Rigging & Lifting

“Rigging” originated as a nautical word which is defined as the ropes, chains, and other lines that support the mast and spars of a vessel or serves to set and trim the sails

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- **In Industry Today:**

- "Rigging"
- Defines the process of moving heavy loads with ropes, hoists, and other types of specifically designed tools.

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Rigging:

- Fundamentals
- Components
  - Terms
  - Safety
  - Inspection
- Procedures & Techniques

Rigging Objectives:

A. Describe the 4 steps to successfully plan a rigging job.
B. Describe the techniques used in finding the load's center of gravity.
C. Identify an appropriate path for making the move
D. Select the proper rigging components for rigging a load
E. Describe proper safety inspection on rigging equipment
F. Identify safe rigging practices
G. Communication with the hoist or crane operator
H. Apply the proper techniques to hoist and move loads

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- **Objective #1:**

A. Planning the rigging job
B. Selecting and inspecting the equipment
C. Using Proper rigging techniques
D. Communication with the crane or hoist operator through proper arm and hand signals

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A. Planning the rigging job.

- Planning is essential for performing a rigging job efficiently and safely. The planning process always includes the determination of:

1. The **weight** of the objective
2. The **center of gravity** of the objective
3. The **path** that will be taken start to finish

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Only after these three facts are known can the rigger choose the best rigging and lifting techniques for moving the objective in the safest possible manner.

1. Weight
2. Center of Gravity
3. Path

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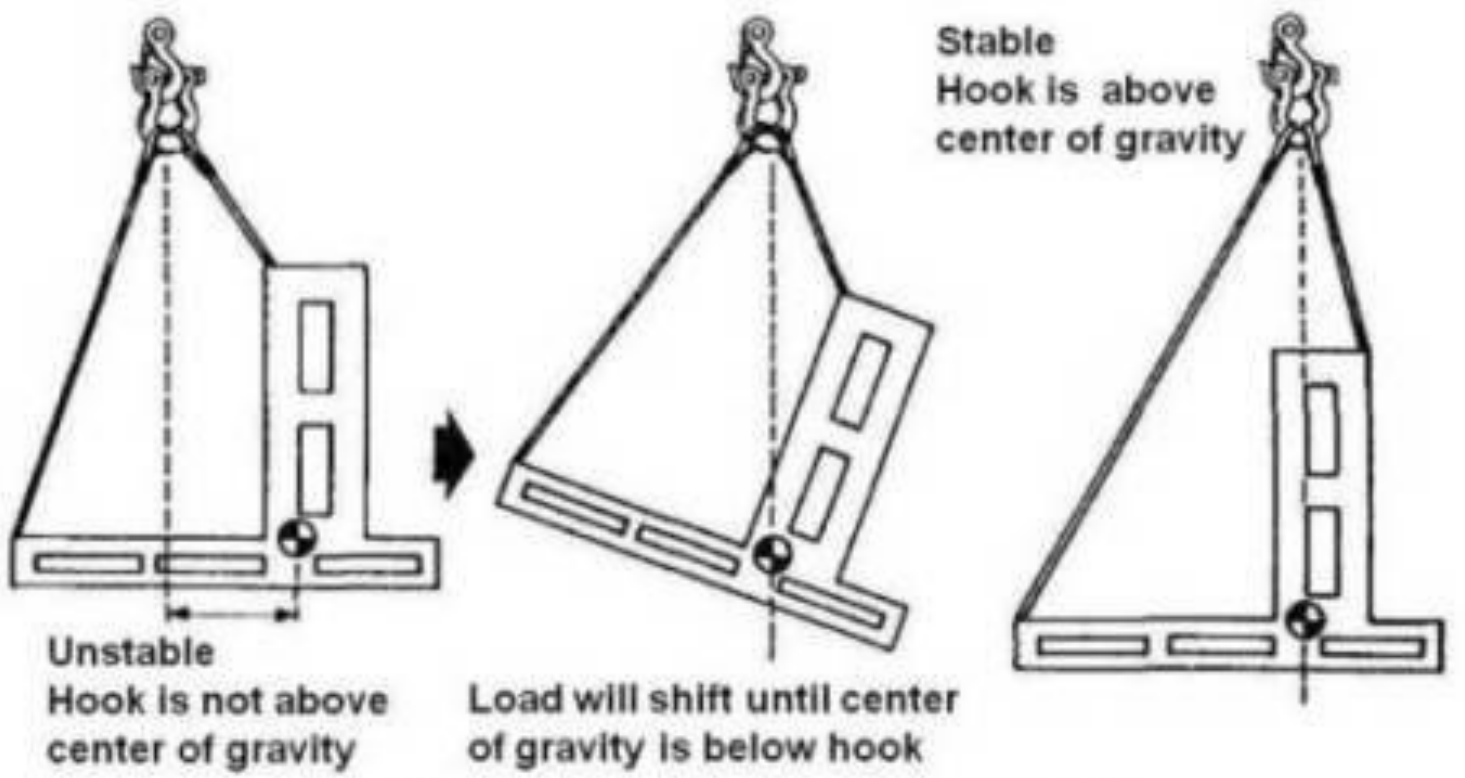
1. The Weight of the Load or Object

Knowing the weight of the objective to be moved will determine the type of rigging equipment to be used during the move and allow for the selection of equipment with the proper capacity. Always reference the equipment manufacturer for proper capacity.

2. The Center of Gravity

Every load must be properly balance if it is to be lifted safely

When a load is lifted from a point directly above its center of gravity it will remain stable.



Effect of Center of Gravity on Lift

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Some loads are more easily balanced than others. A regular shaped load lifted from a point above its center will be balanced as long as one end of the load is not heavier than the other end. Irregular shaped loads are usually much more difficult to balance because the weight is not equally distributed.

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3. The path Taken from Start to Finish.

The rigging plan is not complete until the path that will be taken during the move has been decided, all obstacles checked for clearance, and if the load must be set down the floor capacity is known.

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- **Additional Path safety concerns**
- The load should be kept as close to the floor as possible
- Loads should never be lifted over equipment unless no other path is possible
- People must be kept out of the way
- Never get a hand or foot under a suspended load.

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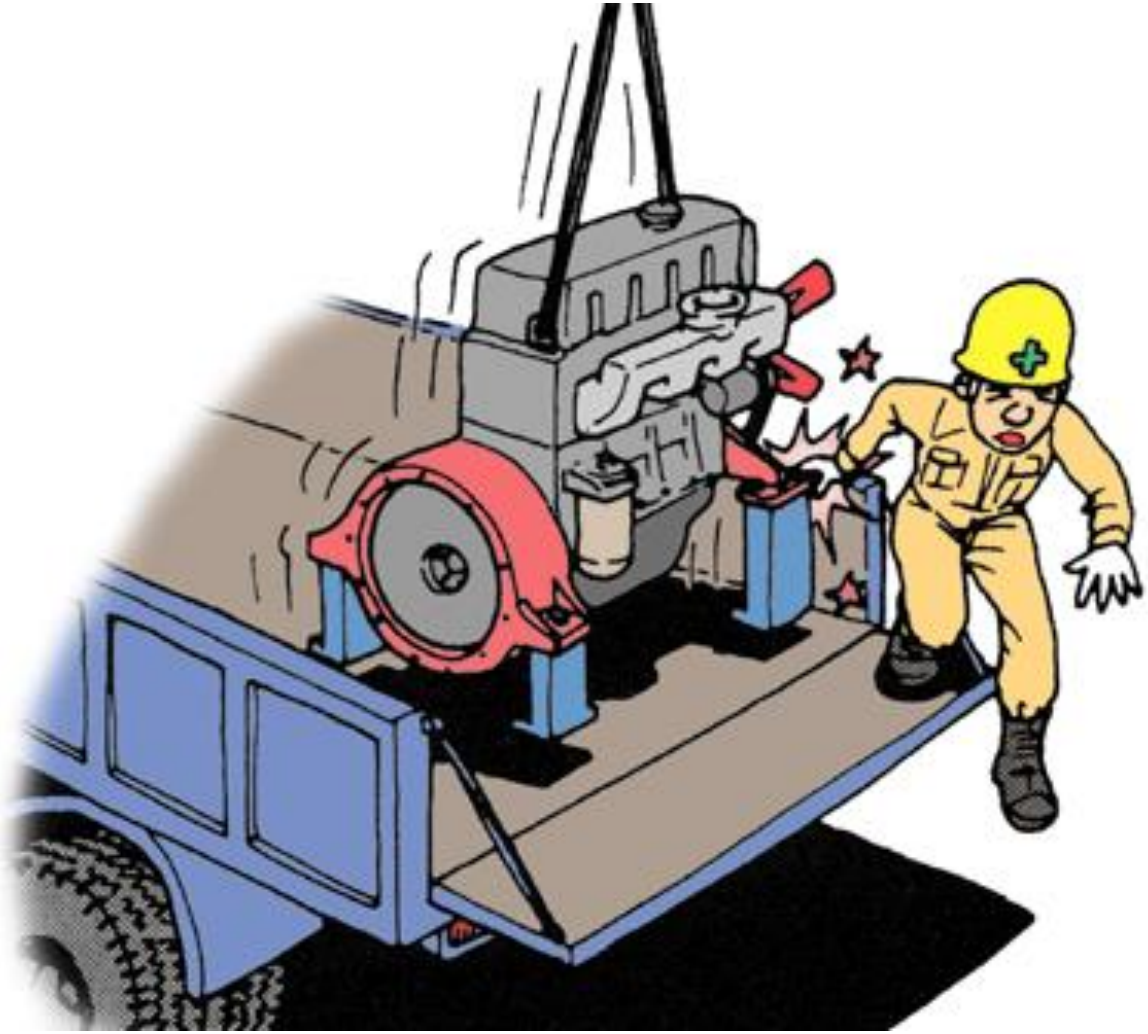

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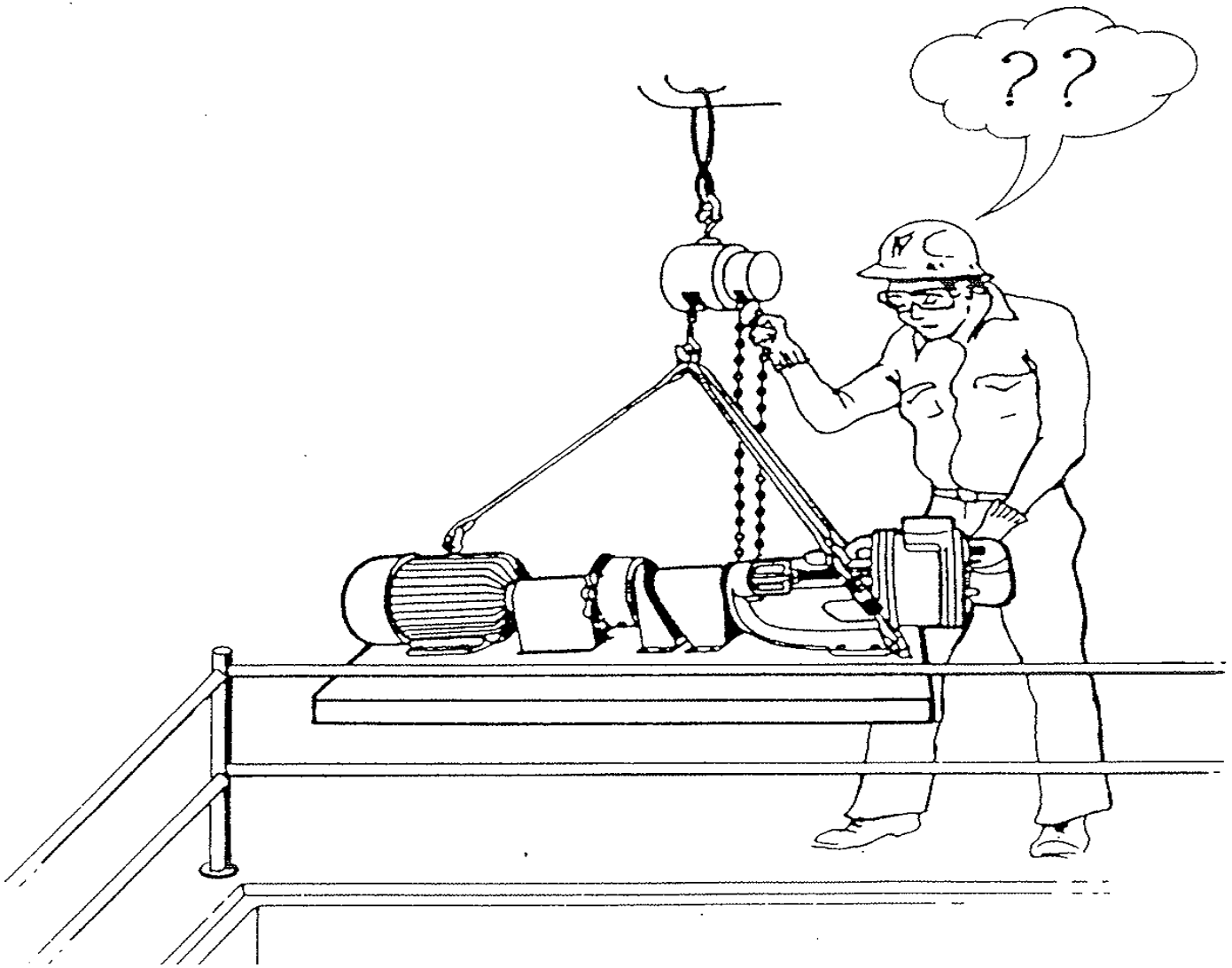

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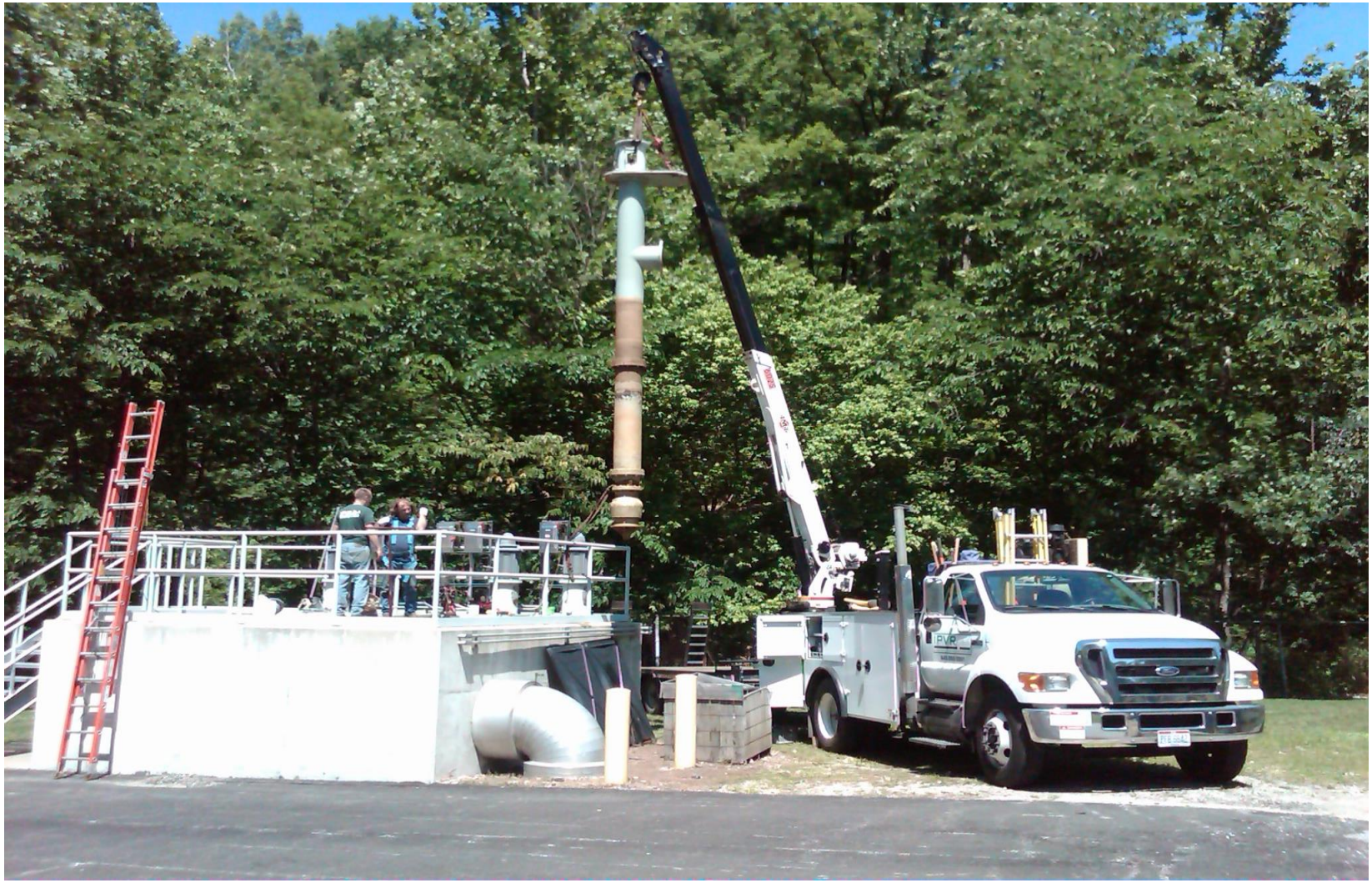

B. Selecting and Inspecting the Rigging Equipment.

Often there is more than one way to safely rig a load. Thus the rigger must have a sound understanding of rigging equipment and how to use it.

Basic Rigging components available.

1. Hoists and cranes provide lift
2. Slings are used to attach the load to the hoist or crane
3. Adjusters are used to balance the load.

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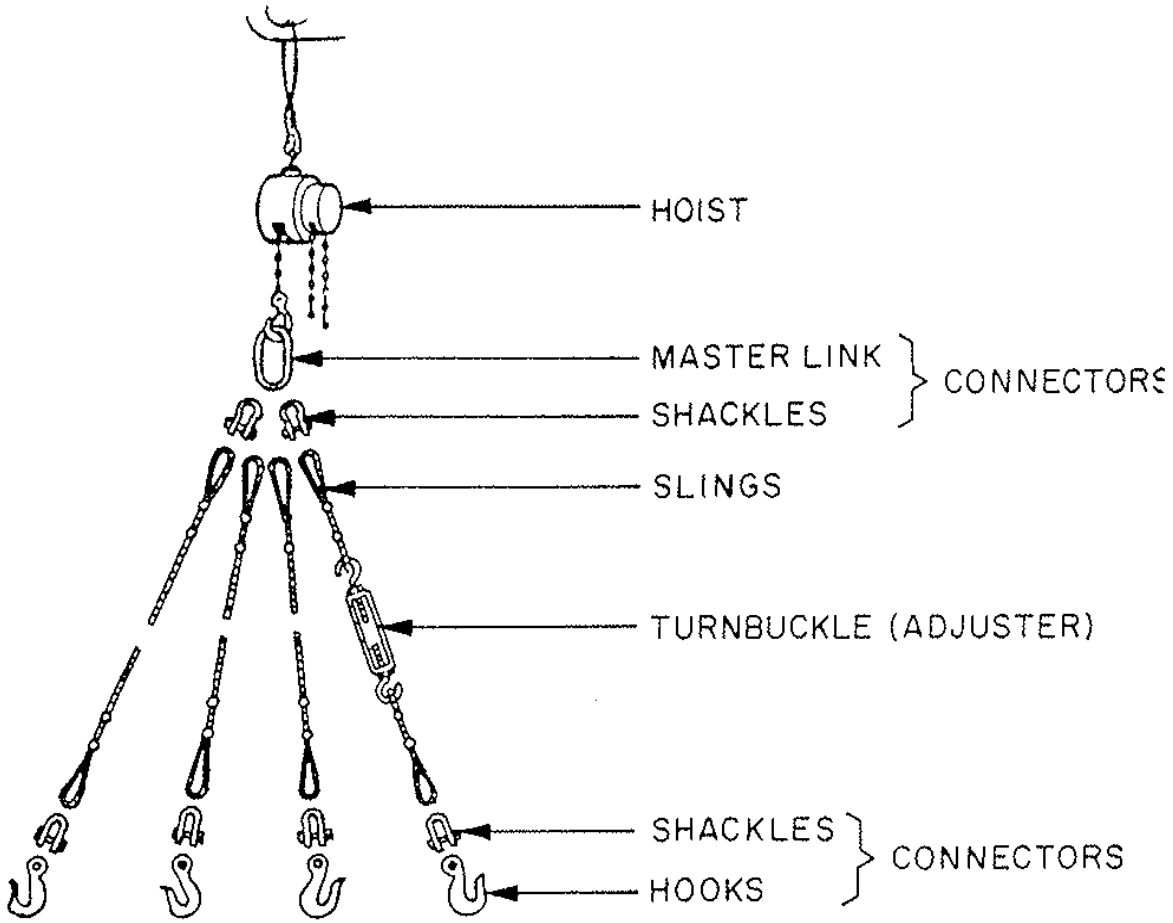
- A safe rigging practice is to over rig a job by selecting equipment rated to one and a half to two times the weight of the load.


HOIST
MASTER LINK
SHACKLES
CONNECTORS
SLINGS
TURNBUCKLE (ADJUSTER)
SHACKLES
HOOKS
CONNECTORS

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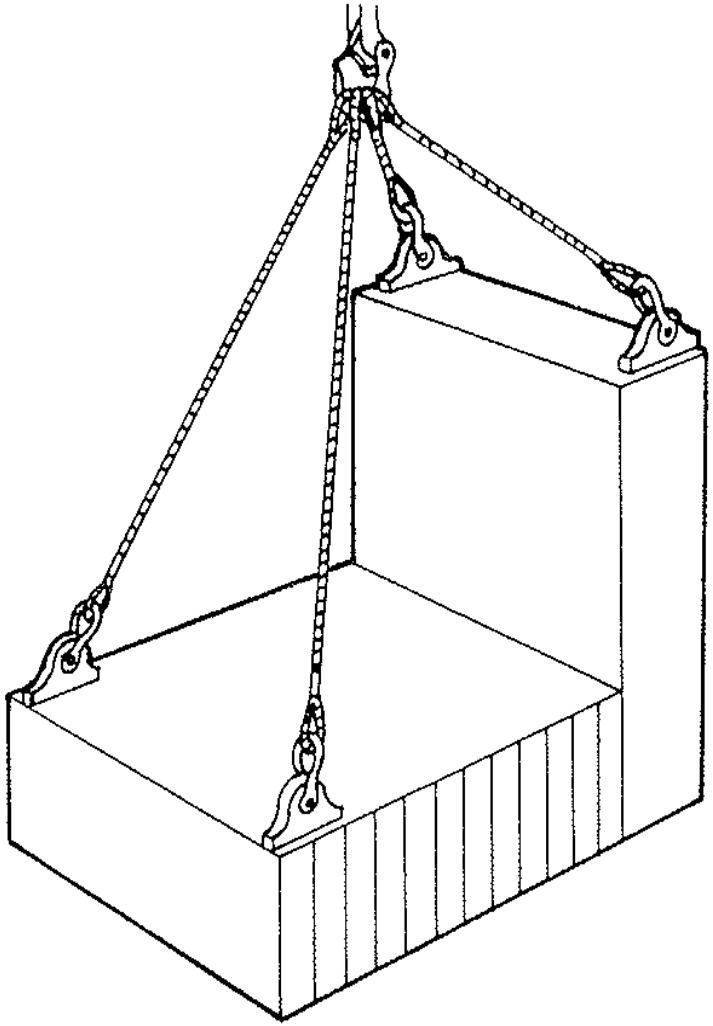
- Rigging equipment will also be selected based on the loads center of gravity and the path to be used. Slings of various lengths can be used to position the load's balance, or an adjuster can be used to balance the load.



C. Using Proper Rigging Techniques.

Just because the proper rigging equipment has been selected and inspected does not mean the rigging job will be performed safely.

Even though each individual piece of rigging equipment may be adequate to withstand the load, improper rigging can reduce the strength of the rig by 90 percent.

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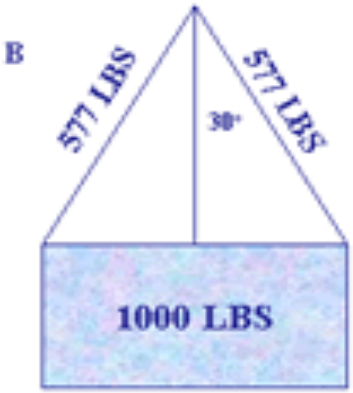
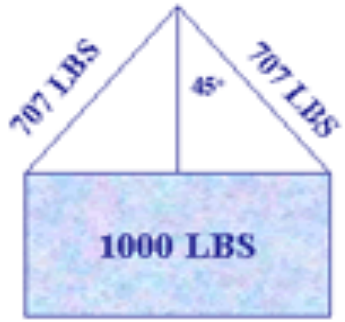
A

B

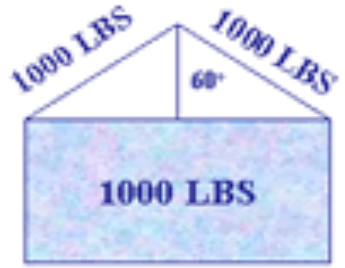


Sling Angle with Vertical	Stresses per Sling Leg Per 1000 Lbs. Total Load
0	500
5	502
10	508
15	518
20	532
25	552
30	577
35	610
40	653
45	707
50	778
55	872
60	1000
80	2880

C



D



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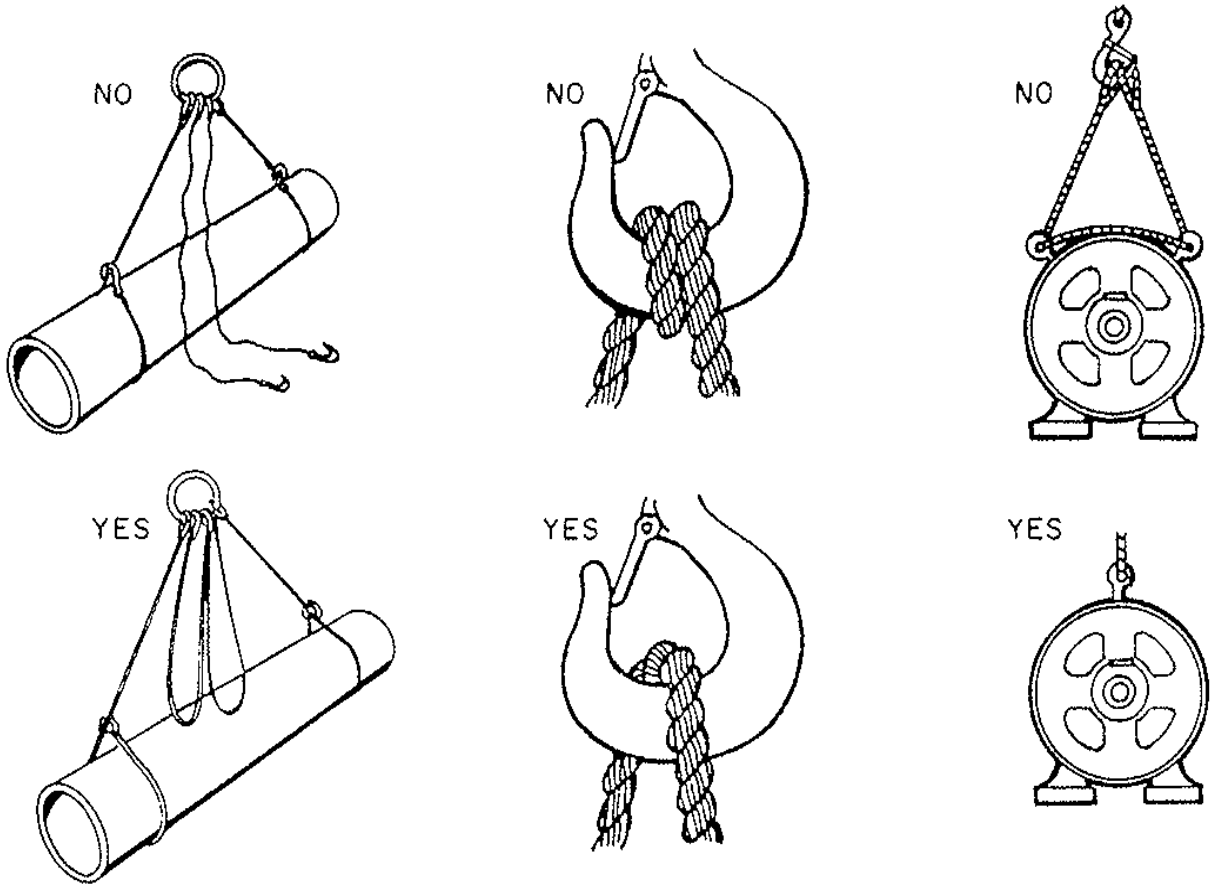

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D. Communication with the crane or hoist operator through proper arm and hand signals.

When the load is lifted by cranes or hoists with remote operation, the rigger directing the move must be able to communicate with the crane operator. The crane operator should take signals from only one signalman, except for emergency stop. The designated signalman must be clearly identifiable to the operator.

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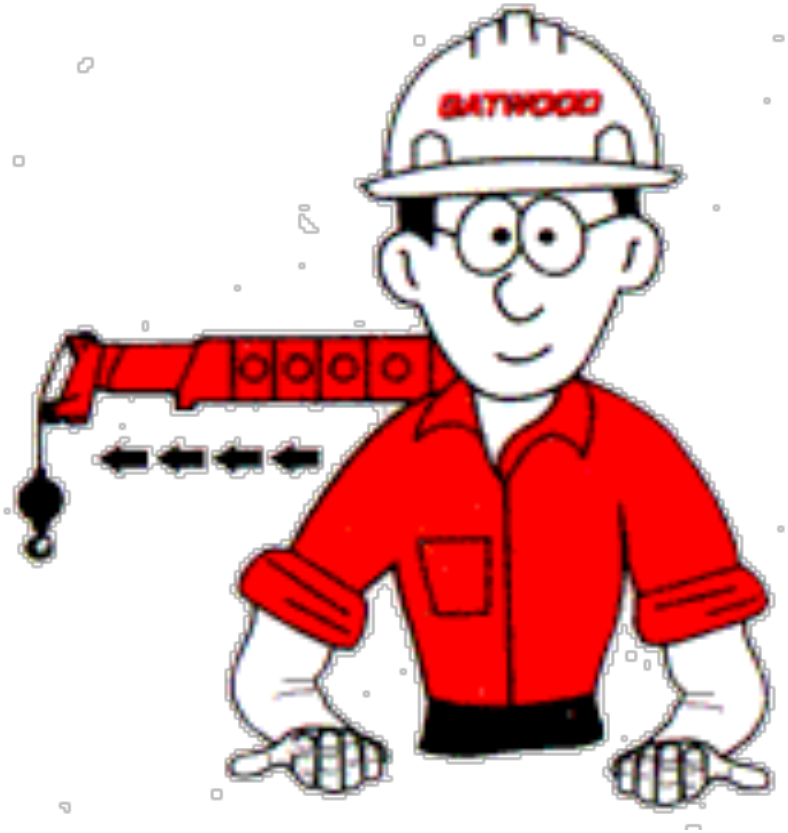
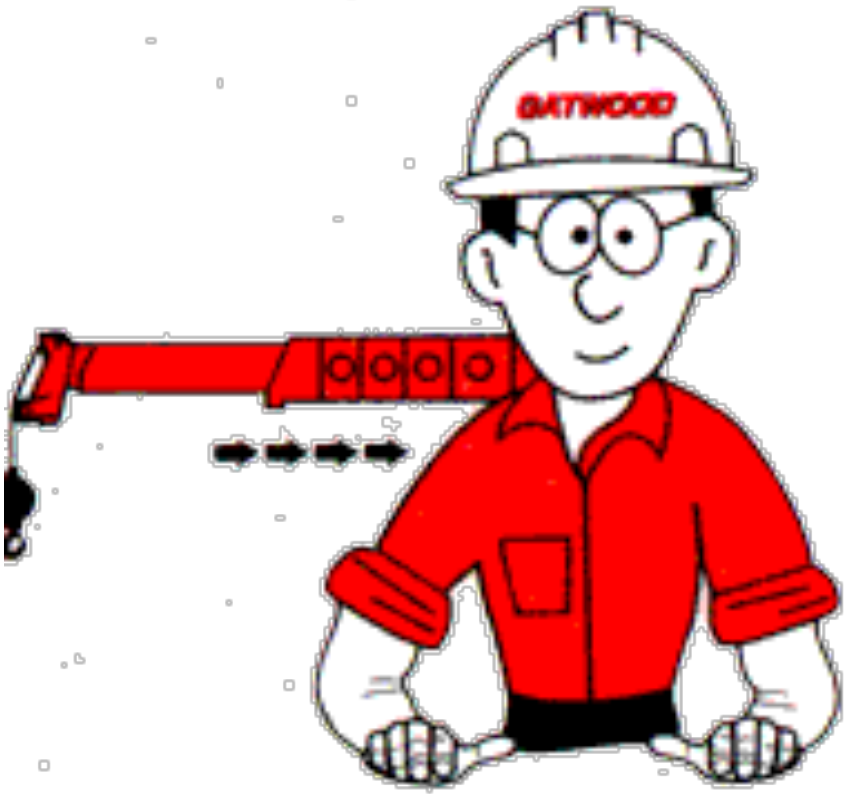
- There are approved hand signals for all types of cranes in all types of applications. The following signals are for boom crane operation.

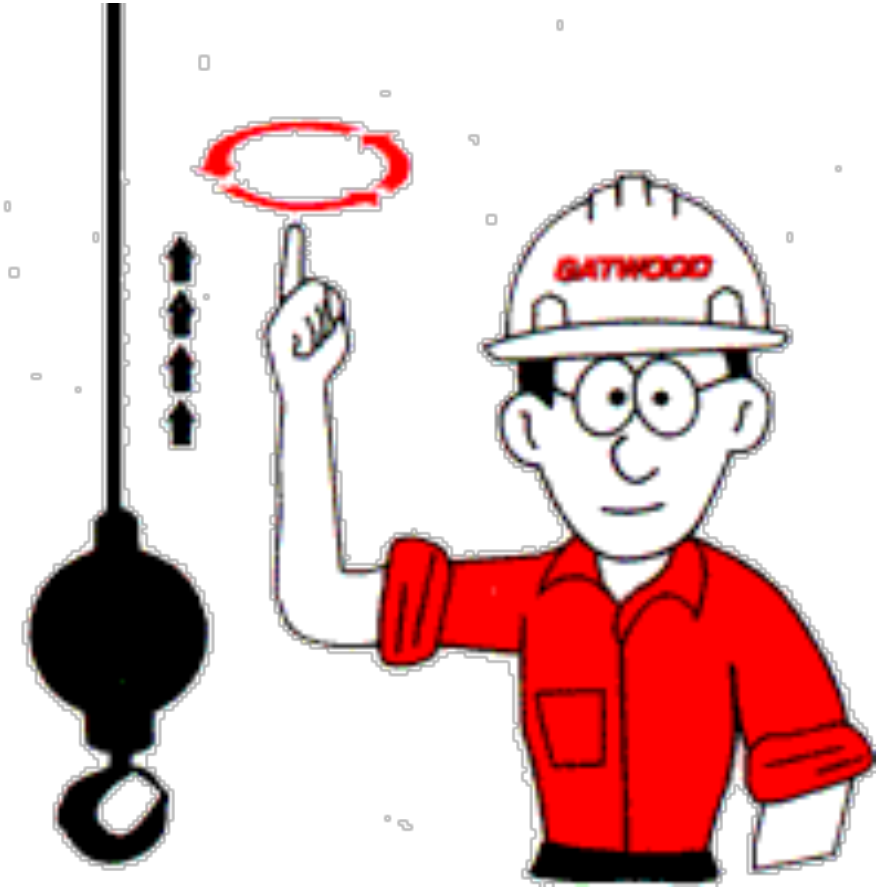
EXTEND BOOM



RETRACT BOOM



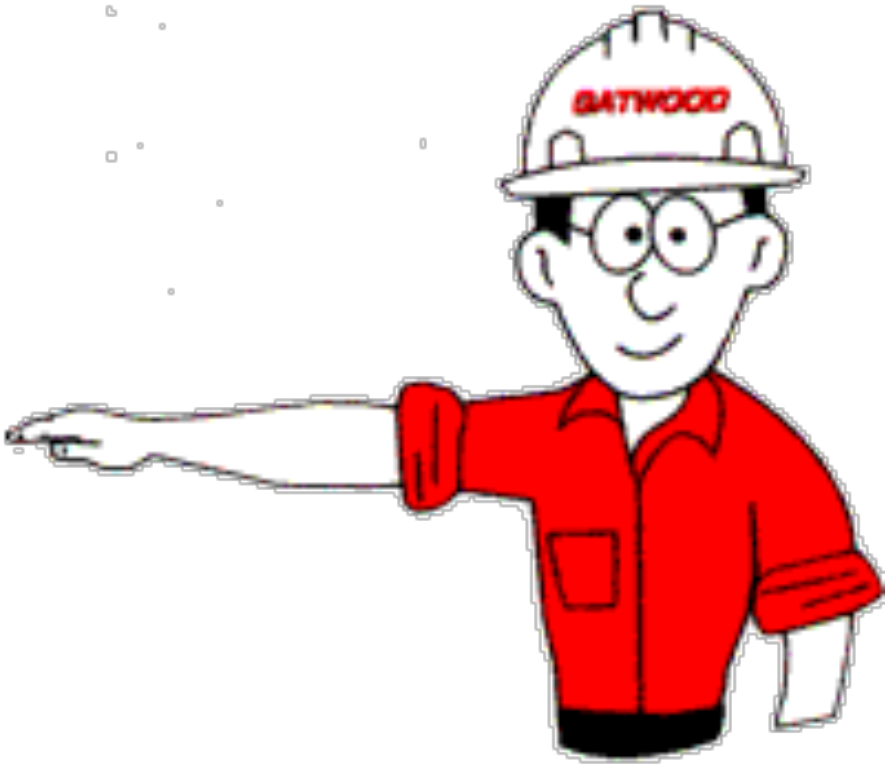
HOIST THE LOAD



LOWER THE LOAD

STOP

SWING THE LOAD



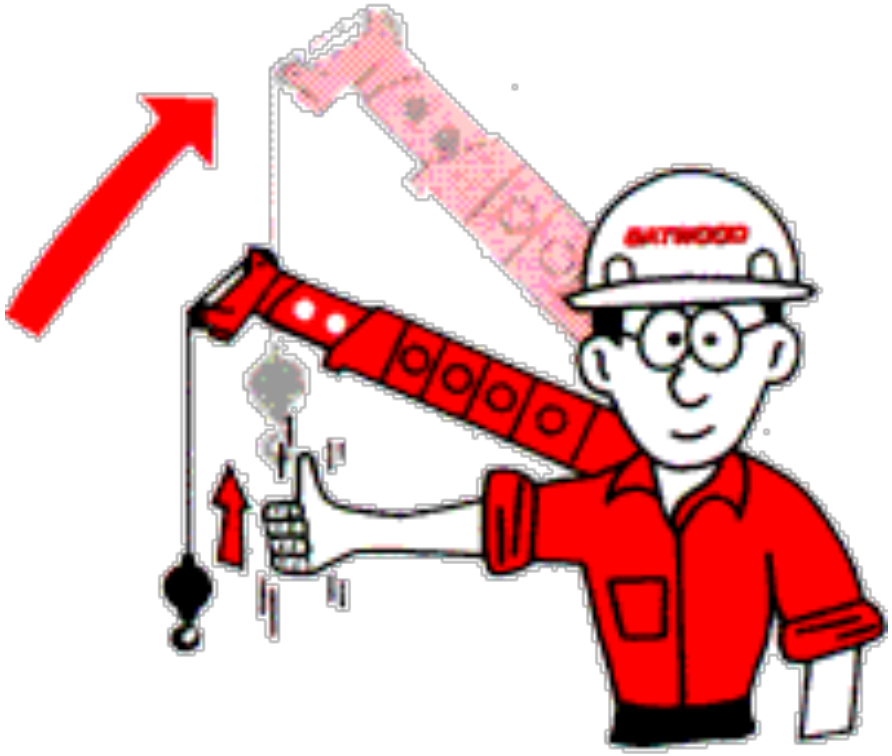
SLOWLY RAISE LOAD

SLOWLY LOWER LOAD

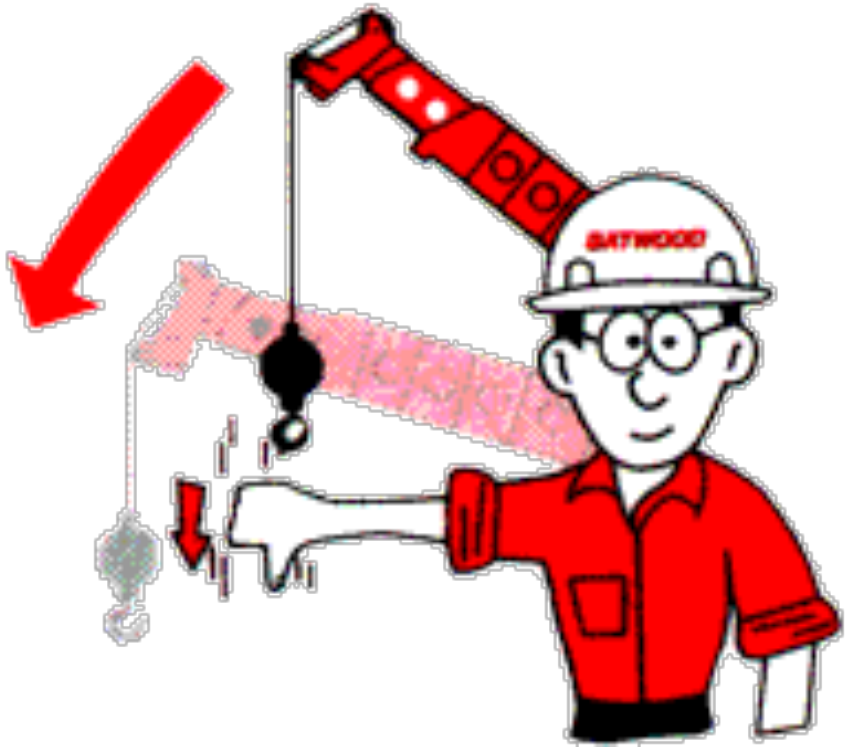
ONE HAND EXTEND BOOM

ONE HAND RETRACT BOOM

RAISE BOOM



LOWER BOOM



RAISE BOOM / LOWER LOAD

LOWER BOOM / RAISE LOAD

DOG EVERYTHING / ALL STOP

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Rigging Components & Terms:

1. Hooks
2. Shackles
3. Eyebolts
4. Ropes, Chains, and Slings
5. Adjusters
6. Load Levelers
7. Ratchet Hoist
8. Powered Hoists

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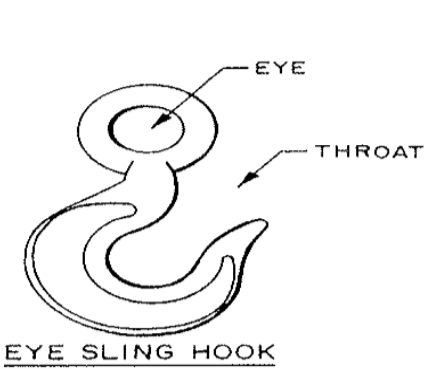
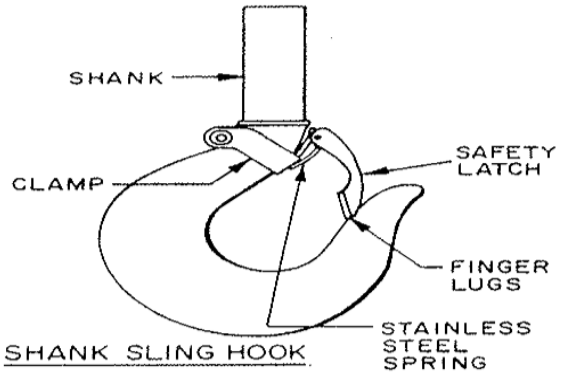
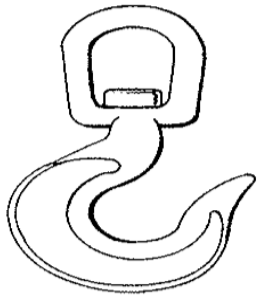
The safety latch will not and should not be required to hold the weight of the load.

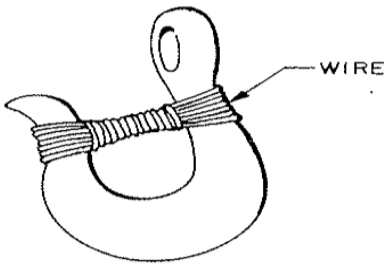


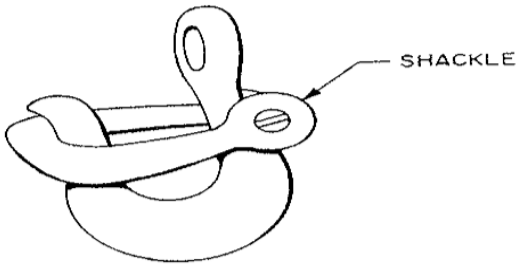
EYE SLING HOOK



SHANK SLING HOOK

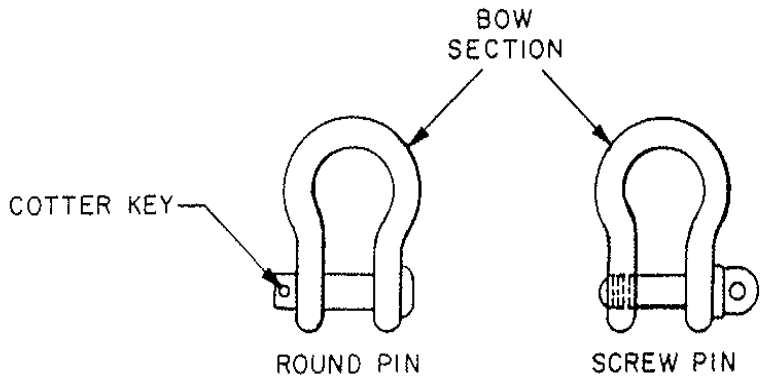

SWIVEL SLING HOOK

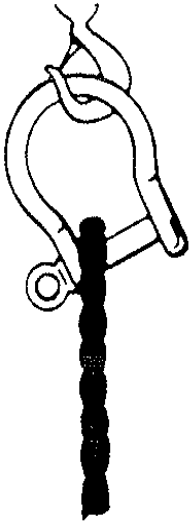




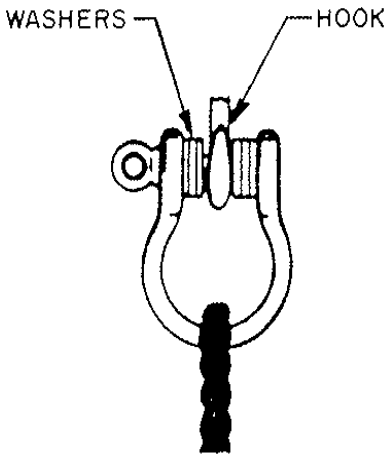
MOUSING

Never replace the shackle pin with a bolt





NO



YES

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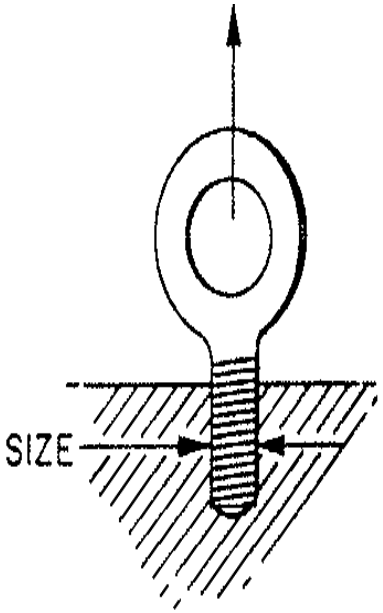
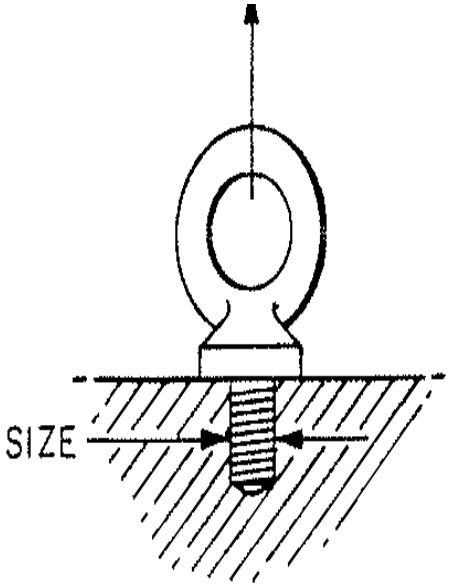
The maximum angle of pull for a shouldered eye bolt is 45 degrees

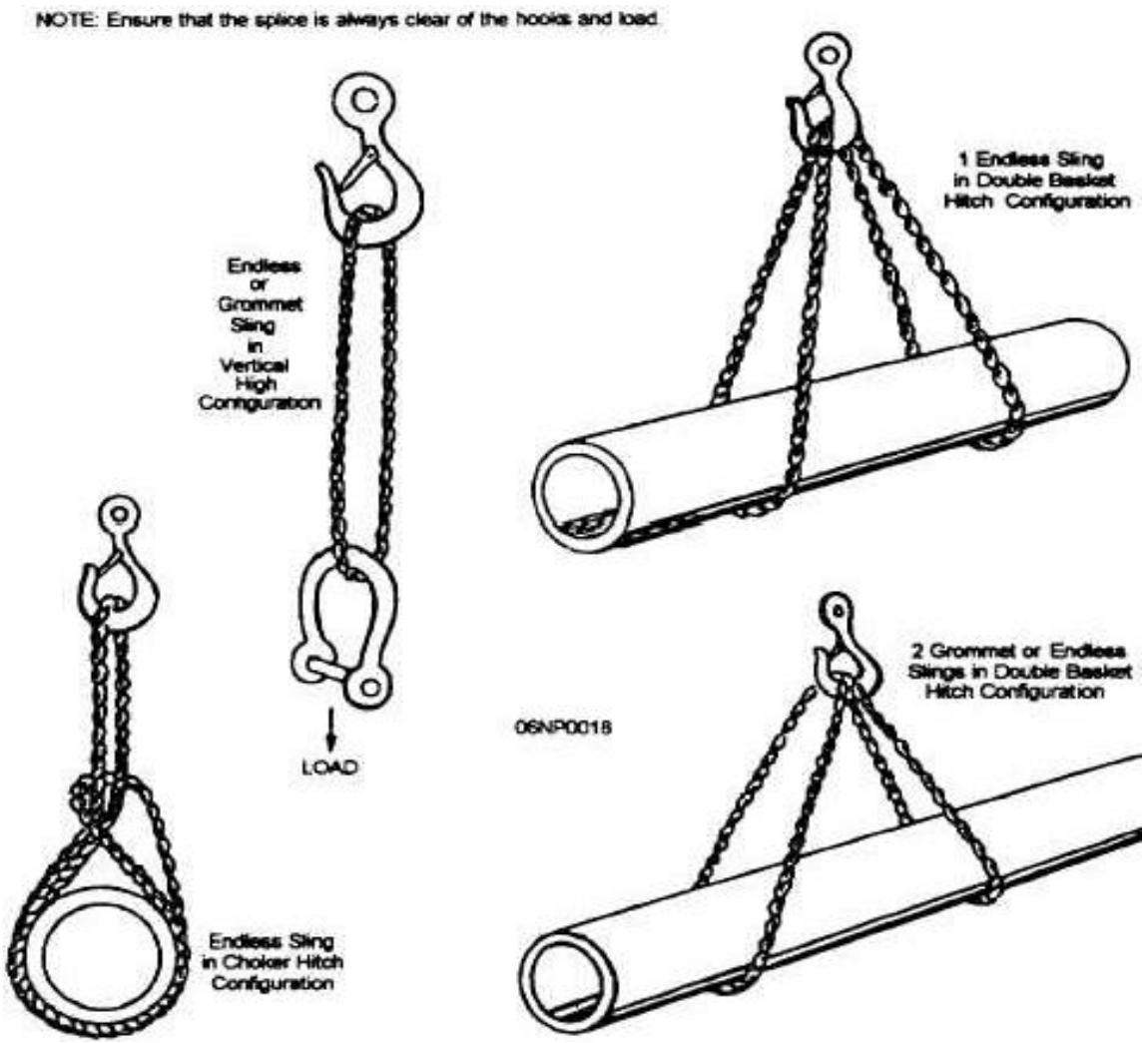


STRAGHT SHANK EYEBOLT



SHOULDER EYEBOLT

The simplest type of sling is the endless sling



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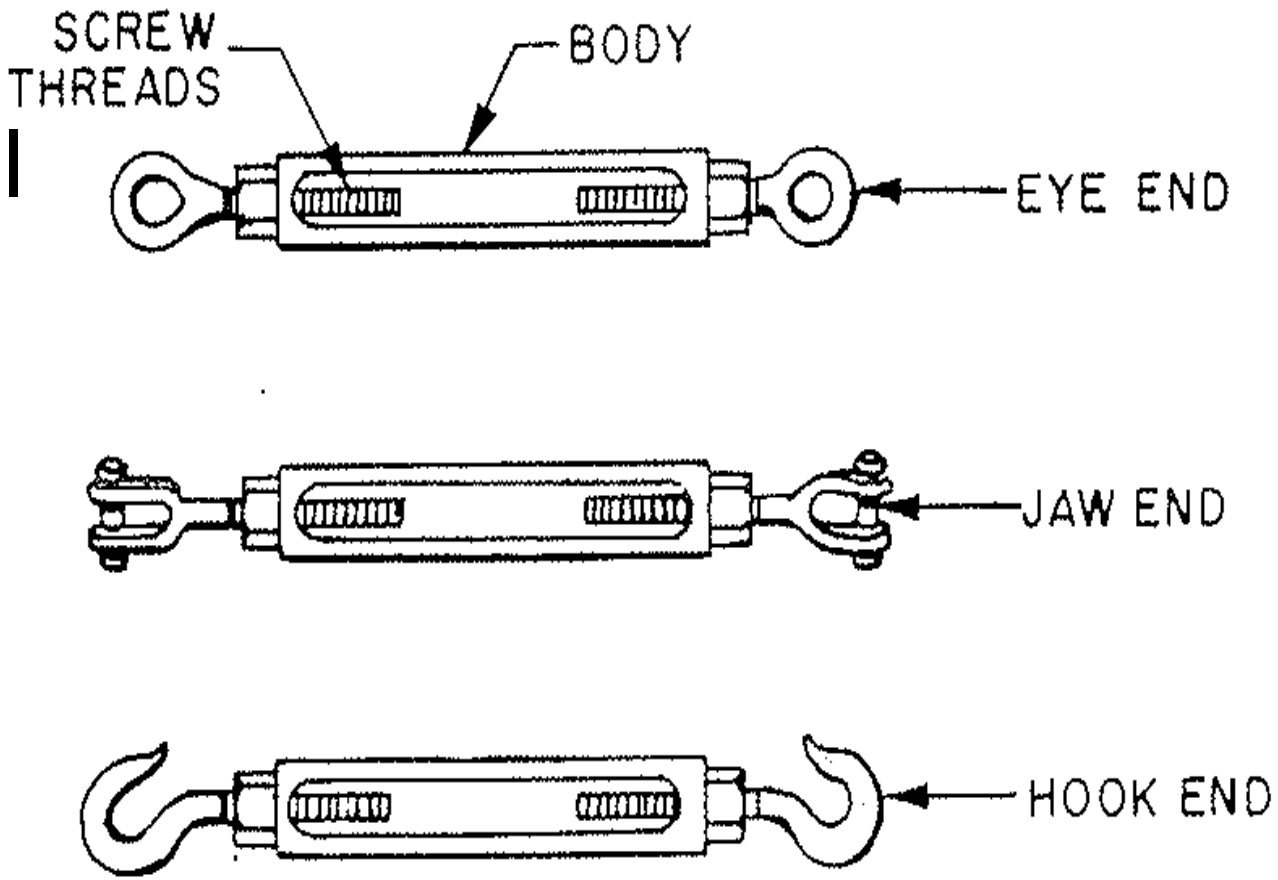
Useful for making small adjustments in the length of a sling



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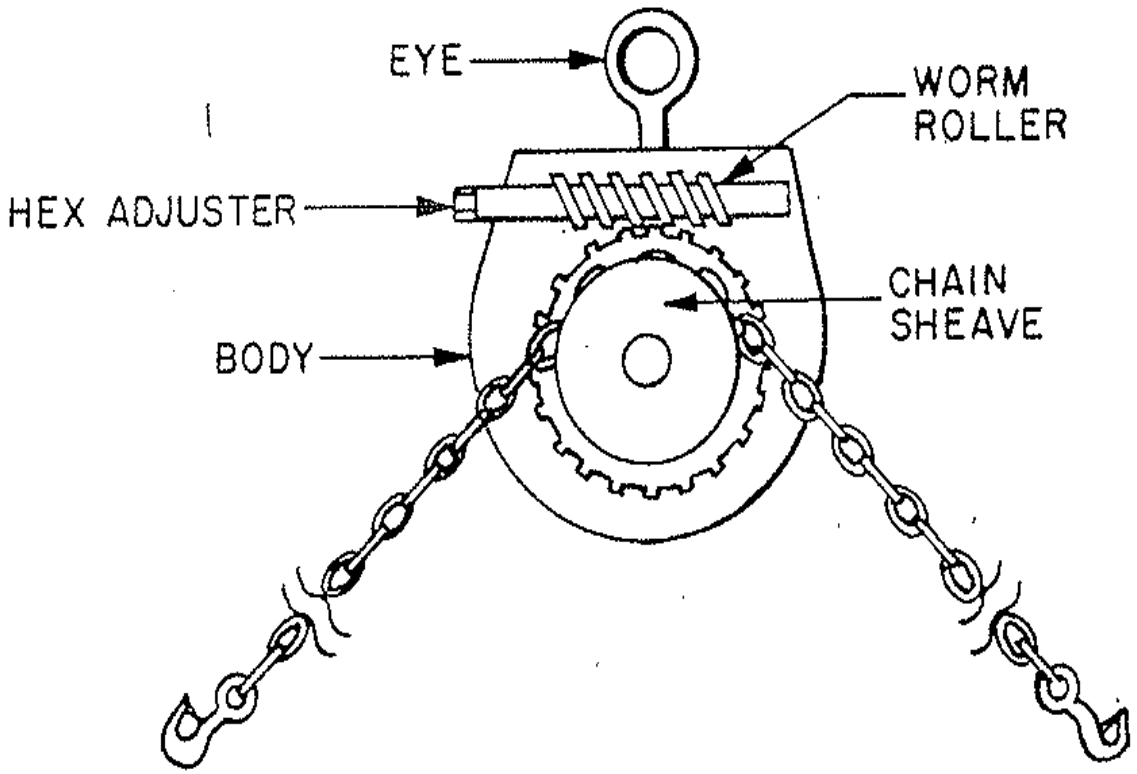
Load Levelers are most useful when fairly large adjustments must be made.



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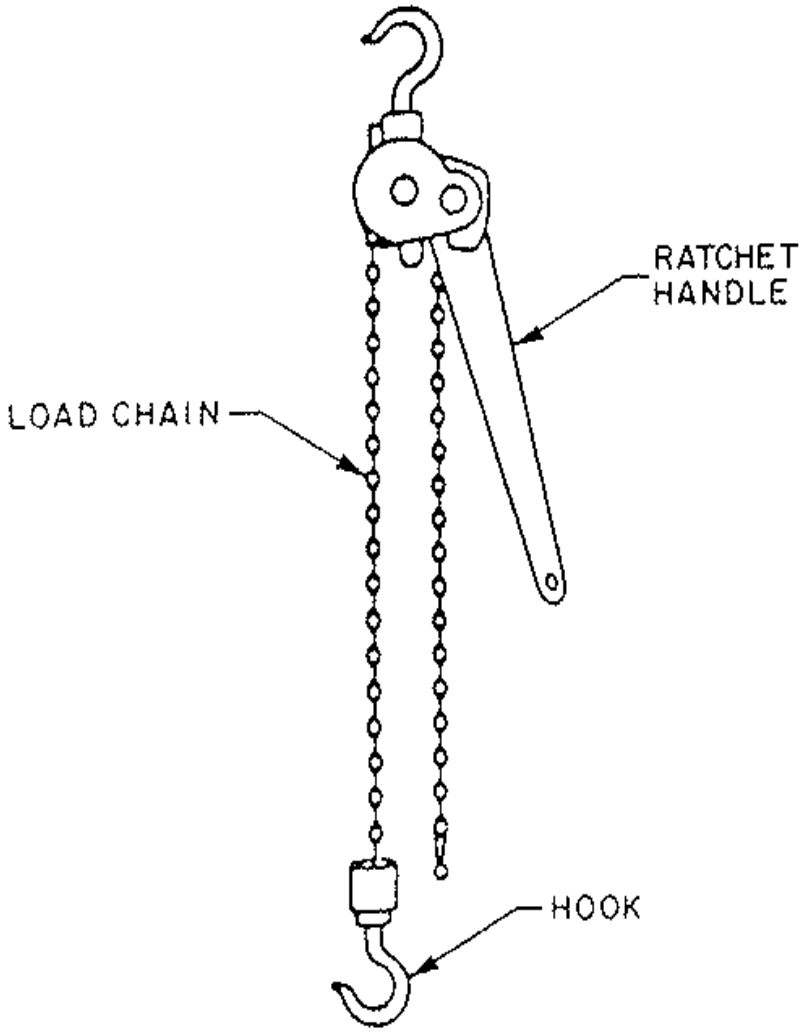
Ratchet Hoist Commonly called a

<u>Come-A-Long</u>



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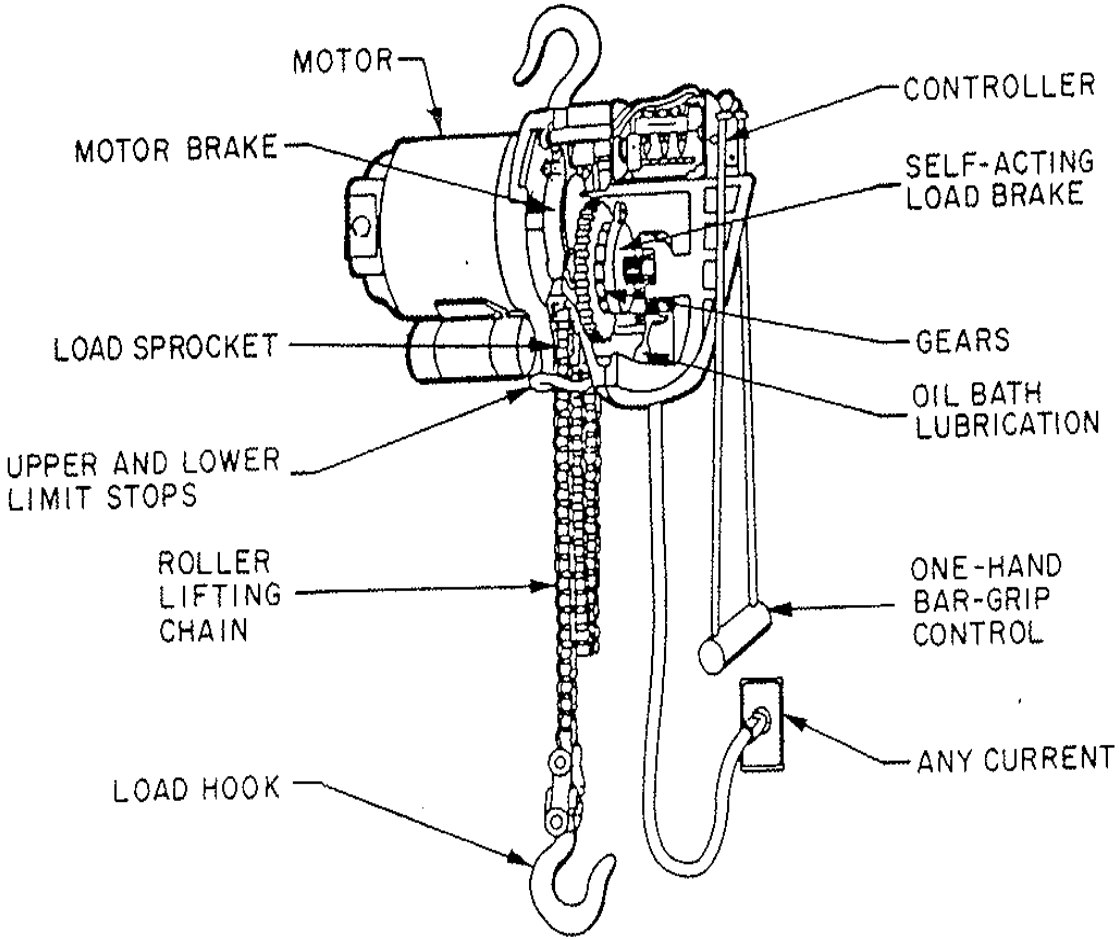
HARRINGTON
2 TON


MOTOR
MOTOR BRAKE
LOAD SPROCKET
UPPER AND LOWER LIMIT STOPS
ROLLER LIFTING CHAIN
LOAD HOOK
CONTROLLER
SELF-ACTING LOAD BRAKE
GEARS
OIL BATH LUBRICATION
ONE-HAND BAR-GRIP CONTROL
ANY CURRENT

Safe Rigging Practices:

- Many accidents are the result of poor house keeping or unsafe rigging practices which can be prevented if the rigging crew follows a few simple rules.

Safe Rigging Practices:

- Never leave debris, tools, or unused equipment lying around in a work area where they can become dislodged and fall during a lift or become a trip hazard on the floor.

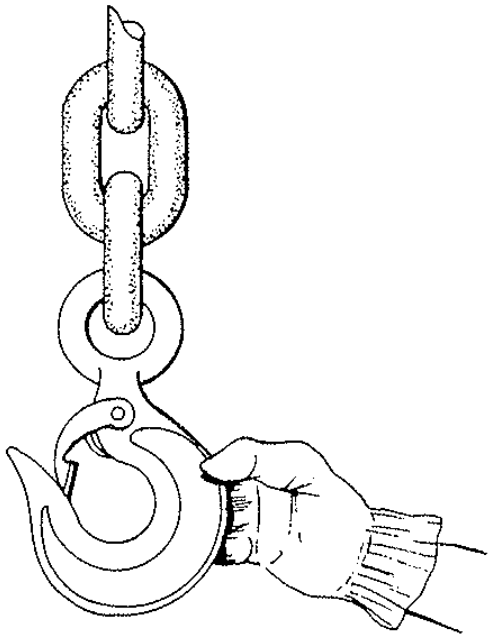
Safe Rigging Practices:

- Only one person can be in charge. Although rigging jobs often involve several people who must work together, the responsibility for safety and the assignment of jobs must fall upon one person.

Safe Rigging Practices:

- Often it is necessary to hold a hook in place by hand, while slack is taken up by a hoist or crane. In this situation riggers must be careful to keep fingers from between the hook and its slings as tension is applied.

Correct way to handle a hook



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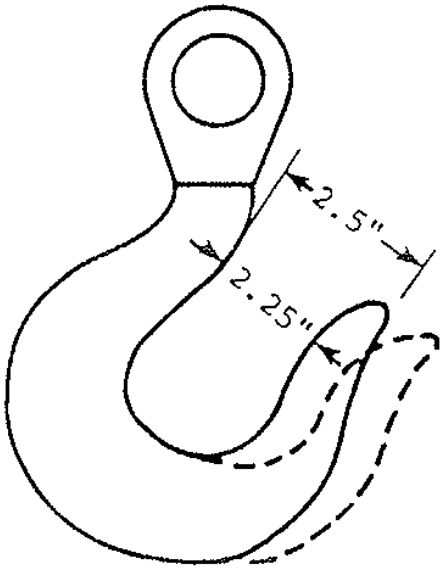
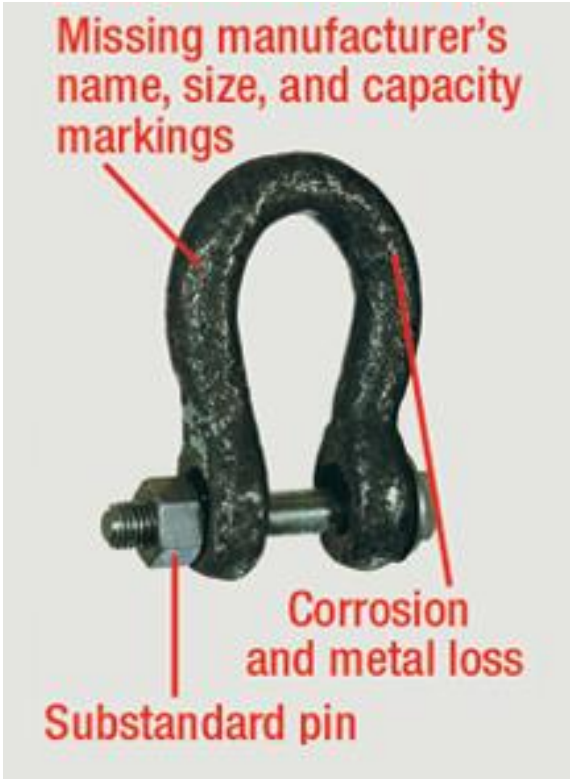
Inspect hooks for spreading and twisting



SPREADING
(a)

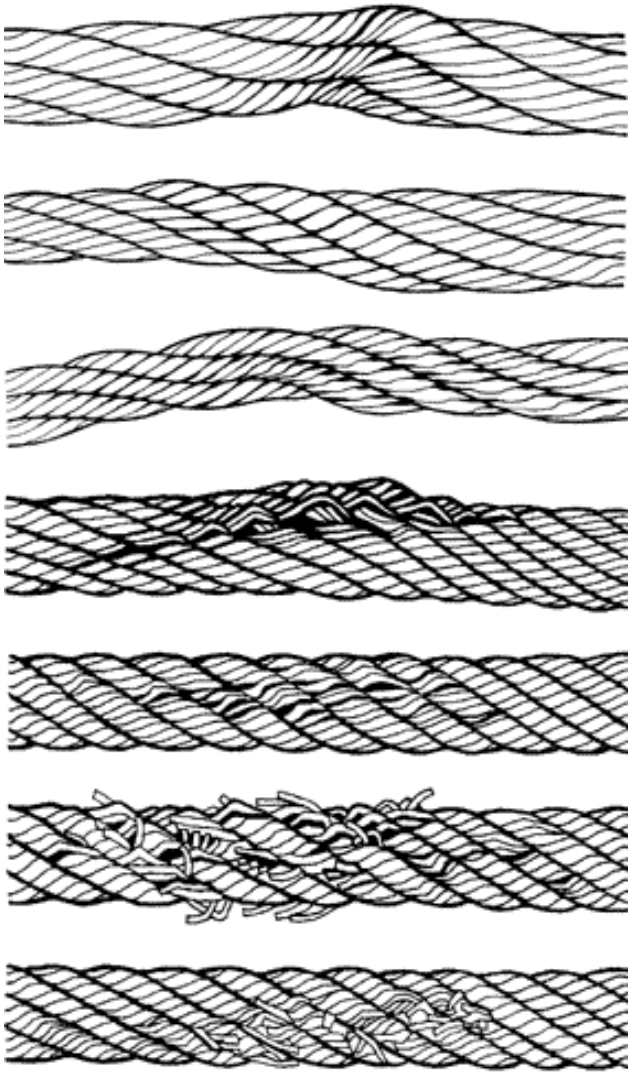

TWISTING
(b)

I.P.V.R.


Missing manufacturer's name, size, and capacity markings
Corrosion and metal loss
Substandard pin


Severe metal loss

Torn cloth slings and worn wire rope.



THINK

PLAN

THE LIFT

WORK

SAFE

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QUESTIONS?