How a sling's rated capacity is calculated to match your load

All the synthetic web products in this handbook are both the same and different.

They all have the same proven workmanship and long-lasting quality you can depend on. But they've all been engineered to give you different performance traits and rated capacities to perform to your different lifting needs.

The factors for calculating a sling's rated capacity

We use the following guidelines for calculating a sling's rated capacity:

1. ***Web tensile strength:*** This factor is the foundation for the calculation. Every webbing material is made with a specified nominal strength, measured in pounds per inch of width, in two basic grades. The webbing manufacturer is required to meet or exceed these nominal strengths with written proof. Any variation must exceed these ratings. This nominal strength of the webbing is used to calculate the sling's rated capacity.

2. ***Fabrication factor:*** This compensates for the reduction in webbing strength that occurs due to stitching and tapering. The greater the stitching, the more the reduction in webbing strength. Two-ply slings, for example, require more stitching than one-ply slings, thereby increasing the fabrication factor for the two-ply sling. Another factor is applied when webbing must be tapered such as in slings' eyes.

3. ***Hardware strength:*** This becomes a factor only when the nominal strength of the hardware is lower than the nominal strength of the sling. If so, the nominal strength of the hardware is used in calculating a sling's rated capacity.

4. ***Design factor:*** After web nominal strength has been adjusted by applying the fabrication factor, the sling's rated capacity is then determined by using a design factor of 5 to 1, as specified by American National Standards Institute (ANSI) standard ANSI B30.9, Section 9 - 5.2. ANSI and OSHA both require sling manufacturers to document published sling ratings with records of test data.

5. ***Random testing:*** In addition to using the above factors for calculating each sling's rated capacity, we test randomly selected slings from production runs to make sure every new sling meets or exceeds specifications and the rated capacity.

We take responsibility for every sling

That's why we sew a permanent tag on each new sling to show its rated capacity and can trace each sling to a manufacturing work order. It's not only a stamp of quality assurance, it's also a permanent record for us to know the precise sources and specification of webbing and hardware, even the machine operator who made the sling. Think of it as our seal of approval. What better way to take a load off your mind?

Take special precautions.

Before installing your slings, always read and follow the warning tag.

COMMERCIAL GROUP LIFTING PRODUCTS

Choose the right hitch for your load

By using the following descriptions, you'll ensure the right choice when selecting a hitch for your various lifting operations:

Vertical

Vertical: Also called straight hitches. These attach by simply using a sling to connect a lifting hook to a load. Use the sling to its full rated lifting capacity, but never above it. Use a tagline to keep the load from rotating, which may damage the sling. When you attach two or more slings to the same lifting hook, the total hitch becomes a lifting bridle, distributing the load among the individual slings. When using two or more slings, remember that the sling angle affects the slings' rated capacities.

Choker: These hitches are used when the load won't be seriously damaged by the sling body (or vice versa) and when the lift requires the sling to hug the load. These reduce a sling's lifting capability.

Choker

The diameter of the bend where the sling contacts the load should keep the point of choke against the sling body — never against a splice or the base of the eye. When a choke is used at an angle of less than 120°, the sling rated capacity must be reduced.

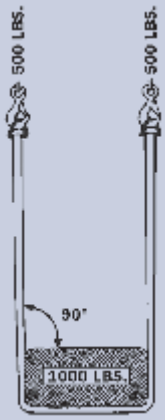
Two notes of caution: Always pull a choker hitch tight before a lift is made — not during the lift. And never use only one choker hitch to lift a load that may shift or slide out of the choke.

Basket

Basket: These hitches distribute a load between the two legs of a sling within the limitations described below.

Calculate the load of basket hitches

There's an important principle to remember before you calculate your load. As the horizontal angle of a sling decreases, the load on each leg increases (see illustrations at right). That's true whether you use a single sling as a basket or two slings with each in a straight pull such as a two-legged bridle.



Anytime you lift a load with a leg (or legs) of a sling at an angle, you can calculate the load per leg as well as the sling's rated capacity by using the following three-step formula.

1. Divide your total load by the number of legs you're using. This gives you the load per leg if the lift were being made with all lifting vertically. All of these calculations assume the center of gravity is directly below the hook. If not, more complicated engineering calculations are needed.

2. Find out the angle between the legs of the sling and the horizontal plane.

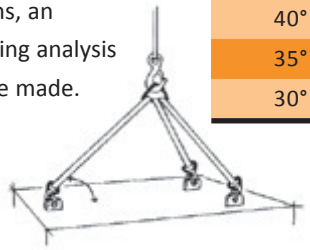
3. Multiply the load per leg (from step 1) by the load factor for the leg angle you're using (from the table above). This gives you the actual load on each leg for this lift and angle. The actual load must never exceed the sling's rated capacity.

CG COMMERCIAL GROUP LIFTING PRODUCTS

Calculating the angle of bridles

The horizontal angle of bridles with three or more legs is measured the same way as horizontal sling angles of two-legged hitches. If a bridle is designed with different leg lengths, it may result in different horizontal angles. Normally, the leg with the smallest horizontal angle will carry the greatest load. That means you should use the smallest horizontal angle when you calculate the actual leg load and evaluate your sling's rated capacity.

In extreme angular conditions, an engineering analysis should be made.



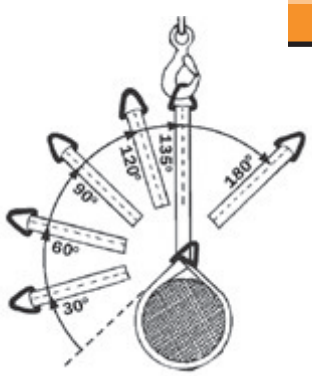
Load factor guidelines	
Leg angle	***Load factor***
90°	1.000
85°	1.003
80°	1.015
75°	1.035
70°	1.064
65°	1.103
60°	1.154
55°	1.220
50°	1.305
45°	1.414
40°	1.555
35°	1.743
30°	2.000

Adjusting choker hitch rated capacity

When a choker hitch is drawn tight at an angle of less than 120°, you'll need to reduce the hitch's rated capacity to allow for loss of rated capacity as the chart shows. Our tests have shown that when the angle was less than 120°, the sling body always failed at the point of choke when pulled to maximum. You must always allow for this anytime you use a choker hitch to shift, turn or control a load, or when the pull is against the choke in a multi-leg lift.

Angle of choke	Rated capacity*
120°-180°	100%
60°-119°	95%
0°- 59°	90%

**Percent of sling's rated capacity in a choker hitch.*



Example 1:

1. *Total load is 1,000 lbs. divided by two legs = 500 lbs. (load per leg if vertical lift).*
2. *Horizontal sling angle is 60°.*
3. *Multiply 500 lbs. by 1.154 load factor (from table) = 577 lbs. actual load per leg.*

Example 2:

1. *Total load is 1,000 lbs. divided by two legs = 500 lbs. (load per leg if vertical lift).*
2. *Horizontal sling angle is 45°.*
3. *Multiply 500 lbs. by 1.414 load factor (from table) = 707 lbs. actual load per leg.*

Example 3:

1. *Two-leg total load is 1,000 lbs.*
2. *Horizontal sling angle is 30°.*
3. *Multiply by 2 and actual load is 1,000 lbs.*

WARNING: Horizontal sling angles less than 30° shall not be used.

CG COMMERCIAL GROUP LIFTING PRODUCTS

Choose material, coatings and wear pads to fit your load

Choose nylon or polyester material

Both materials are heavy webbing loomed specifically to deliver dependable service in tough industrial conditions. Each is offered in two grades or strength ratings, identified in the numbering code of every stock number. Choose the strength that fits your application.

Nylon and polyester perform equally well in many applications, but each is designed for use in specific conditions. Here's a summary of their differences and similarities.

Differences

Stability under exposure to many common chemicals.

Chemical	*Nylon*	*Polyester*
Acid	NO	*
Alcohol	OK	OK
Aldehydes	OK	NO
Strong alkalis	OK	**
Bleaching agents	NO	OK
Dry cleaning solvents	OK	OK
Ethers	OK	NO
Halogenated hydrocarbons	OK	OK
Hydrocarbons	OK	OK
Ketones	OK	OK
Oil, crude	OK	OK
Oil, lubricating	OK	OK
Soaps, detergents	OK	OK
Water, seawater	OK	OK
Weak alkalis	OK	OK

**Disintegrated by concentrated sulfuric acid.*
***Degraded by strong alkalis at elevated temperatures.*

Elastic stretch: Nylon will stretch about 6% when loaded — about twice that of polyester — at sling's rated capacity and still return to original length. Overloading beyond rated capacity will permanently stretch and weaken both types.

Stability to acids vs. alkalis: In general, nylon is more stable when exposed to alkalis, while polyester performs better when exposed to acids. But there are exceptions to each. For more details, please check with us.

Similarities

Handling characteristics: Each type handles the same way. Water absorption is also low for both, which means the sling's rated capacity isn't seriously affected.

Identical temperature constraints. Neither nylon nor polyester should be exposed to heat exceeding 194° F (90° C) or below -40° F (-40° C).

Susceptibility to prolonged sunlight: Although we've added special treatments to provide some protection against long-term exposure to direct sunlight, both nylon and polyester are vulnerable. In direct exposure to sunlight, properly stabilized nylon outperforms polyester, but when exposed under glass, it's polyester that outperforms nylon. We recommend you store both types inside or under cover.

Stability under exposure to many common chemicals: As shown in the chart, neither is affected by common chemicals, normal dry-cleaning solutions, or soap and water. Both also retain their strength in oil and grease.

Both materials work best clean: Neither material supports the growth of mildew or bacteria, although dirt may accumulate on slings to support such growth. That's why we recommend cleaning with soap or detergent and water when needed.

CG COMMERCIAL GROUP LIFTING PRODUCTS

Increase wear protection with optional wear pads

Wear protection is standard only on Types 6 and 7. If you plan to use any of our other slings in damaging conditions, please specify wear pads when you order.

Our padded slings include a nylon and polyester buffer designed specially for this application. They're also available in synthetic leather that's more economical and stiffer than regular leather or in the same material as the sling body. You may choose another material if you wish — please specify when you order.

Choose from four types of wear pads

Regular: An extra layer of material is sewn at the wear points on either or both sides of the sling body or eyes. Multiple layers are also available upon request.

Edge guard: Pads are sewn along the edges of the sling body to offer extra protection at a critical wear area.

Sleeve or tube: Protects both sides of the sling body, and you can easily slide it across the sling. It remains stationary as the sling stretches while the load is being lifted.

Wrap: Similar to the sleeve, but is sewn onto the sling body to protect the edges as well as the lifting surface.

Increase wear protection on your slings with optional coatings

To protect the finished webbing against moisture and dirt penetration, we treat all our sling webbing with a special coating during the final stages of looming to promote cohesion of the yarns in the fabric. This also helps reduce abrasion.

Reduce edge cutting by over 60% with optional Scuff-Edge® webbing

The first place you normally see damage to a web sling is along its edges. Once a cut starts, it quickly spreads across the face of the webbing and shortens its useful life. With Scuff-Edge webbing, you can increase the resistance to edge cutting over 60% compared to standard sling webbing, according to independent research.

Scuff-Edge webbing has a patented polymer-coated web edge woven into slings that reduces edge abrasion as well as edge cutting to help make the most of your sling's useful life. It's easy to identify with its yellow body and black edge.

Slings with Scuff-Edge webbing are available only in the 900 series and have the same rated capacities as the regular 900 series slings.

You may also choose a coating of ***Neoprene*** if you wish. We'll apply it after sling fabrication but it will increase the stiffness of the finished sling. The coating helps improve abrasion resistance and helps decrease absorption of fluids and dirt.

Red-Guard® wear warning tells you when to replace slings

Standard in all slings except Econylon™, Red-Guard web features inner, load-bearing yarns that carry over 80% of the load. When the protective outer layer of webbing is worn away or damaged, it exposes the red yarns of the inner layer to give you a telltale warning. If visible, remove sling from service immediately.

CG COMMERCIAL GROUP LIFTING PRODUCTS

How to inspect web slings.

All of our synthetic web products are designed for long life under punishing conditions, but they will eventually wear out after extended use. The key is knowing when to replace them, and that's why it's very important to inspect your slings on a regular basis.

We've developed an inspection program based on the procedure outlined in ANSI B30.9 that will make the most of your investment. It's based on four sound beliefs:

- The importance of following regular and uniform inspections.
- A respect for the capabilities and limitations of synthetic web slings.
- The need to keep complete, permanent records.
- Perhaps most importantly, a lot of common sense.

How often to inspect slings

The frequency of inspection depends on three important factors:

1. *Sling usage – the more you use a sling, the more you need to inspect it.*
2. *The working environment – the harsher the conditions, the more often you need to inspect.*
3. *Sling service life – based on your experience in using slings.*

It's a good idea for the person handling the slings to visually inspect all slings before each lift. Additional inspections should be performed at least annually by a qualified designated person and permanent records kept.

OSHA specifies, "Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use, where service conditions warrant." In other words, you should visually inspect your sling before each lift.

When to replace slings

Remove all slings, including Flexi-Grip® round slings, from service if you see damage such as the following, and return to service only when approved by a designated person. These are removal criteria established by ANSI B30.9:

1. *Acid or caustic burns.*
2. *Melting or charring of any part of the sling.*
3. *Holes, tears, cuts or snags.*
4. *Broken or worn stitching in load-bearing splices.*
5. *Excessive abrasive wear.*
6. *Knots in any part of the sling.*
7. *Excessive pitting or corrosion, or cracked, distorted or broken fittings.*
8. *Other visible damage that causes doubt as to the strength of the sling.*
9. *Missing or illegible sling identification.*

In addition, we recommend three other important reasons to remove slings from service:

1. *Anytime you see our Red-Guard® warning yarns.*
2. *Distortion of the sling.*
3. *Anytime a sling is loaded beyond its rated capacity for whatever reason.*

While most of these standards are very specific regarding reasons for removal, others require your good judgment. The critical areas to watch are wear to the sling body, the selvage edge of webbing and the condition of the sling eyes.

Repair guidelines

It's never enough to give slings temporary repairs. Always follow these guidelines:

1. *Damaged slings should be repaired only by a sling manufacturer. If that isn't possible, the repairman should certify in writing the sling's rated capacity.*
2. *Slings repaired by a manufacturer must be proof-tested to twice the designated rated capacity on the tag before returning it to service — and back it up with a certificate of the proof-testing.*
3. *Inspection records for individual slings that have been repaired should be updated with all the relevant information such as the circumstances involved and proof-testing.*

Our synthetic web products measure up.

Our synthetic web products don't merely meet our own strict standards for workmanship and performance. They also meet or exceed these military and federal specifications:

1. ANSI Standard Z1.8 – specifications of general requirements for a quality program.
2. MIL-Standard-105 – sampling procedures and tables for inspection by attributes.
3. MIL-W-4088F – military specification for textile webbing — woven nylon.
4. MIL-W-23223A – military specification for slotted nylon webbing.
5. Fed. Spec. VT-285-E – federal specification for polyester thread.
6. Fed. Spec. VT-295-E – federal specification for nylon thread.

In addition, all work conforms to standards established by the following national safety institutions and their respective regulations:

- American National Standards Institute (ANSI) B30.9 Safety Standards for Cranes, Derricks, Hoists, Hooks, Jacks and Slings.
- Occupational Safety and Health Administration (OSHA) 1910.184 Standards for Slings.

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Identifying wear and abuse.

These are some of the most common types of web sling damage caused by abuse and misuse. When you see any of these problems during your regular inspection, stop. Replace the sling immediately because the damage is done. Never attempt to mend the sling yourself and, more so, never attempt to lift with these slings.

Whether a sling is damaged from improper use or normal wear, the same rule applies in all cases: Always cut the sling eyes and discard the sling right away when you see damage. Only with properly working slings can you take a load off your mind.

Tensile break

The distinguishing sign of a tensile break is a frayed appearance close to the point of failure or damage. This usually happens when a sling is loaded beyond its existing strength. The photo shows an example of a sling pulled to destruction on a testing machine. You can avoid tensile breaks by never overloading your sling.

Cut

You can easily see a cut in your sling when you see a clean break in the webbing structure or fibers. This usually results when a sling contacts a sharp object or unprotected edge of a load. This can happen anywhere on the sling body or eyes. Many slings feature Red-Guard warning yarns to alert you of serious cuts. One way you can avoid cuts from contacting sharp corners is to use wear pads on the sling to protect the fabric. See page 7 for details.

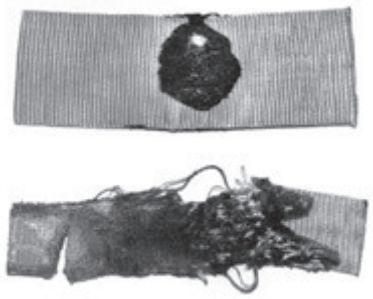
Cut and tensile damage

A good example is the photo shown here. It shows what can happen when you use a sling that's already been cut by a sharp object along one edge of the sling body. The cut dramatically reduces lifting capacity, and continued use will ultimately lead to sling failure, usually at a load far below the sling's rated capacity. The solution, obviously, is to never use a sling after it's been cut.

Abrasion damage

Anytime you see frayed fibers on the surface exposing the "picks," or cross fibers, of the webbing that hold the load-bearing (lengthwise) fibers in place, it's abrasion damage. The most common abrasion damage occurs either when the sling slips while in contact with a load during a lift or when the sling is pulled from under a load. When you see the Red-Guard warning yarns exposed, it's your signal that serious damage — and loss of lifting capacity — has occurred. We recommend that slings with any damage to load-bearing fibers be discarded. Wear pads are one way to avoid this damage.

Acid damage



It's true nylon and polyester webbing are stable when exposed to many common chemicals, but they should never be exposed to any strong acids or corrosive liquids whenever possible. The same is true for metal fittings on slings.

Example 1 (top photo). This is what happens when sulfuric acid, like car battery acid, is heated to the boiling point and dropped on nylon webbing. The charring on the surface fibers deteriorates the sling and will continue to get worse, severely affecting the webbing strength.

Example 2 (bottom photo). This is what happens when nylon webbing is immersed in sulfuric acid at room temperature for three weeks, resulting in major damage. Note the fibers are softened and swollen, and the entire fabric is grossly distorted, virtually destroying the webbing. You can help prevent this damage by never storing slings in areas where they may be exposed to acid or acid fumes, which are as destructive as liquid.

CG COMMERCIAL GROUP LIFTING PRODUCTS

Truck Tie-down Assemblies

Secure cargo on trucks and trailers

With a soft, pliable and non-abrasive polyester webbing, our Truck Tie-down Assemblies are ideal straps for securing cargo on flatbed trucks and trailers. They're lighter and easier to handle than chain load binders, and stronger and more durable than elastic tension bands. They also adjust easily in length to fit the size of load you're hauling.

The polyester webbing offers many advantages:

- Fabricated to meet your specific order.
- Fits standard 3" and 4" winches.
- Low-stretch design (approximately 3% at Working Load Limit) for improved handling.
- High-strength design isn't affected by moisture.
- All cut ends are heat-sealed to prevent fraying.
- Corner protectors and sliding sleeves also available.

Flat Hook
*F-1-803: 4,000 lbs. WLL; 12,000 lbs. nominal strength**
*F-1-804: 5,000 lbs. WLL; 15,000 lbs. nominal strength**

D-Ring
*D-1-803: 4,000 lbs. WLL; 12,000 lbs. nominal strength**
*D-1-804: 5,000 lbs. WLL; 15,000 lbs. nominal strength**

Sewn Eye
*E-1-803: 4,000 lbs. WLL; 12,000 lbs. nominal strength**
*E-1-804: 5,000 lbs. WLL; 15,000 lbs. nominal strength**

Chain Anchor Assembly**
*C-1-803: 4,000 lbs. WLL; 12,000 lbs. nominal strength**
*C-1-804: 5,000 lbs. WLL; 15,000 lbs. nominal strength**

Other options

1. Sliding winches designed to slide along the winch track are available. Please specify manufacturer of winch track when ordering.
2. Other winches and winch tracks are also available. For more information, please call your distributor, distribution center or the factory.
3. You may also order sliding sleeve-type wear pads and metal corner protectors (see page 7 for details).

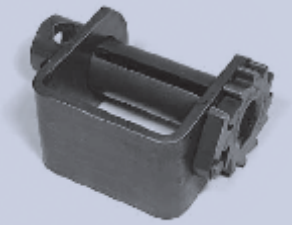
Choice of four end treatments, each with two Working Load Limits

***Type G Grab Hook end fitting is the same as C without the chain section. Other end fittings are available on request.*

* ***CAUTION:*** *Do not subject these assemblies to loads greater than the Working Load Limits because permanent loss of strength may result. These cargo straps have a design factor of 3 calculated into the Working Load Limit.*

Two types of winches

Portable winch provides flexibility of mounting position without need for winch track. Simply mount on side channel. Available with or without locking screws. Mandrel slotted for pull-through 3" and 4" webbing.



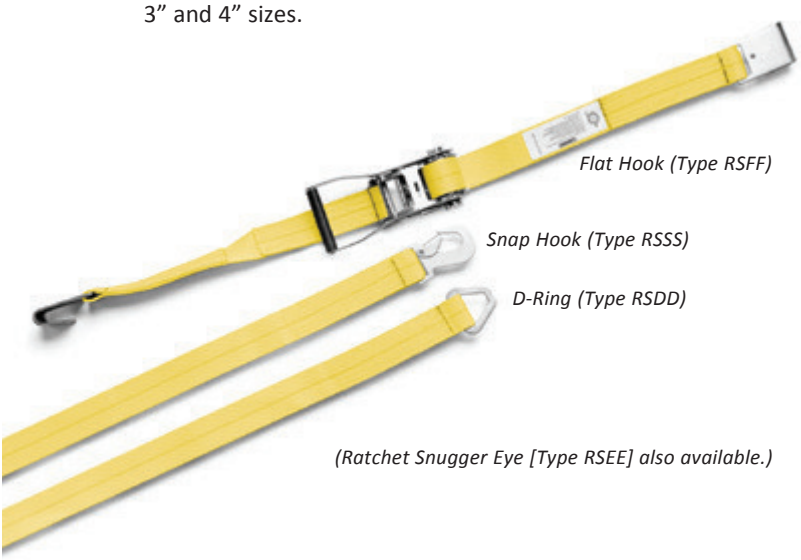
Fixed winch is designed for fixed mounting for use with loose end (pull-through) straps. Rugged 3/8" steel frame, 5/8" ratchet and pawl, hardened steel pawl pin, 4" slotted mandrel. Dimensions: 8 1/8" long, 5 1/2" high, 3 1/2" wide. Models available to store 30' of webbing.

CG COMMERCIAL GROUP LIFTING PRODUCTS

Ratchet Snugger® Binders

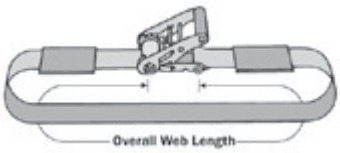
Fast, one-handed snugdowns

Ideal for use on pallets, in trucks or vans, baggage compartments, shipping containers or aircraft. Just snug down your load with a Ratchet Snugger control binder, adjust the tension and lock in place by pressing down on the ratchet handle. Your load is secure. When unloading, you can release the Ratchet Snugger binder just as easily. Choose from 1,670-lb. to 3,300-lb. Working Load Limits (WLL) in 2" webbing. Also available in 1", 3" and 4" sizes.



(Ratchet Snugger Eye [Type RSEE] also available.)

Ratchet Snugger Straight Assemblies (Type RSA). One end of webbing is sewn to the ratchet head, leaving the other end free to pass around the load or through narrow openings to insert into the ratchet spool. Fabricated to any practical web length plus 6" extra length for end hold. Optional sliding sleeve-type wear pads, ratchet pads and corner protectors help protect the webbing on both types of binders.



Ratchet Snugger two-piece devices (Type RS__). All feature metal fittings or eyes sewn at the ends of two pieces of webbing with the shorter piece sewn to the ratchet head. The variable length piece is heat-sealed to prevent fraying for easy insertion into the ratchet spool. Fabricated to any practical web length (between bearing points of eyes or hooks) plus 6" extra length for end hold. Ratchet buckle and metal end fittings are plated to resist corrosion. Other fittings are also available.

Hardware

Flat Hooks

Type RSFF-1-802

Rated 3,300 lbs. WLL; 10,000 lbs. nominal strength

Order code letter F (1 3/4" or 2" only).

Snap Hooks

Type RSSS-1-802

2" Snap Hook rated 3,300 lbs. WLL;

10,000 lbs. nominal strength

Order code letter S.

Ratchets

Standard Handle

Rated 3,300 lbs. WLL; 10,000 lbs. nominal strength

Long/Wide Handle

Rated 3,300 lbs.

WLL; 10,000 lbs. nominal strength

D-Rings

Type RSDD-1-802

Rated 3,300 lbs. WLL; 10,000 lbs. nominal strength

Order code letter D.

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