DOCK AND VESSEL MOUNTED

PEDESTAL CRANE OPERATOR SAFETY TRAINING

WWW.HARDHATTTRAINING.COM
“When anyone asks me how I can best describe my experience of nearly forty years at sea, I merely say uneventful….(I)n all my experience I have never been in any accident of any sort worth speaking about. I have seen but one vessel in distress in all my years at sea…I never saw a wreck and never have been wrecked, nor was I ever in any predicament that threatened to end in disaster of any sort.”

Captain E. J. Smith - 1907

Have someone read the following quote.
5 years after that quote, Captain E. J. Smith sank.

Ask the class what are some of the factors that contributed to the Titanic sinking. You will probably hear such comments as:

• It was a “unsinkable” ship and they became overconfident
• They were trying to break the record for trans-atlantic crossing
• Because it was an unsinkable ship they did not need as many life boats
• Icebergs were generally not spotted that far south that time of year
OBJECTIVE: Familiarization of the components on a pedestal mounted crane.
1. Point out each component and function.
2. Note that this drawing is a cut away of the crane showing internal components.
3. Note that certain components are the same on a boom truck and rough terrain crane.
4. A more detailed explanation of each function will be discussed in a later slide.
OBJECTIVE: Familiarization of the basic components of a knuckle crane.
1. Point out the differences between knuckle boom and straight boom cranes.
2. Indicate how the knuckle hinge is particularly susceptible to side loading.
The swinging boom type of crane is the simplest crane found on most docks.
OBJECTIVE: Familiarization of the basic components of a knuckle crane.

Whether the crane is the straight boom or knuckle boom type, the components are very similar.

- The pedestal, which is mounted to the dock, is typically a cylindrical tube or a box. The height varies depending on the crane’s usage.
- The turret is mounted on a bearing which is mounted to the pedestal. The boom, lift cylinder(s) and swing motor(s) are mounted on the turret.
- The wire rope is wound on the winch which is normally mounted on top of the boom.
- Lift cylinder(s) raise and lower the boom.
- The boom tip houses the sheaves on which the wire rope runs.
- The hook is attached to the end of the wire rope by various methods.
OBJECTIVE: Familiarization of the basic components of a swing boom crane.

The swinging boom type of crane consists of a fixed length boom that is mounted on a vertical mast. The boom cannot be raised or lowered. This feature limits the movement of a load to a circular pattern at a fixed radius. The vertical mast is fixed in length as well and the base has a bearing of some type and is mounted to the dock. Crane rotation is typically manual, by means of bar or pipe which is pushed or pulled to rotate the crane. The winch used to hoist the load is often electrically powered, with the up / down control mounted on the end of an electrical cord.
The operator is responsible for inspecting the crane prior to using it.

OBJECTIVE: Review the parts of the crane that need to be inspected.
1. Note similarities and differences between this crane and vehicle mounted cranes.
2. Indicate who is responsible for performing these inspections.
3. Indicate how the inspections are to be recorded.
OBJECTIVE: Point out specific areas of the crane to be inspected.

1. This drawing can be used to show the general location of components for all three types of cranes.

2. Refer back to slides 2 & 3 if necessary to point out additional inspection areas.
OBJECTIVE: Swing boom crane mounting methods.

Check mounting methods to ensure that bolts are not loose and that no damage to the mounting or the dock is apparent.
OBJECTIVE: Review operator’s responsibilities.

Prior to a crane being used, the crane operator is responsible for conducting a basic inspection of it. The operator is also responsible for investigating other deficiencies that may be apparent.
OBJECTIVE: Review crane components to be inspected.

Look up inside the pedestal from time to time for leaks, lubrication and condition of hoses.
OBJECTIVE: Review crane components to be inspected.

Hydraulic fluid coming from the end of the boom lift cylinder is normally a result of worn seals. All leaks need to be reported to whoever is responsible for the crane. Typically, minor weeping of hydraulic fluid does not render the crane inoperable, but if fluid is dripping heavily, the crane should not be used.

Hydraulic hoses are often chafed when they move back and forth over metal edges. The edges do not necessarily need to be sharp to cause chafing and eventual hose failure. Report any damage to the responsible individual. If the wire mesh below the outer rubber jacket of the hose is exposed, the hose needs to be inspected and repaired by a competent person. Any hydraulic fluid found leaking from a hose compression fitting is a sign of potential serious failure and the crane should not be used until repairs are made.

Leaking hydraulic fittings need to be repaired prior to a crane being used.
OBJECTIVE: Familiarization of the design of the turret rotation bearing.

1. Point out how the balls are what keeps the inner and outer races together.
2. Allowable wear for most 3/4” balls is .055 inches. Need to check with the manufacturer for specific specifications.
3. Note importance of proper lubrication.
4. Wear can be identified by rocking the boom up and down when positioned in its most vertical position.
OBJECTIVE: Review causes of damaged wire rope.

Before operating a crane and during operation, the winch should be inspected to ensure that the wire rope is smoothly wrapping onto the winch drum. If re-spooling is necessary, raise the boom up high and lower the hook until the improperly spooled area is cleared. Then raise the hook and monitor the winch to verify proper spooling.

The primary cause of loose and uneven wraps of wire rope on a winch drum is continuing to unwind the winch after the load has been set down. When lowering a load, stop paying out the wire rope as soon as the line becomes slack. If the hook must be placed on the ground, lower the hook to the ground, stopping just before the hook touches it. Continue to lower the hook with a boom down function. Boom functions are not possible for swinging boom cranes.
OBJECTIVE: Use this slide to discuss the parts of the crane that have not been covered yet.

1. All welds need to be checked for cracks.
2. The boom needs to be extended and check for smoothness of operation. Any binding or difficulty in extending could be the result of damaged boom sections.
3. Any hydraulic leaks need to be investigated and repaired. Check the hoses for chaffing and damage.
4. The slide pads can be checked for proper alignment by extending the boom completely and lowering the tip toward the ground. Move the boom tip back and forth by pushing on it and observing how much the boom sections move inside each other. Excessive movement will require the slide pads to be adjusted or replaced.
5. The boom tip needs to be checked to deformation and twisting.
OBJECTIVE: Review the inspection of the sheaves.

1. Check for bearing wear and lubrication.
2. Check the flanges and treads.
3. Show how to use a sheave gauge.
4. Sheaves can only be repaired per manufacture’s procedures.
OBJECTIVE: Review hook requirements.
Most pedestal cranes are fitted with one of the above types of hooks.

The safety latch type of hook is equipped with a flapper that is spring loaded and keeps the latch closed. Latches are often damaged or missing. If a latch is missing or deformed, or the spring is missing, the hook is not to be used. The mouth of a hook should not be sprung open, deformed or bent.

Any damage identified should be reported to the person responsible for the crane.
OBJECTIVE: Review hook requirements.

The self-closing type allows the hook to be opened with one hand. The spring loaded thumb latch should work freely, and the spring should lock the latch to prevent the hook from opening. Hooks with broken springs and latches should not be used. Worn hinge and latch components should not allow a hook to be opened more than a ¼ of an inch. A hook should not be used if it is bent, twisted or shows any other sign of damage.
OBJECTIVES: How to identify different types of wire rope problems.

1. Note the differences between fatigue “failures” and fatigue “breaks”.
2. Kinked rope is common on small cranes because of over running the wire rope when winching down.
3. Refer to information sheet on this.
OBJECTIVES: How to identify different types of wire rope problems.

Wire rope should be inspected for damage prior to operating a crane.

Crushing is the primary cause of wire rope damage on cranes. The main cause of crushed wire rope is lifting loads when the rope is crossed over itself on the winch drum. This type of damage can be eliminated by keeping the wire rope spooled correctly at all times.

Improper spooling can also cause broken wires in strands. Any broken wires found during inspection need to be reported to whoever is the responsible for the crane.

Wire rope that has been kinked, crushed or shows other signs of damage needs to be evaluated by a competent person before it is used.
CRANE CONTROLS

Crane controls need to function smoothly and without excessive play in the control linkage. All controls need to be properly labeled including function and direction of motion.

OBJECTIVES: Inspection of crane controls.

Before picking a load with a crane, test each of the crane controls to verify that all are operating correctly and smoothly. Each control is required to have a label indicating its function and the direction of motion for that function. When inspecting controls, make sure that all lever pins are securely fastened.
OBJECTIVES: Inspection of crane controls.

The electrical controls for a winch on a swinging boom crane need to be free of damage, and the up / down control labels need to be legible. The electrical cable entering the control housing needs to be free of chafing and properly sealed to prevent water from entering the unit.
OBJECTIVE: To show how the stress on the crane can increase by the movement of the load.

How fast the load motion is started or stopped determines how much more dynamic loading will take place.

When starting to lift a load, the crane must exert additional energy to put the load in motion. The amount of additional energy is dependent on how fast the load is accelerated. Fast acceleration will require a significant more effort than slow acceleration.

Stopping a load that is in motion also requires additional energy. Sudden stops can place significant stresses on the crane which can result in structural failure.
OBJECTIVE: How to determine gross load.

1. Include the weight of blocks, hook, overhaul weights.
2. All rigging must be included.
3. Load is considered to be anything below the tip of the boom.

For all cranes, the gross load is considered to be anything hanging from the boom tip. This includes the weight of the wire rope, hook, slings, lifting hardware and the load itself. For most dock cranes, the weight of the hook and wire rope are not significant enough to affect the overall capacity of the crane. These can therefore be excluded from the gross load calculation. Other attachments used to lift the load should be included in determining the gross load.
OBJECTIVES: Review improper uses of cranes.

Cranes are designed to move loads vertically up and down. When a load is dragged by swinging the boom, extensive stress is applied to the boom, turret and swing drive components. This results in severe wear and eventual crane failure. At no time should the crane be used to drag any load in any direction.

Side loading of a crane can also occur when lifting a large object in high winds. This practice should be avoided to prevent crane side loading and creating unsafe load handling conditions.
OBJECTIVES: Review improper uses of cranes.

Never intentionally side load the crane by yarding or dragging a load on the ground. This could seriously damage the boom or swing mechanisms on the crane. Knuckle booms are particularly susceptible to damage from this practice. This puts tremendous strain on the pinion gear of the swing motor which over time could fail.
OBJECTIVE: Review the steps in determining lift capability.

The lift capacity of a crane is dependent on several factors. The maximum load that a crane can lift is often limited by the safe working capacity of its wire rope. Cranes used in maritime applications use a 5:1 safety factor for the wire rope. Therefore, a wire rope with breaking strength of 25,000 lbs. has a maximum safe working capacity of 5,000 lbs. Regardless of the lift capacity shown on a crane’s load chart, the maximum that the crane can safely pick will be the safe working capacity of the wire rope.

The radius, or distance a load is from the crane, also affects the crane’s lift capacity.

With these pieces of information, the load chart can be consulted.
OBJECTIVES: Review the use of the load capacity chart.

A load capacity chart is used to determine the maximum capacity of a crane for a given crane setup.

Load capacity charts for telescopic cranes have two sections: One for boom retracted, and one for boom extended. When the boom is fully retracted, use the **Boom Retracted** portion of the load capacity chart. When the boom is extended, regardless of how far it is extended, use the portion of the chart titled, **Boom Extended**.

Knowing either the boom angle as read from the boom angle indicator or knowing the distance from the crane to the load or radius, the maximum allowed lift capacity can be determined.

If the measured boom angle or radius falls between given values on the load chart, the capacity is limited to the lower of the two given values.
OBJECTIVE: To emphasize the importance in understanding all the elements of the lift.

1. Note all obstructions.
2. Need to limit access to the area of the lift and placement.
3. Restrict the movement of vehicles and personnel through the lift area.
4. Note location of the power lines.
5. Evaluate the load.
6. How long can the area be closed.
OBJECTIVE: To understand the importance of knowing the nature of load.
1. Weights are often unknown or inaccurate.
2. The size and shape of the load needs to be assessed to determine rigging and crane requirements.
3. The center of gravity is often unknown but directly affects the stability of the load.
4. Assessing the load will be covered in more detail further on during the training.
OBJECTIVE: To emphasize that the load needs to be properly rigged before attempting a lift.
1. Determining how the load will be rigged is essential for a safe lift.
2. The selection of the type of hardware is dependent on the load and were it is going.
3. Rigging needs to be selected to prevent damage to the load and the lifting hardware.
OBJECTIVE: To illustrate the importance in evaluating where the load will be picked.

1. Everything needs to be considered prior to starting the lift.
2. Allow sufficient time to preparing for and make the lift.
3. The crane operator and the riggers need to confer on difficult lifts.
OBJECTIVE: To emphasize the importance in checking out the placement area.

1. Assess the placement area to assure that the load can be safety moved into place and set.
2. Review each point on the slide and give examples as appropriate.
HAND SIGNALS

- SWING
- STOP
- DOG EVERYTHING

- FLOAT IN
- KNUCKLE
- FLOAT OUT

- WIRE DOWN
- WIRE UP
- TELESkop IN SLOWLY

- BOOM UP
- BOOM DOWN
- TELESCOPE IN, TELESCOPE OUT

- EMERGENCY STOP

SAMPLE

WWW.HARDHATTRAINING.COM
The “wire down” signal is made by pointing your index finger down and moving it in a wide circular motion.

Remember, the crane operator needs to be able to distinguish between all of the different hand signals. Often you will see a signal person point his hand down and rub his fingers together like he a chef season some some hot dish in the skillet. If he has a glove on and the lighting is not optimal it would be very difficult to know that he wanted you to wire down.
The “wire down slowly” signal is made by pointing your index finger down and moving it in a wide circular motion above the palm of your other hand. Again, the signal is clear and can be seen from a distance.
The “wire up” signal is made by pointing your index finger up and moving it in a wide circular motion.
The “wire up slowly” signal is made by pointing your index finger up and moving it in a wide circular motion below the palm of your other hand.
The “boom up” sign is given by extending your arm with the fingers in and the thumb pointing up.
The “boom down” sign is given by extending your arm with the fingers in and the thumb pointing down.
The sign for “swing” is given by pointing with one or both arms in the direction you want the load to travel. Be sure to keep your thumb tucked so as not to look like you want the operator to boom up.
On knuckle cranes, you may need to show which boom you want to have moved up.
The sign for “telescope in” is holding both hands out with thumbs pointing in. This sign can also be used on non-telescopic knuckle cranes for “knuckle in”. In essence it does the same thing. It moves the load toward the operator.
The sign for “telescope out” is holding both hands out with thumbs pointing out. This sign can also be used on non-telescopic knuckle cranes for “knuckle out”. In essence it does the same thing. It moves the load away from the operator.
This is the sign for signaling riggers that only have one hand free because they are active in controlling the load with the other hand.

The sign is made by pointing the thumb in the direction you want the boom to telescope. To “telescope in” you would point your thumb toward the operator and to “telescope out” you would point your thumb toward yourself.
HAND SIGNALS

Stop

The stop is given by extending your arm and bringing it across your body in one quick motion.

(It is not recommended that you use the common stop signal of clinching your hand and raising it above your head. This is not an easy signal to see a far distances or dim lighting.)
The “emergency stop” signal is given by crossing your arms in front of your and bringing them out to your sides. This can be done several times in succession until the operator does indeed stop. This signal is internationally know and can be given by anyone who might notice something amiss.

Do not use this signal for your normal stop signal.
The ‘dog everything’ hand signal means for the operator to not perform any operation until the signal person gives the next signal.
This signal is a two-in-one signal basically telling the operator to float the load in or towards the operator. This can be done by booming up and wiring down at the same time. It can also be accomplished by telescoping in and wiring up.
This signal is a two-in-one signal basically telling the operator to float the load out or towards the signal giver. This can be done by booming down and wiring up at the simultaneously. It can also be accomplished by telescoping out and wiring down simultaneously.
### MAKING THE LIFT

- Review the lift scenario with the operator, riggers and signal person
- Attach taglines when necessary
- Position signal person within visibility of the load and operator
- Begin by lifting the load **slowly**
- Re-check the boom angle indicator to assess radius increase
- Keep load as low as possible when moving it
- Swing **slowly** to avoid swing out.
- Avoid erratic booming
- Follow signal and stop operation when uncertain
- Lower load **slowly**

**OBJECTIVE:** Review the basics of making a safe lift.

1. Discuss each item with examples.
2. Ask participants to add any additional items to the list.
CRANE SAFETY

- Avoid two-blocking the crane
- Do not leave the crane with a suspended load
- Rig the crane with sufficient parts of line for the load
- Always have a minimum of three wraps of cable on the drum
- Monitor the winch to make sure it is spooling correctly
- Do not lift loads over personnel
- Lift one load at a time

OBJECTIVE: To review the basics of crane safety.
1. Review each item and have the class comment on each.
2. Ask participants for any additional items that could be added to the list.
OBJECTIVE: To discuss the inspection of wire rope slings.

1. The inspection criteria for wire rope applies to slings.
2. Use a sling as an example to discuss the areas to inspect.
Example of wire rope sling capacity tag
OBJECTIVE: To discuss how to inspect chain slings.

1. Chain length should be recorded when the chain is new and then subsequent measurements will disclose stretch due to overloading.

2. Review the various causes for chains being removed from service.
OBJECTIVES: Inspecting synthetic slings for damage.

This page and the next two pages show different types of damage for which synthetic flat slings should be removed from service. These slings need to be inspected prior to each use.
SLING INSPECTION

KNOTS IN SLING

WELD SPLATTER DAMAGE

HEAT DAMAGE

SAMPLE
SLING INSPECTION

ILLEGIBLE DATA TAG

BROKEN STITCHES

EXPOSED RED YARNS

DOCK AND VESSEL MOUNTED CRANE

WWW.HAR DHATTRAINING.COM
OBJECTIVE: Discuss basic design and inspection of shackles.
1. Use only load rated shackles.
2. Review the examples on the slide for inspecting the shackles.
OBJECTIVE: Show the proper load attachment to shackles and reductions that need to be considered.

1. Use a shackle to demonstrate the points made in the slide.
2. Review the side loading reduction chart.
3. Discuss where slings and hooks should be attached to the shackles.
4. Point out the potential ways the pin can be unscrewed by the load and how to avoid it.
Shackles symmetrically loaded with two leg slings having a maximum included angle of 120 deg. can be utilized to full Working Load Limit.
OBJECTIVE: Discuss the proper use of eyebolts.

Unshouldered eyebolts are to be used only for pulls inline with the shank of the bolt. They are not designed for angular pulls which could result in failure. Shouldered eyebolts may be used in angular pulls as long as the pull is in line with the plane of the eye. Angular pulls result in a significant reduction of the eyebolts capacity. Review the load reduction chart for shouldered eyebolts.

Proper seating and the pull directions limits its capacity.

### EYE BOLTS

<table>
<thead>
<tr>
<th>DIRECTION OF PULL</th>
<th>ADJUSTED WORKING LOAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Line</td>
<td>Full Rated Working Load</td>
</tr>
<tr>
<td>45 Degrees</td>
<td>30% of Rated Working Load</td>
</tr>
<tr>
<td>60 Degrees</td>
<td>25% of Rated Working Load</td>
</tr>
</tbody>
</table>
OBJECTIVE: To show how the stresses in the load and the slings increase as the sling angle decreases.

When the sling angle decreases, the stress in the slings will increase. Also, the stress imposed on the load referred to as compression loading will increase significantly. The load has to be sufficiently strong enough to resist this loading or crushing may occur.
OBJECTIVE: To demonstrate how the load in the slings increases as the sling angle decreases.

Ideal sling angle is 60 degrees. This minimizes the stress on the slings and the load itself.

A 60 degree sling angle exist if the distance between the pick points is equal to the length of the slings being used to make the lift.

Note how the stress increases as the sling angle decreases. For each degree decrease in the sling angle, the stress increase much more rapidly.
OBJECTIVE: To show how the sling angle affects the stress on the sling.

1. These formulas only work when the sling legs are the same length.

2. Show how to do the calculations by completing a few examples.
OBJECTIVES: Review the importance of proper palletizing the load.

Loads that are to be lifted by a crane need to be properly prepared for the lift and lifted correctly.

Prior to lifting a load, the operator is responsible for ensuring that the load is secure and will not fail during the lift.

Cargo placed on pallets needs to be properly secured. Loose items need to be fastened to a pallet to prevent them from falling.

Heavy items should be placed at the bottom of the load and as close to the center as possible.
OBJECTIVES: Review proper handling of cargo.

Boxes of frozen product can become slippery as frost forms on the boxes when exposed to warmer moisture. A stable load in the freezer hold may become unstable when it is hoisted onto a dock.
OBJECTIVES: Review proper handling of cargo.

Boxes stacked on pallets need to be placed so that upper boxes help to lock the lower ones in place. This is done by placing boxes so that the edges between the upper layers are not directly above the edges of boxes on lower layers. The above diagrams show various ways to properly stack boxes on pallets.
OBJECTIVES: Review proper handling of cargo.

Box edges from layer to layer should not line up. When they do line up as shown above, the layers are not locked together and the whole load can fall from the pallet when moved.
OBJECTIVES: Review proper handling of cargo.

Cargo nets are used to handle loads of various sizes. Like other load handling equipment, these need to be load rated. The Safe Working Load needs to be on the cargo net indicating how much weight it can hold. Prior to use, the net needs to be inspected. If any defects are found, the net should be removed from service.
OBJECTIVES: Review proper handling of cargo.

Cargo nets need to be properly loaded to avoid losing a load. The sides of the net should be higher than the cargo being lifted. When lifting a load, make sure that the net does not snag on anything.
OBJECTIVES: Review proper handling of cargo.

Pallet bars are used to lift pallets of cargo to and from vessels. Prior to use, these bars need to be inspected for damage. Any discrepancies found need to be corrected or the hardware removed from service. Pallet bars also need to be load rated and this load capacity designation needs to be on the pallet bar set.
OBJECTIVES: Review proper handling of cargo.

Special care needs to be taken when handling gas cylinders. NEVER lift a gas cylinder by the valve or valve protection housing.

Gas cylinders can be lashed to pallets or placed in cargo nets or there are special gas cylinder cages and bags designed for lifting cylinders.
OBJECTIVES: Review proper handling of cargo.

When placing cargo on the deck of a vessel, the crane operator needs to be aware of where people are and stop an operation if any person gets himself into a dangerous place. No individual should attempt to stop cargo that is swinging. The crane operator is responsible for controlling the load and keeping it from swinging. Tag lines should be used to help control a load rather than any person coming in contact with the load.
OBJECTIVES: Review proper handling of cargo.

Lifting bulky loads should not be attempted, all at one time if there is any doubt about safety. Rather, break the load apart if necessary and lift the parts individually. This will ensure a safe lift.