



**SECTION 4**

**CHAPTER 11**

**RIGGING MATERIAL AND HANDLING**

**Purpose** This chapter outlines the safety guidelines for working with rigging material during loading, unloading, spotting, and lifting operations.

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**Scope** These regulations apply to all employees, temporary employees, and contractors who work with rigging material.

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## Working with Rigging Material

**Purpose** This document outlines the safety regulations for working with rigging material.

**Types of rigging material**

Rigging material includes:

- clamps (Crosby or Fist Grip Clips)
- links
- chains
- shackle or clevis
- slings (wire rope, nylon, chain), both permanent and temporary
- thimbles

Rigging materials and/or lifting devices being used **must have** a legible manufactured identification marking/tag affixed indicating safe working loads

Employees shall **not exceed** the recommended safe working load indicated on the manufacture identification marking which is permanently affixed to the rigging material and/or device

**Using clamps**

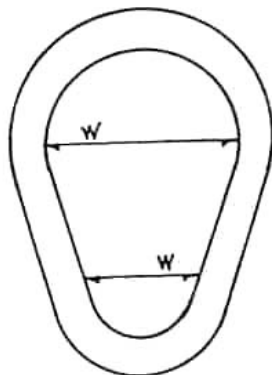
Use clamps on wire rope according to the OSHA Safety and Health Regulations. Do **not** use clamps anytime for lifting loads.

**Using links**

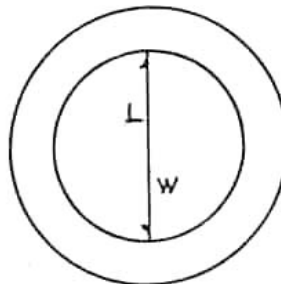
Use links to connect two or more slings when lifting bulky loads with two or more lifting points.

Links are named according to their shape, and include:

- pear-shaped (or sling) links
- ring link
- oblong link

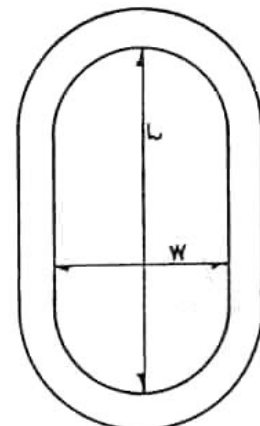


PEAR-SHAPED (OR SLING) LINK



L=LENGTH  
W=WIDTH

RING LINK



OBLONG LINK

### Using shackles or clevises

Shackles or clevises are probably the most widely used sling fittings in lifting operations. Shackles include:

- screw pins
- round pins
- bolts

Shackles are most commonly used to connect the eye of the sling to the load eye.

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### Using slings per ANSI B 30.9

All slings and attachment shall be visibly inspected by the person handling the sling each day they are used. In addition, a monthly inspection must be completed by a designated person and documented.

Inspection criteria for wire rope:

- kinking
- crushing
- un-stranding
- broken or cut stands
- stranding displacement
- core protruding
- corrosion
- bird caging
- broken wires

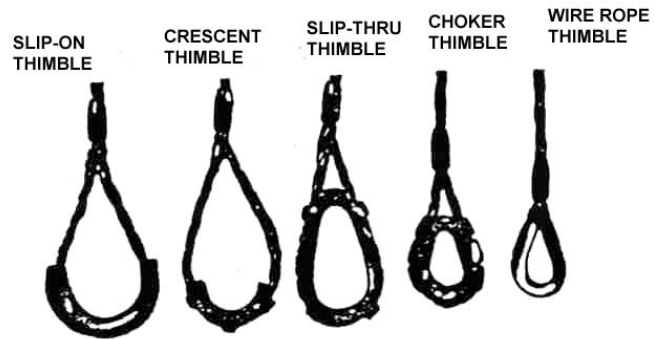
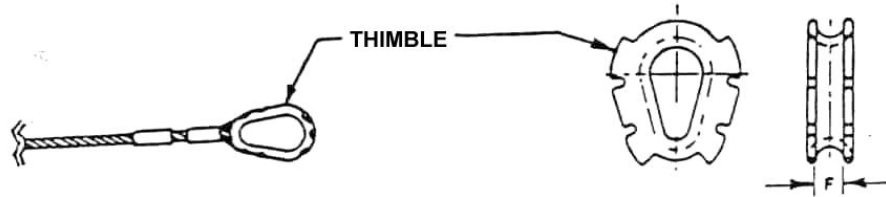
**Wire rope** sling eyes are made with swages with or without thimbles. Slings used for hoisting purposes will be tagged and inspected. Inspections shall be conducted prior to each use, on each shift, and as necessary during its use to ensure it is in safe working condition.

**Synthetic (Nylon)** slings are used in our industry daily. All synthetic (nylon) web slings must be protected against damage caused by abrasion and cutting when used with structural steel and equipment. The following are causes for removal:

- holes, tears, cuts, snags
- excessive abrasive wear
- acid or caustic burns
- melting or charring on part of sling
- broken or worn stitches
- knots in any part of sling
- discoloration, brittle, or stiff areas on any part of sling
- missing or illegible sling identification, or
- other damage that would cause doubt

## Using thimbles

Use thimbles whenever possible to strengthen and protect the eye of a sling. Thimbles have no impact on capacity. Any thimble used must match the size of the wire rope being used.



## Maintaining Wire Rope

**Purpose** Using wire rope in good condition is essential to ensuring safe operations.

This section describes the importance of proper maintenance and the procedure for:

- performing required inspections
- inspecting the wire rope
- identifying common defects in wire rope
- inspecting the wire strands
- identifying unusable wire rope

**Importance of proper maintenance**

Proper use, maintenance and storage can:

- prevent damage and other abuses to the wire rope slings and cables
- ensure longer life of the rigging material
- provide a safe work situation

**Required inspections**

A strong inspection program is crucial to ensuring safe operations. In addition to a visual inspection prior to each use, thoroughly inspect and document all wire rope, cable, and accessories used on a monthly basis. (i.e. Rig Inspection, Truck Trailer Inspection, Shop and Yard Inspection.)

The inspection must include the:

- wire rope
- wire core (if protruding through strands, take out of service)
- wire strands, and
- other components of the system (i.e., shackle, clevis, thimble, links, clamps, etc.)

**Inspecting the wire rope**

Good quality rope has uniform strands and wires that have been cleanly woven into a smooth pattern. The direction of the strands and wires must be consistent and smooth in appearance, giving the rope a round, healthy look.







There are four common patterns for wire rope.


Pattern	Direction
Regular Lay	Right Lay
Regular Lay	Left Lay

Long Lay	Right Lay
Long Lay	Left Lay






**Identifying common defects in wire rope**

The following table contains a series of diagrams illustrating the most common defects that can occur in wire rope used in the field.

Condition	Diagram
Bird Cage Wires	
Broken Wires	
Corrosion or Rust	
Crushed or Bruised Wires	
Cut or Sheared Wires	
Decrease in Lay (twisting and tightening)	

Doglegs or Kinks	
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*Continued on next page*

Condition	Diagram
Excessive Abrasion	
Failure at a Socket/Connection	
High Strands	
Increase in Lay	
Marked Reduction in Diameter	

# GRAVITY

*Working with Loose Gear*

*Safety Manual*

Popped Core	
Side Wear on Wire Rope	



## Inspecting the wire strands

The wire strands in the wire rope must be free of:

- rust
- corrosion
- wear
- breaks
- kinks
- stretched eyes
- other damage or deformation

## Identifying abused wire rope

Wire rope only has 100% capacity when its:

- strands are uniform and lie in an unbroken weave in a constant direction
- core is healthy, undamaged, and non-protruding
- wire is free of defects

**IF** the rope has any **one** of the following problems:

- three broken wires in one strand in one lay
- six randomly broken wires (total) in one lay
- two broken wires in a small area on standing ropes (non-moving wire rope), especially near connections or sockets
- any disfiguring of the cable so that it is out of original shape, including:
  - rust
  - stretched eyes or kinks
  - breaks
  - damage
- any evidence of heat damage, melting, or excess exposure to high temperatures
- reduction in diameter of more than:
  - 3/64 inch for 3/4 inch wire rope and less
  - 1/16 inch for 7/8 inch to 1 1/8 inch rope
  - 3/32 inch for 1-1/4 inch to 1-1/2 inch rope.

**THEN** you must replace the wire rope cable or the wire rope sling, using the procedure in "Disposing of Abused Rigging Material" in this chapter.

Note: One lay of rope is approximately six inches long.



## Disposing of Damaged Rigging Material

**Purpose** This document outlines the requirements for disposing of damaged rigging material.

**Safety hazard** **Never** use damaged rigging material in loading operations.

Damaged rigging material does not operate at its full capacity. It is impossible to tell how much capacity a damaged piece rigging material has. Using damaged rigging material could result in dropped loads and injuries in the workplace.

**Disposing of damaged rigging material** The following table describes the process for disposing of abused rigging material. This procedure should be used in all lines of business.

Stage	Description
1	The employee plainly marks the abused rigging material as being unfit for use on cranes or other load-carrying devices. <u>Recommended method:</u> Spray one end of the cable, sling, or rigging material with red paint.
2	The employee notifies the supervisor that the rigging material has been marked for disposal.
3	The supervisor tags the item as "Do Not Use" or "Danger", and places them in an area where they can be disposed of properly.
4	The Yard Manager/Supervisor will ensure that a proper replacement is made available.

## Lifting Barrels

**Purpose** This document describes the safety precautions for attaching rigging material to a barrel.

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**Using barrels** Use barrels to store:

- soaps
- cleansers
- lubricants
- oils
- other chemicals

Barrels generally weigh 500 pounds and can hold 55 gallons of liquid. Smaller barrels are occasionally used.

Transfer and handle barrels with care, using either a barrel clamp or a barrel sling.

**Attaching a barrel clamp**

The barrel clamp is safer than the barrel sling because:

- it requires less handling by the helper
- the barrel remains upright at all times
- the attachment is more secure
- the helper remains a safe distance away when the barrel is lifted or lowered

The following procedure describes the safety requirements for attaching a barrel clamp for lifting purposes.

Step	Action
1	Inspect the clamp before each use. <b>IF</b> it is damaged or worn, <b>THEN</b> do <b>not</b> use it.
2	Inspect the drum to verify that the top lip where the clamp will fit is not rusted or damaged. <b>IF</b> the top is damaged, <b>THEN</b> use a barrel sling. After the lift using the sling, dispose of the defective barrel properly so that a second lift isn't necessary.
3	Unlock the clamp. Place it over the top of the barrel and let it rest on its retainers.
4	Lock the barrel clamp in place by turning the locking lever clockwise in a half-circle (toward the center of the barrel). <b>IF</b> the clamp is loose, <b>THEN</b> tighten the adjusting screw until it is snug. Do <b>not</b> unlock the clamp to tighten the adjusting screw.
5	Attach one eye of a sling to the barrel clamp harness link with a shackle.
6	Attach the other eye of the sling to the hook on the load (lifting line).
7	Transport the barrel as you would any other load.

**Removing a barrel clamp**

The following procedure describes the proper technique for removing a barrel clamp safely after transporting a barrel.

Step	Action
1	Wait until there is enough slack in the sling before approaching the barrel.
2	Unlock the clamp by turning the locking lever counter-clockwise one half-circle (towards the center of the barrel).
3	Remove, separate, and store the barrel clamp, sling, and shackle.

## Lifting Loads with a Single Sling

### Purpose

This document includes:

- the safety precautions for using a single sling
- the procedure for lifting a load using a single sling safely
- a sample training exercise

### Safety precautions

Never:

- wrap the hoist rope around the load
- assume that sling with kinks or twists in them will perform at full capacity

Always:

- attach the load to the block using an approved sling or other device
- attach the lifting devices so that they balance the load and prevent the load from shifting or overturning in the lifting process

IF...	THEN...
attaching a load with hook slings,	point the hooks outward to prevent the hooks from unhooking when there is slack in the slings.
wrapping a sling around a pipe,	attach the bolt end of the shackle to the eye of the sling to prevent the bolt from unscrewing.
using multi-part slings,	unwrap them prior to attaching the load. Any twisting in a sling will reduce its capacity.

### Procedure

Use the following safety procedure to complete a lift using a single sling.

Step	Action
1	Attach the eye of one end of the sling to the load with the appropriately sized shackle.
2	Screw the bolt of the shackle in completely.
3	Position the shackle so that the bolt goes through the eye of the load and cannot twist and unscrew.
4	Place the other end of the sling on the hook (lifting line), allowing the safety latch on the hook to spring back and close off the connection. The safety latch will keep the eye from slipping off the



	hook if the sling becomes slack while handling the load.
<b>5</b>	<b>ALL</b> employees shall be kept clear of loads about to be lifted and of suspended loads. Only those employees using taglines will be allowed in the area of the lift and will remain in view of the person running those controls.
<b>6</b>	Ensure that the boom is centered over the load. Signal the operator to raise the block to take the slack out of the sling.
<b>7</b>	Verify that the sling is free between the eye on the load and the hook to: <ul style="list-style-type: none"><li>• prevent damage to the sling</li><li>• prevent damage to the equipment</li><li>• ensure full lifting capacity of the sling</li></ul> <b>IF</b> the sling doesn't hang freely when the lift is started, <b>THEN</b> stop the lift and rearrange the rigging material.

## Lifting Loads with Two Slings

**Purpose** This document describes the procedure for lifting a load with two slings.

**Attaching two slings** Always attach slings to the lifting eyes or lifting mechanisms. **Never** attach slings to the equipment.

Step	Action
1	Attach the slings to eyes at the balance points of the load. <b>IF</b> the load does not have designated eyes, <b>THEN</b> choose two points on the load that will result in a balanced lift.
2	Use shackles to secure the slings to the load eyes. Positioning the shackles properly and attaching them securely is essential to completing the lift safely.
3	Attach each sling or link to the hook. Close the safety hatch on the hook.
4	Move beyond the load and ensure that the boom is centered over the load.
5	Signal the operator to raise the block slowly to tighten the slings. Both slings must be stiff and tight before the load is lifted.

**Lifting pipe with two slings**

This table outlines the procedure for lifting pipe using slings.

Step	Action
1	Locate the center of the pipe and attach each sling approximately five feet from the center in opposite directions. <u>Note:</u> It is not necessary to attach the slings near each end of the pipe. This will only increase the angle and, therefore, the sling capacity required to lift the pipe.
2	Wrap the sling around the pipe twice.
3	Attach the eye to the sling with a shackle as shown in the diagram below.
4	Pull on the loose end of the sling and push down on the attached end to tighten the sling around the pipe. <u>Note:</u> Anytime a wire rope sling is wrapped around an object that is too small, it will develop a permanent bend in the sling. This will reduce its capacity. When possible, use a synthetic sling to lift joints of pipe as long as the joints do not exceed the synthetic sling capacity.
5	Attach the slings to the lifting hook and attach a tag line to the pipe.
6	Signal the operator to lift the load.
7	Place two boards under the pipe before lowering to allow the removal of the slings.
8	Signal the operator to lower the load. <u>Note:</u> When lowering the pipe must <b>not</b> be placed flat on the surface.
9	Allow enough slack in the slings and loosen the sling loop around the pipe by pulling outward on the shackle. <u>Note:</u> <b>IF</b> the shackle is removed before the sling is loosened, the sling eye could snap back and cause injury.
10	Place your foot on the eye of the sling and remove the shackle or remove the shackle from the opposite side of the pipe.
11	Remove the slings and properly store them.



## Using Tag Lines

**Purpose** This document outlines the safety regulations for attaching and using tag lines.

**Attaching a tag line** Attach tag lines to either the load or the sling. They must extend a minimum of 15 feet from the load.  
Use two tag lines for large loads (one on each end).

**Using a tag line** Use the following procedure to direct a load into place using a tag line.

Step	Action
1	Prior to lifting and using the taglines, complete a JSA.
2	Pull on the tag line easily to control the load.
3	Direct the load into place by using only enough force for desired position.
4	Ensure there are adequate personnel positioned on each tagline to control the load.
5	Do not release the tagline until the load is secured, unless it creates an unsafe environment.