

LEEA Rigging and Slings

RIGGING SAFETY GUIDE



Experienced mechanical construction and service workers are experts in pipefitting, plumbing, or mechanical service work, but not necessarily in rigging. However, many of these workers perform rigging as a part of their regular work routine. Therefore, they do need some knowledge in safe rigging practices for the types of rigging they perform on a regular basis. Additional knowledge or refresher information on some of the key safe rigging practices provided by this guide will help these workers:

- Prevent rigging/lifting related injuries;
- Prevent damage to equipment, materials and property; and
- Perform their rigging responsibilities more effectively.

The three main parts to any load lifting operation are the lifting equipment (crane/derrick/ hoist), the operator/operation of the equipment, and the rigging of the load. This guide focuses on the rigging of the load. Specifically, it addresses how mechanical construction and service workers can safely rig the types of loads that are most common in our industry.

This guide does not cover all there is to know about rigging but you will get to know the basic and more will cover in the in person training in Dubai and Abu Dhabi. *For more information for full certification of this course call us*

Basic rigging safety for routine lifts in mechanical construction and service industry applications are covered in this guide. Critical lifts are not routine lifts and require considerable professional expertise in lifting equipment, operation of the equipment, rigging, and critical lift planning.

Critical lifts may include, but are not necessarily limited to lifts involving multiple cranes, lifts over operating facilities, lifts close to power lines, lifts that exceed the designated percentage of the rated capacity (usually between 70% and 80%), lifts over occupied buildings, etc. Before participating in the rigging of a critical lift make sure that:

- A critical lift plan designed specifically for the critical lift that you will be involved with has been developed by a properly trained/qualified person;
- The most senior supervisor in charge of the lift, the equipment operator and the lead rigger have approved and signed off on the critical lift plan; and
- Your supervisor has verified that you are properly trained and qualified to participate in the critical-lift rigging process.

Introduction

Asses the weight of the load

The rated capacities of cranes/derricks/hoists and rigging equipment are of little practical use if you do not know the weight of the load that is to be rigged and lifted. In some cases it will be rather obvious that the load is too light to exceed lifting and rigging equipment- rated capacities. However, there will be cases when you are uncertain whether the load can be lifted safely.

That is when you need to establish the weight of the load and compare it to the rated capacities of the lifting equipment, sling or slings, and rigging hardware. Here is how to determine the weight of the materials most commonly rigged for lifting in the mechanical industry.

Pipe Pipe weights are standardized by material and wall thickness. Manufacturers often paint the weight per foot on the pipe making weight calculations simple. You can also use pipe charts when they are available, but when necessary, calculate the weight of steel pipe by using the formula below. If there are multiple pieces of the same size and type of pipe, remember to multiply the weight of one piece by the total number of pieces. For various sizes/types of pipe, calculate the weight of each piece and add them together. **Weight of Steel Pipe = Pi x D x L x T x (Unit Weight) Key What It Means**

Pi D L T Unit Weight 3.14 Diameter of the pipe Length of the pipe Thickness of the steel The unit weight provided by the manufacturer or supplier

In the following example, we will calculate the weight of a single piece of steel pipe. **Weight of Steel Pipe = Pi x D x L x T x (Unit Weight) Key What It Means Illustration**

Pi D L T Unit Weight 3.14 3 feet 20 feet .03125 feet (.375 inches divided by 12) 189.57 pounds/foot

Using the formula and numbers above, we determine that this piece of pipe weighs 1,116 pounds ($3.14 \times 3' \times 20' \times .03125' \times 189.57 = 1,116$).

HVAC Units/Equipment In some cases the weight will be listed on the equipment. Otherwise obtain the weight from the manufacturer or supplier. Request the specifications of the equipment in writing and confirm that they match the brand and model number of the equipment to be rigged. **Pumps, Fans, Welding Machines, Boilers, and Miscellaneous Equipment** Check the specifications provided by the manufacturer or supplier for the weight of the object or objects.

If that information is not available at the jobsite, contact the manufacturer or supplier and give them the brand and model number of the equipment. Request the specifications in writing and confirm that the specifications match the brand and model number of the equipment that will be rigged/lifted.

Compressed Gas Cylinders Determine whether the cylinders are empty or full and multiply the number of cylinders by the proper weight. Remember to add the weight of the cage to the total weight of the cylinders. **Typical Cylinder Weight Examples** These are sample weights and should not be used for your load weight calculations. Obtain cylinder weights from your supplier. Also, be sure to use approved cylinder handling cages/devices when lifting compressed gas cylinders. **Size Weight – Empty Weight – Full**

Large

Medium

Small 220 pounds 115 pounds 60 pounds 240 pounds 170 pounds 75 pounds

Determine Proper Hitch Based on Load Type

A rigging hitch is used to attach the sling to the load. There are three basic types of hitches: the vertical hitch, choker hitch, and basket hitch. It is critical that the hitch you select will safely support the load. For example, a single choker hitch would not provide full support for a stack of loose pipe.

When the lift starts and the sling tightens, it would become taut around the bottom and sides of the stack, but the pipe on top of the stack would remain loose. A much safer choice for a stack of loose pipe would be a 2-sling double wrap choker hitch or a 2-sling double wrap basket hitch, which would secure the pipe for lifting. The illustrations on the following pages show the proper applications for hitches that are commonly used in our industry.

Double Choker Hitch Longer Pipe (Single Piece) 2-Sling Double Wrap Choker Hitch (Multiple Pieces)

Single Vertical Hitch (Various Applications)

Spreader Bar (Taller HVAC Units/Equipment) 4 Slings/Shackles

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Get to know tensions on Slings

One of the most important things to remember about sling tension is that the lower the angle between the load and the sling, the higher the tension on the sling. Angles also increase the tension on hardware. Hardware's rated capacity decreases when it is pulled from any direction other than vertical. This is critical information for proper sling and hardware selection and proper use. **Sling Angle/Tension Examples**

Sling Tension = (WT) x (L) 2 H 905 pounds of force per sling 517 pounds of force per sling

Hardware Examples Continuous reduction in percentage of rated capacity as the angle increases. Check with the manufacturer for details.

Continuous reduction in percentage of rated capacity as the angle is increased and load moves out from center of hook. 100% of Rated Capacity
100% of Rated Capacity

H: 19.36'

Multi Leg Slings Be sure to consider the number of legs on multi leg slings when determining sling tension and rated capacity. • Each leg of a two leg sling shares the load. • Each leg of a three leg sling shares the load. • On a four leg sling only two of the legs may be carrying the majority of the load. The other two legs balance the load. • Make sure the rated capacity of each sling is adequate for the load. 2-Leg Slings Share the Whole Load 3-Leg Slings Share the Whole Load 4-Leg Slings: 2 Legs Carry Most of the Load

How to select right slings

There are several different types of slings to choose from. The slings used most frequently in the mechanical industry are synthetic web slings, synthetic round slings, wire rope slings, and alloy steel chain slings. A critical consideration in sling selection is the relationship between the rated capacities of the sling and the type of hitch you plan to use. The rated capacity of a sling used with a vertical hitch will be different if you use the same sling with a choker hitch or a basket hitch. For example: **Synthetic Round Sling** Rated capacities for a specific brand and model of synthetic web sling: **Hitch Type Rated Capacity What to Look for**

Vertical

Choker

Basket 8,400 pounds 6,720 pounds 16,800 pounds

Wire Rope Sling Rated capacities for a specific brand and model of wire rope sling: **Hitch Type Rated Capacity What to Look for**

Vertical

Choker

Basket 2,800 pounds 2,200 pounds 5,600 pounds

When selecting a sling for a particular application, ask yourself: 1. Is the sling compatible with the hitch you will use to perform the lift safely? 2. Does the design and composition of the sling make it strong enough to perform the work safely (rated capacity)? Remember to consider reductions for sling angles and the type of hitch you will be using.

Rated capacity.

Protection from sharp edges.

Strength largely depends on the size of the sling.

Great for temporary work such as mechanical construction and service work.

PROS

- Forms easily to the shape of the load.
- Provides a non-slip grip on the load.
- Less likely to damage delicate loads such as HVAC units.
- Less likely to scratch loads with polished surfaces such as HVAC units.
- Can absorb a lot of shock without being damaged.
- Rated capacity is unaffected by abnormally hot air temperatures.
- Unaffected by mildew.
- Resistant to some chemicals.
- Long service life.

CONS

- Can burn from exposure to acids or caustics.
- Can melt or char from contact with flames/extremely hot heat sources.
- Susceptible to cuts from sharp objects.
- Stitching can break.

Synthetic Round Slings Considerations What to Look for

Rated capacity.

Protection from sharp edges.

Strength largely depends on the size of the sling.

PROS

- Forms easily to the shape of the load.
- Unlikely to damage delicate loads such as HVAC units.
- Unlikely to scratch loads with polished surfaces such as HVAC units.
- Rated capacity is unaffected by abnormally hot air temperatures.
- Unaffected by mildew.
- Resistant to some chemicals.
- Long service life.

CONS

- Can burn from exposure to acids or caustics.
- Can melt or char from contact with flames/extremely hot heat sources.
- Susceptible to cuts from sharp objects.
- Exposure and/or damage to core yarns render these slings ineffective/defective.

Alloy Steel Chain Slings Considerations What to Look for

Rated capacity.

Rigging/lifting conditions.

Type of load to be rigged/lifted.

PROS

- Strong and durable.
- Perform very well in harsh environments.

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Hand signals to know



LOWER THE BOOM AND RAISE THE LOAD – With arm extended horizontally to the side and thumb pointing down, fingers open and close while load movement is desired.



MOVE SLOWLY – A hand is placed in front of the hand that is giving the action signal.



USE AUXILIARY HOIST (whipline) – With arm bent at elbow and forearm vertical, elbow is tapped with other hand. Then regular signal is used to indicate desired action.



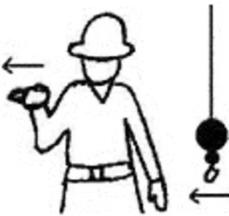
CRAWLER CRANE TRAVEL, BOTH TRACKS – Rotate fists around each other in front of body; direction of rotation away from body indicates travel forward; rotation towards body indicates travel backward.



USE MAIN HOIST – A hand taps on top of the head. Then regular signal is given to indicate desired action.



CRAWLER CRANE TRAVEL, ONE TRACK – Indicate track to be locked by raising fist on that side. Rotate other fist in front of body in direction that other track is to travel.



TROLLEY TRAVEL – With palm up, fingers closed and thumb pointing in direction of motion, hand is jerked horizontally in direction trolley is to travel.

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If you need any more information about what is needed to become an a certified professional, want to book a course or have any question then please [get in touch](#).