M451	9,000	0.63	0.75	1.09	2.00	3.78	1.58	2.63	1.30
M452	13,000	0.75	0.88	1.25	2.38	4.53	1.89	3.13	2.20
M453	17,000	0.88	1.00	1.44	2.88	5.31	2.14	3.63	3.00
M454	20,000	1.00	1.13	1.72	3.19	5.81	2.41	4.44	4.70

* Product has a hex-head bolt and galvanized finish

SHACKLES

LONG-REACH SHACKLE

WORKING LOAD LIMIT: 7,000 TO 50,000 LBS.

As one of the only manufacturers of long-reach shackles, we designed these shackles for use in construction applications where a longer reach is needed to attach to pick points.

BENEFITS & FEATURES

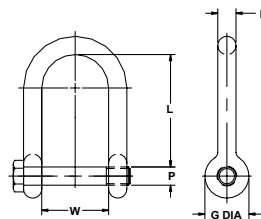
- Design factor of 5:1
- Meets the requirements of ASME B30.26, but must not be side loaded
- Alloy steel
- WLL forged on body
- Offered in self-colored or durable orange powder coated finish
- Do not point load. The load should be evenly distributed over the entire pin to achieve full working load limit.
- Do not side load long-reach shackles
- 80% of bolt/pin must be covered to obtain full working load limit



Screw Pin



Bolt, Nut & Cotter



STYLES: Screw Pin, Bolt/Nut/Cotter
FINISHES: Self Colored, Orange Powder Coated



Size (in.)	Working Load Limit (lbs.)	Screw Pin			Bolt, Nut & Cotter			Dimensions (in.)				
		Product Code		Weight (lbs.)	Product Code		Weight (lbs.)	P	D	L	W	G
		Self Colored	Painted		Self Colored	Painted						
5/8	7,000	M7151	M7151P	1.80	M9151	M9151P	1.95	0.75	0.63	4.00	2.25	1.57
3/4	10,000	M7152	M7152P	2.72	M9152	M9152P	3.21	0.88	0.75	5.00	2.75	1.81
1	19,000	M7154	M7154P	5.86	M9154	M9154P	6.31	1.00	1.00	5.50	3.25	2.38
1-1/4	28,000	M7156	M7156P	11.90	M9156	M9156P	12.90	1.38	1.25	6.19	3.88	3.06
1-1/2	34,000	M7157	M7157P	19.60	M9157	M9157P	20.70	1.50	1.50	7.00	4.50	3.50
1-3/4	50,000	M7177	M7177P	30.70	M9177	M9177P	33.30	2.00	1.75	8.00	5.25	4.00

Check with your sales rep for a list of models eligible for our In-Stock Guarantee.



Columbus McKinnon is proud to offer some of the strongest and most reliable shackles on the market. Manufactured in the U.S.A. through our state-of-the-art forging process, CM shackles are available in a variety of different styles and materials for virtually any rigging application.

DESIGN & DEVELOPMENT

SPECIFICATIONS

When manufacturing our shackles, Columbus McKinnon utilizes state-of-the-art forging equipment. The forging process is closely monitored to ensure consistent quality and the heat treatment process is computer-controlled and monitored to ensure that maximum performance parameters are met.

Each lot of product is checked to verify that the desired hardness range has been obtained.

All CM shackles are made from special bar quality material and comply with ASTM A322, ASTM A576 or ASTM A921. Galvanized shackles meet ASTM A153 or ASTM B695. Pins and bolts meet SAE J429 and ASTM A354.

CM shackles meet or exceed the performance requirements of the specs listed below:

- ASME B30.26 ■ ANSI B18
- EN 13889 ■ ISO 2415

CM also offers shackles that meet U.S. Government Specification RR-C-271.

Every CM shackle is marked with an alpha-numeric trace code. For full information on CM shackle identification markings, see the Shackle Identification box to the right.

ENGINEERING & TESTING REQUIREMENTS

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

CM products having strength requirements are sample tested to ensure hardness, ductility and requisite loading parameters. All testing and measuring equipment is calibrated on a periodic basis. CM testing equipment is calibrated to National Institute for Standards and Testing (NIST) requirements. Columbus McKinnon is also ISO 9001:2008 certified.

Certifications for all shackles are available online. RR-C-271 certification is available if requested at time of order.

Columbus McKinnon can also provide the following information if requested at time of order:

- Material certification
- Magnetic particle inspection
- Proof, ultimate, charpy, deformation and fatigue testing

FORGING VERSUS CASTING

Forging and casting are two very different manufacturing methods. When something is cast the material is heated above its melting temperature and poured into a mold where it solidifies. When something is forged it is physically forced into shape while remaining in a solid state – although it is frequently heated.

Forged shackles are generally better than cast. Forgings normally have less porosity, finer grain structure, higher tensile strength, better fatigue life and strength, and greater ductility than cast shackles. Why is this the case? When you melt metal to cast it, the grain size is free to expand. When it cools back to a solid, the grain structure is coarser and more random, decreasing its strength. Interior voids are also possible. The diagrams on the right illustrate the difference in grain flow between a forging and a casting.

For these reasons, CM utilizes a best-in-class forging process to ensure our shackles are strong, durable and reliable. All of our forged shackles are made right here in America at our Chattanooga, Tennessee facility.

CUSTOMIZATION

CM shackles are always designed to meet internal, customer, contractual and regulatory requirements. Columbus McKinnon has the capability to develop original product designs based on unique customer applications. 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) and all drawings are filed electronically.

Custom products, or specials, designed to meet customer requirements require customer approval before the design is finalized.

In addition to product design, Columbus McKinnon also performs tooling and machine design to manufacture and process these products. Tooling that is required is purchased by the customer and remains their proprietary property throughout the life of the product.

▶ SHACKLE IDENTIFICATION

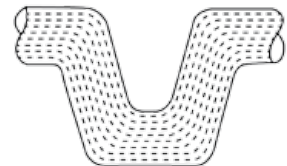
CM shackles and other rigging products can be identified by their unique markings.

We have taken extra efforts to enhance our shackle identification markings and our products now feature some of the largest and most user-friendly forged identification markings on the market. This innovation improves operator safety, reduces replacement costs and allows for easier identification of CM products in the field.

Every shackle is forged with the CM logo, its body or diameter size in imperial and/or metric units, trace code, USA, "Forged" and its specified strength requirements/working load limit (WLL). Most CM products also 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 determine:

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

Design and markings meet or exceed ASME B30.26



FORGING
Uniform grain flow gives material higher strength



CASTING
Random grain flow with larger grain structure makes material weaker than forged products

STANDARD & SPECIALTY SHACKLES

CM offers a full line of forged chain and anchor shackles for standard and specialty applications that are made right here in America. Chain shackles are best used for straight-line pulls, while anchor shackles have a more generous loop that allows them to be side loaded or used for multiple connections.

STANDARD:

SCREW PIN SHACKLES

Screw Pin Shackles allow for quick and easy removal of the screw pin, which makes this style ideal for applications where the shackle is removed frequently. While the threaded pin can resist axial forces, it should not be cyclically loaded and is unreliable and vulnerable to backing out in applications where the pin is subjected to a torque or twisting action. In some applications, it is recommended to mouse the screw pin to prevent the pin from unscrewing. **Recommended for overhead lifting**, screw pin shackles are available in Super Strong, carbon and alloy steel with capacities up to 43 tons.

Shackles meet ASME B30.26. They also meet the performance and dimensional requirements of RR-C-271.



BOLT, NUT & COTTER SHACKLES

Of all shackle types, Bolt, Nut and Cotter Shackles provide the most secure pin arrangement, resisting axial and torsional loading. This type of shackle should be used in semi-permanent applications where the pin is removed infrequently.

Recommended for overhead lifting, bolt, nut and cotter shackles are available in Super Strong, carbon and alloy steel with capacities up to 120 tons.

Shackles meet ASME B30.26. They also meet the performance and dimensional requirements of RR-C-271.



ROUND PIN SHACKLES

Round Pin Shackles allow for easy removal by simply removing the cotter that holds the pin in place. These shackles perform well where the pin is subjected to a torque or twisting action, but are not best for use where the pin is subject to an axial load.

Round pin shackles are **not recommended for overhead lifting or side loaded**. They feature a forged, heat-treated steel body with forged, heat-treated alloy steel pin and are available in Super Strong, carbon and alloy steel with capacities up to 43 tons.

Shackles meet the performance and dimensional requirements of RR-C-271.



SPECIALTY:

WEB SLING SHACKLES

Designed primarily for use with a synthetic web and round slings up to 6" in width. Available in capacities up to 12 tons. Body is made of carbon steel or heat-treated alloy steel.

NOTE: Shackles cannot be point loaded. The load should be evenly distributed over the entire pin to achieve full working load limit.

LONG REACH SHACKLES

Made of alloy steel, CM is one of the only manufacturers of long reach shackles. These shackles are ideal for use in construction applications where a longer reach is needed to attach to pick points, and can also be used as a bail for lifting thicker products.

NOTE: Shackles cannot be side loaded. The load should be evenly distributed over the entire pin to achieve full working load limit.





SHACKLE MATERIAL & FINISHES

MATERIALS

CM forged shackles are made exclusively from domestically produced (U.S.A.) Special Bar Quality (SBQ) steel having fine grain, with 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

Using this Special Bar Quality steel, CM manufactures shackles in three distinct materials: carbon, super strong and alloy. Each material has different properties and specifications. See our complete material comparison below.

3 TYPES OF SHACKLE MATERIAL

MATERIAL	STYLE	WLL (TONS)	SIZES (IN.)	STYLES	DESIGN FACTOR	FINISHES
CARBON	Anchor	1/3 to 85 tons	3/16" to 3"	Bolt, Nut & Cotter; Screw Pin; Round Pin	6:1*	Orange Powder Coated, Galvanized
	Chain	1/2 to 35 tons	1/4" to 2"			
CARBON SPECIFICATIONS: Meet dimensional, performance and marking requirements of Federal Specification RR-C-271 (Regular Strength).						
SUPER STRONG 17 to 50% stronger than comparable-sized Carbon	Anchor	1/2 to 55 tons	3/16" to 2-1/2"	Bolt, Nut & Cotter; Screw Pin; Round Pin	6:1**	Orange Powder Coated, Self Colored, Galvanized
	Chain	3/4 to 35 tons	1/4" to 2"			
SUPER STRONG SPECIFICATIONS: Meet dimensional and exceed performance requirements of Federal Specification RR-C-271 (Regular Strength). Because they exceed requirements and are marked with higher strengths, they cannot be marked as meeting RR-C-271.						
ALLOY (U.S.) ~50% stronger than comparable-sized Carbon and ~25% stronger than Super Strong	Anchor	2 to 120 tons	3/8" to 3"	Bolt, Nut & Cotter; Screw Pin; Round Pin	5:1	Orange Powder Coated, Self Colored, Galvanized
ALLOY SPECIFICATIONS: Meet dimensional, performance and marking requirements of Federal Specification RR-C-271 (High Strength).						

* 2-1/2" and 3" carbon shackles have a 5:1 design factor.

** Round pin and all 2-1/2" Super Strong shackles have a 5:1 design factor.

FINISHES

CM shackles are available in three finishes: galvanized, self-colored and the recognizable CM orange powder coating.

GALVANIZED

Provides the best corrosive protection of all finishes which prevents it from wearing over time. Meets ASTM standards.

SELF-COLORED

Natural steel color easily blends with other steel finishes. Provides no protection from corrosion, but enables full exposure of identification markings.

CM ORANGE POWDER COATED

Easily recognizable as a CM product. Provides protection from corrosion and harsh environments and allows for visual identification of the manufacturer.

SHACKLE USE, CARE & INSPECTION

Improper use or care of shackles can result in bodily injury or property damage. Always observe the following guidelines when using shackles.

- Do not exceed the working load limit.
- Do not shock load.
- If the shackle is side loaded, the WLL must be reduced in accordance with the manufacturer's recommendation or a qualified person. Shackles are designed and rated for in-line applied tension. You can attach multiple slings in the body of a shackle without reducing the capacity provided that the shackle is symmetrically loaded and the included angle does not exceed 120 degrees. (See Side Loading and Symmetrical Loading sections).
- Do not replace pin or bolt with other than original equipment.
- Inspect before use for wear, deformation and pin engagement as outlined in ASME B30.26. (See full inspection guidelines below).

Care should be exercised so that the shackle is not abused during use. When using shackles, it is important to:

- If necessary, use spacers on the shackle pin to assure that the shackle is not loaded at an angle. Load line of action should be through the center line of the shackle body and the middle of the shackle pin.
- The shackle should be protected with zinc plating or a galvanized finish if used in harsh environments.
- The shackle should not be subjected to high or low temperatures that could affect thermal treatment and the strength of the shackle. (Note: Per ASME B30.26 shackles are rated for temperatures between -40°F to 400°F.

SCREW PIN TIGHTENING

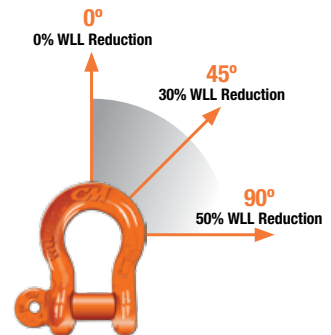
When tightening screw pins, it is important that shackle screw pin threads and the tapped threads in the shackle head are clean and free of burrs and damage. These conditions can cause an under-tightening of the shackle screw pin. The shackle screw pin should be tightly fitted into the shackle's leg opening until the threads engage and the shoulder of the screw pin makes contact with shackle body.

SIDE LOADING

When side loading a shackle with a single sling, the rated WLL will be reduced in accordance with the manufacturer's recommendation or a qualified person. ASME B30.26 also recommends reducing the capacity of a shackle when it is side loaded. (See figure below.) Note that only anchor shackles 3/16" to 3" may be side loaded. Chain or long-reach shackles should not be side loaded.

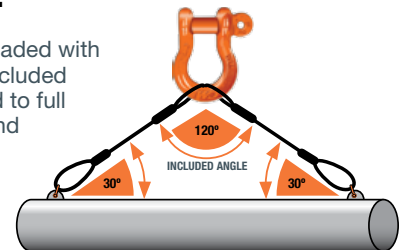
ANCHOR SHACKLES SIZES 3/16" TO 3"

Angles in Degrees	Working Load Limit Reduction
0° to 10°	0%
11° to 20°	15%
21° to 30°	25%
31° to 45°	30%
46° to 55°	40%
56° to 70°	45%
71° to 90°	50%



SYMMETRICAL LOADING

Shackles symmetrically loaded with two legs at a maximum included angle of 120° can be used to full working load limit. Side and symmetrical loading data applies to screw pin and bolt nut cotter anchor shackles as shown to the right.



SHACKLE INSPECTION

Shackles should be visually inspected before each use in line with ASME B30.26 regulations. Shackles should be discarded if any of the following conditions are apparent:

- ▲ Any parts are worn more than 10% of the original dimensions
- ▲ Load bearing components are bent, twisted, distorted, stretched, elongated, cracked or broken
- ▲ Excessive pitting, corrosion, nicks or gouges
- ▲ Indication of heat damage
- ▲ Missing or illegible manufacturer's name or trademark, working load limit or size
- ▲ Load pins have bent or visibly damaged threads
- ▲ Cotter pins or hairpin retainers are damaged



CHARPY IMPACT TEST

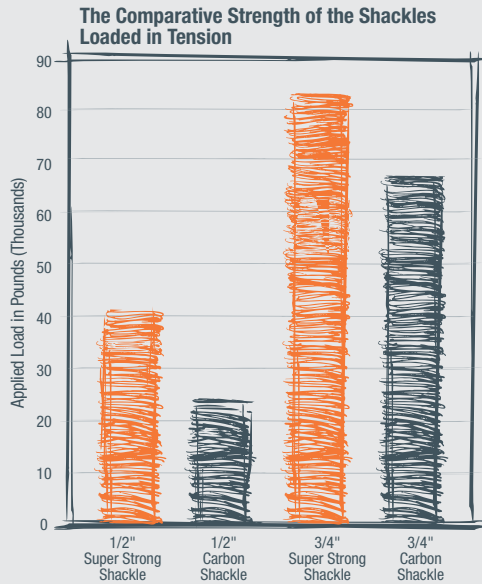
The Charpy V-Notch Test was developed during World War 2 to test the penetration resistance of steel armor. It has since evolved into a method to test for toughness of steel in critical structures such as buildings or bridges.

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 is then 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 Super Strong shackles greatly exceed the minimum strength requirements.

RESULTS OF COMPARISON TESTING 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.

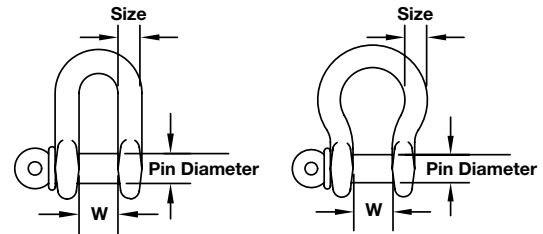
* CM Big Orange[®] shackles are now referred to as CM Super Strong shackles.

SHACKLES

SHACKLE SPECIFICATIONS

DIMENSIONS & WORKING LOAD LIMITS

CM shackles are available in different dimensions with varying working load limits depending on the material they are made of. See the charts below for sizes and working load limits of our alloy, carbon and super strong shackles.



CARBON

Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/16	1/3	667	0.25	0.38
1/4	1/2	1,000	0.31	0.47
5/16	3/4	1,500	0.38	0.53
3/8	1	2,000	0.44	0.66
7/16	1-1/2	3,000	0.50	0.72
1/2	2	4,000	0.63	0.84
5/8	3-1/4	6,500	0.75	1.06
3/4	4-3/4	9,500	0.88	1.28
7/8	6-1/2	13,000	1.00	1.44
1	8-1/2	17,000	1.13	1.72
1-1/8	9-1/2	19,000	1.25	1.84
1-1/4	12	24,000	1.38	2.03
1-3/8	13-1/2	27,000	1.50	2.25
1-1/2	17	34,000	1.63	2.41
1-5/8	20	40,000	1.75	2.66
1-3/4	25	50,000	2.00	2.94
2	35	70,000	2.25	3.28
2-1/2	55	110,000	2.75	4.13
3	85	170,000	3.25	5.00

SUPER STRONG

Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/16	1/2	1,000	0.25	0.38
1/4	3/4	1,500	0.31	0.47
5/16	1	2,000	0.38	0.53
3/8	1-1/2	3,000	0.44	0.66
7/16	2	4,000	0.50	0.72
1/2	3	6,000	0.63	0.84
5/8	4-1/2	9,000	0.75	1.06
3/4	6-1/2	13,000	0.88	1.28
7/8	8-1/2	17,000	1.00	1.44
1	10	20,000	1.13	1.72
1-1/8	12	24,000	1.25	1.84
1-1/4	14	28,000	1.38	2.03
1-3/8	17	34,000	1.50	2.25
1-1/2	20	40,000	1.63	2.41
1-5/8	24	48,000	1.75	2.66
1-3/4	30	60,000	2.00	2.94
2	35	70,000	2.25	3.28
2-1/2	55	110,000	2.75	4.13

ALLOY

Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/8	2	4,000	0.44	0.66
7/16	2.6	5,200	0.50	0.72
1/2	3.3	6,600	0.63	0.84
5/8	5	10,000	0.75	1.06
3/4	7	14,000	0.88	1.28
7/8	9.5	19,000	1.00	1.44
1	12.5	25,000	1.13	1.72
1-1/8	15	30,000	1.25	1.84
1-1/4	18	36,000	1.38	2.03
1-3/8	21	42,000	1.50	2.25
1-1/2*	25	50,000	1.63	2.41
1-1/2**	30	60,000	1.63	2.41
1-5/8*	29	58,000	1.75	2.66
1-5/8**	35	70,000	1.75	2.66
1-3/4*	34	68,000	2.00	2.94
1-3/4**	40	80,000	2.00	2.94
2*	43	86,000	2.25	3.28
2**	50	100,000	2.25	3.28
2-1/2**	85	170,000	2.75	4.13
3**	120	240,000	3.25	5.00
3-1/2**	150	300,000	3.75	5.25

* Screw Pin & Round Pin style only
 ** Bolt, Nut & Cotter style only

