

# Crane Maintenance

## **What should you check for when inspecting a crane before maintenance?**

- Lower hoist to unload rope sheaves.
- Unwind all wire rope from the hoist drum to expose all parts of a rope, making sure that the rope does not rewind in the reverse direction.
- Inspect sheaves, sockets, dead-ends, thimble joints, and all wire rope hardware.
- During rope changes, check the sheaves for worn bearings, broken flanges, proper groove size, smoothness, and contour.
- Inspect all parts of the cable, cleaning wire rope only as required to complete an inspection. Excessive removal of lubrication will lead to damage.
- Re-lubricate rope to prevent corrosion, wear, friction, and drying out of the core.
- Check for ropes that may have been operated dry (unlubricated). Replace dry ropes. There may be hidden damage that is not detected by visual inspection.
- Compare the rope length and diameter with the original dimensions. Lengthening accompanied by diameter reduction is often an indication of interior core defects.
- Visually examine the crane structure for deformed, cracked or corroded members in the structure and boom. Check for loose bolts or rivets. Check for excessive wear on brake and clutch system parts.
- Check for deterioration or leakage in air or hydraulic systems.
- Check all control mechanisms for poor adjustment or excessive wear.
- Check accuracy of marking on the load/radius indicator over full range.
- Establish a schedule of rope replacement to change wire rope before it breaks. Periodic replacements do not take the place of inspections. If rope breaks or inspections reveal abnormal wire breakage or defects, reduce the time between replacement. Do not make wire rope slings from used wire rope.

## **What are some things to remember when repairing a crane?**

- Take a crane to a location where repairs will least interfere with other cranes.
- Ensure that all controllers are placed in the "off" position, and the main switches are open and locked.
- Place on the switch a standard warning tag stating "DO NOT START." The tag must be filled out and signed
- Place rail stops or make other safety provisions when another crane operates on the same runway.
- Use fall protection equipment.
- Do not carry anything in your hands when going up and down ladders. Items that are too large to go into pockets or belts should be lifted to or lowered from the crane by a rope.
- Prevent loose parts or tools from falling to the floor.
- The area below the crane must be cleared and a barrier erected to prevent injury from a falling object.
- Replace all guards and other safety devices before leaving a crane.
- Remove all stops, tools, loose parts and other material and dispose of them before completing the repair job.
- Enter all service inspections and repairs in a crane log book or file.

# Crane Hitches

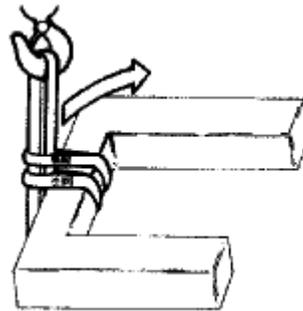
## How should you use a vertical hitch?

- In most cases use more than one sling. A single rope sling load tends to rotate in a twisting action that unwinds cables causing them to weaken.
- Do not use for lifting loose materials, long or unbalanced loads.



## How should you use a turning hitch?

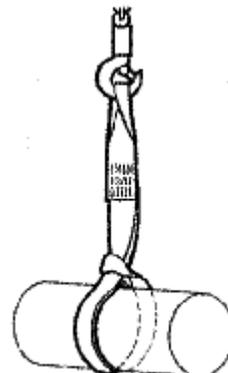
- Use a doubled choker to turn loads.
- Place both sling eyes on top of the load pointing in the direction opposite to the direction of the turn. This sling will remain tight while the load is turning.
- Never use a basket hitch to turn a load.



## How should you use choker hitches?

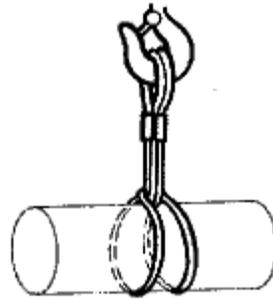
### Choker hitch

- The sling tightens on a load as it is lifted.
- Do not use on loose bundles.
- Use choker hitches at 75% or less of rated sling capacity.



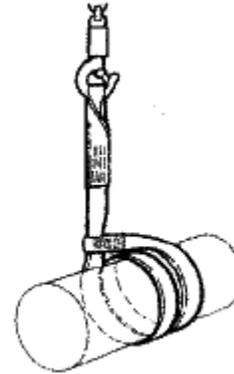
### Doubled choker hitch

- Provides more contact area to secure a load.



### Double Wrap Choker Hitch

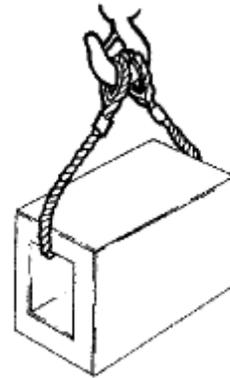
- This hitch compresses the load and prevents it from slipping out of the sling.
- Where overhead space is limited, a double wrapped choker hitch is acceptable.



### How should you use basket hitches?

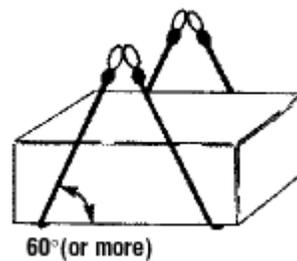
#### Basket hitches

- Provide relatively good control and eliminate the tendency of the load to twist, compared with a vertical hitch.
- Do not use on a load that is difficult to balance.



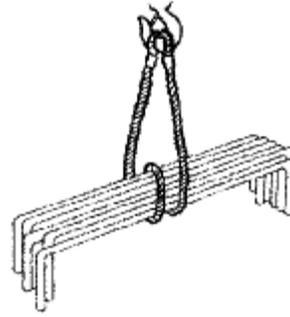
#### Double basket hitches

- Balance loads by keeping slings apart.
- Prevent sling slippage by keeping the angle between the load and sling 60° or more.



### Double Wrap Basket Hitches

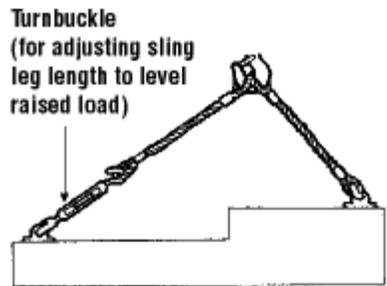
- Provide more contact for handling loose material and pipe.
- Tend to draw the load together.



### How should you use bridle hitches?

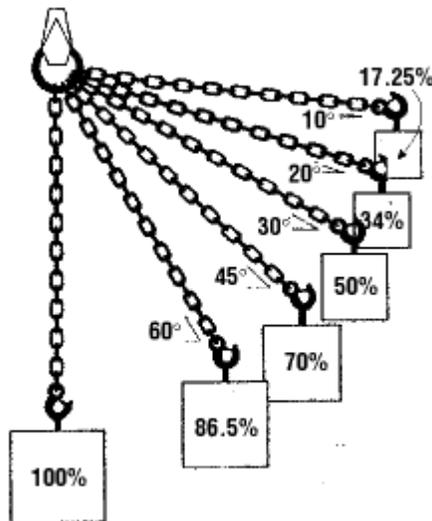
#### Bridle hitches

- Are made of 2, 3 or 4 single leg hitches.
- Are used for hoisting an object that has lifting lugs or attachments.
- Position the hook over the centre of gravity of the load.
- Adjust sling leg lengths with turnbuckles to level raised load.
- Check each sling leg angle to ensure sling is not overloaded.



### How does the angle of hoisting affects a sling load limit?

- The angle affects the working load limit. The smaller the angle, the less load a sling can carry.



## Crane Pre-operation Inspection

What should you check for before operating a crane?

- Rope appearance - lubrication, kinks, breaks, corrosion, reduced diameter, or other signs of wear or damage.
- A rope drum - position of cable in groove tracking, means of anchoring and drum wear or damage.
- Sheaves - alignment of ropes, guides, dead ends, wear in sheave groove.
- Hooks - cracks, twisting, straightening, hook throat opening or other signs of wear or damage.
- Lights - burned out, broken.
- Mechanical parts and guards - loose, bent, broken, and missing.
- Rails - broken, chipped, cracked.
- Wheels - worn (showed by bumpy riding).
- Bearings - loose, worn.
- Brakes - shoe wear.
- Bridge bumpers and a trolley end stop - loose, missing, improper placement.
- Controllers and collector shoes or bars - worn, pitted, loose, broken, or faulty operation.
- A foot walk - condition of the boards, railings, and ladders.
- Gears - lack of lubrication or foreign material in gear teeth (indicated by grinding or squealing).
- A fire extinguisher must be in the crane cab.
- Make sure that no one is on or around a crane before closing the main or emergency switch, even when starting on regular duty.
- Before closing the main switch, make sure that all controllers are in the "off" position.
- Inspect oil only after opening and locking out the main switch.

### **What should you inspect a moving crane for?**

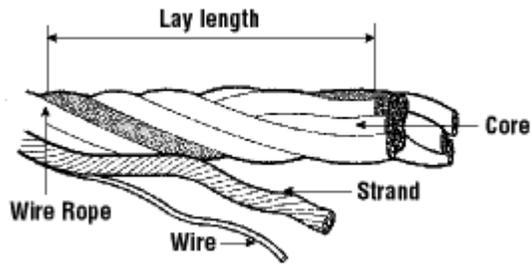
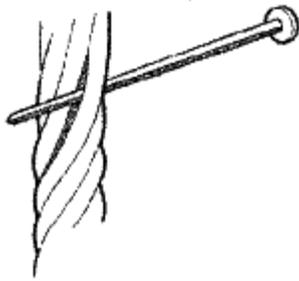
Before lifting any load you should start the crane and inspect it when it is moving

- Smooth play out of wire rope to and from a drum.
- Sheaves turning without binding or jerking as a rope passes over them.
- Proper alignment where ropes enter sheaves.
- Ropes not rubbing on rope sheave guards.
- Rubbing, scraping, or clattering noises during operation.
- Proper operation of controls and brakes.
- Test the limit switch. Slowly raise the hook block with no load attached to the hook. If the switch is defective, make sure the block does not strike the cable drum.

## **Hoist Wire Rope**

### **Who should inspect wire ropes and when?**

- Only trained personnel should carry out an inspection of wire ropes.
- Inspect a wire rope when installing it.
- Inspect wire ropes every working day.
- Keep records of daily inspections.
- Check for abrasions, corrosion, pitting, and lubrication inside rope. Insert a marlin spike beneath two strands and rotate to lift strands and open rope.



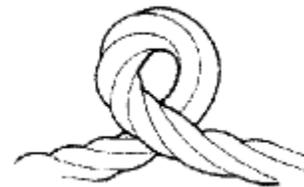
### When should you eliminate the rope from its use?

Assess the condition of the rope at the section showing the most wear. Discard a wire rope if you find any of the following conditions:

- In running ropes (wound on drums or passed over sheaves), 6 or more broken wires in one lay length; 3 or more broken wires in one strand in one lay.
- In pendant standing ropes, 3 or more broken wires in one lay length.
- Wear of 1/3 of the original diameter of individual outside wires.
- Kinking, crushing, cutting or unstranding, bird caging or other physical damaged that has distorted the shape of the wire rope.
- Heat damage (check for burn marks, discoloration of the metal).
- Excessive stretch or sharp reduction in the rope diameter.
- Knots or splices (except eye splices) in a wire rope.

### What can cause a wire rope break?

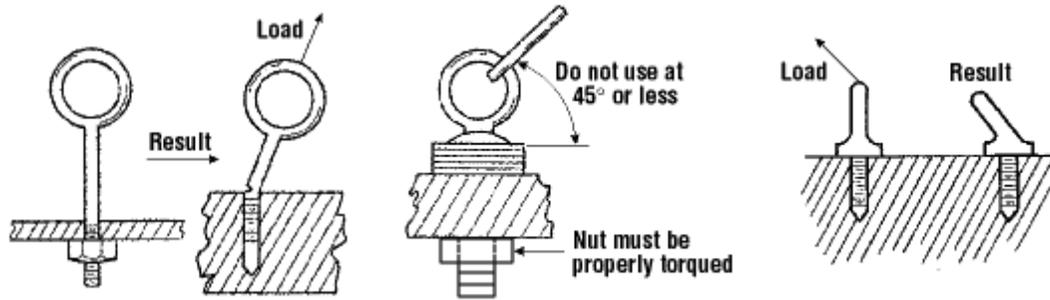
- Wear on areas in contact with hoist sheaves and drums.
- Corrosion from lack of lubrication and exposure to heat or moisture (e.g., wire rope shows signs of pitting). A fibre core rope will dry out and break at temperatures above 120°C (250°F).
- Fatigue from repeated bending even under normal operating conditions.
- Overloading the safe working load limit. Follow manufacturers' charts.
- Mechanical abuse - crushing, cutting or dragging of rope.
- Kinks from improper installation of new rope, sudden release of a load or knots made to shorten a rope. A kink cannot be removed without creating a weak section. Discarding kinked rope is best.



## Lifting With Eye Bolts

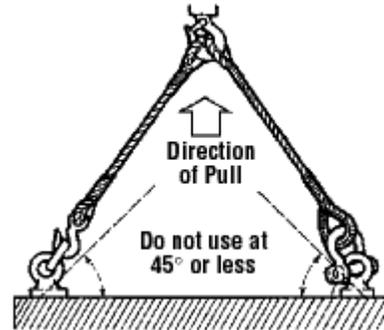
### How should you select the right bolt?

- Use plain or shoulderless eye bolts or ring bolts for vertical loading only. Angle loading on shoulderless bolts will bend or break them.
- Use shoulder eye bolts for vertical or angle loading.



### How should you use eye bolts safely?

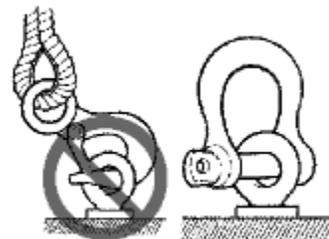
- Orient the eye bolt in line with the slings. If the load is applied sideways, the eye bolt may bend.
- Pack washers between the shoulder and the load surface to ensure that the eye bolt firmly contacts the surface. Ensure that the nut is properly torqued.
- Engage at least 90% of threads in receiving a hole when using shims or washers.
- Attach only one sling leg to each eye bolt.



- Inspect and clean the eye bolt threads and the hole.
- Screw the eye bolt on all the way down and properly seat.
- Ensure the tapped hole for a screw eye bolt (body bolts) has a minimum depth of one-and-a-half times the bolt diameter.
- Install the shoulder at right angles to the axis of the hole. The shoulder should be in full contact with the surface of the object being lifted.

### What should you avoid when using eye bolts?

- Do not run a sling through a pair of eye bolts: this will reduce the effective angle of lift and will put more strain on the rigging.
- Do not use eye bolts that have been ground, machined or stamped.
- Do not paint an eye bolt. The paint could cover up flaws.
- Do not use eye bolts that have worn threads or other flaws.
- Do not insert the point of a hook in an eye bolt. Use a shackle.



## Overhead Crane Operation

### What should you do before moving a load?

- Ensure all loose materials, parts, blocking and packing have been removed from the load before lifting.
- Remove any slack from the sling and hoisting ropes before lifting the load.
- Make sure that the lifting device seats in the saddle of the hook.

### How should you move loads safely?

- Move crane controls smoothly. Avoid abrupt, jerky movements of the load.
- Follow signals only from one slinger in charge of the lift, except a stop signal.

- Make sure everyone is away from the load before hoisting. Sound a bell, siren or other warning device and start to hoist slowly.
- Ensure nothing links or catches on the load while raising it or traveling.
- Ensure that nothing obstructs the movement of a load.
- Keep the load under control when lowering a load. If the braking system stops working, the load can usually be lowered by reversing the hoist controller to the first or second point.
- Stay in a crane cab during power failure. Attract attention and wait for help.

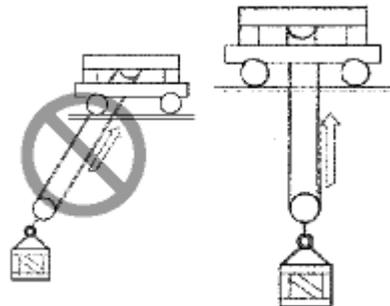
### **What should you do before leaving the crane?**

- Remove the load hanging on crane hooks.
- Raise all hooks to a mid position.
- Spot the crane at a designated location.
- Place all controls in the OFF position.
- Open the main switch to the OFF position.

### **What should you avoid when operating an overhead crane?**

- Do not carry anything in your hands when going up and down ladders. Items that are too large to go into pockets or belts should be lifted to or lowered from the crane by rope.
- Do not operate a crane if limit switches are out of order, or if cables show defects.

- Do not lower the blocks below the point where less than two full wraps of cable remain on the drum.
- Do not attempt lifts beyond the rated load capacity of a crane or slings.
- Do not lift a load from the side. Centre the crane directly over the load before hoisting to avoid swinging the load.



- Do not allow anyone to ride on a load or hooks.
- Do not leave slings dangling from the load hook. Have sling hooks placed on the sling ring when carrying slings to the load.
- Do not raise loads higher than necessary to clear objects.
- Do not pass a load over workers.
- Do not reverse a motor until it has come to a full stop except to avoid accidents.
- Do not walk on the crane runway.
- Do not leave suspended loads unattended

## **Slinging on Overhead Crane Hooks**

### **How should you sling a load onto a crane hook?**

- Make clear signals according to standard signals. Refer to "[Materials Handling - Crane and Hoist Hand Signals](#)" for examples.
- Signal the crane operator from only the one slinger who is in charge of lift. The only exception is a stop signal. (A slinger or rigger is the person who hooks loads onto cranes using various types of slings.)
- Determine the weight of the load to be lifted.

- Select the right sling for each job using the manufacturers' tables. A slinger must be familiar with these tables showing the safe capacities of slings.
- Inspect each item of lifting equipment before and after lifts.
- Protect slings from damage by sharp edges with corner saddles, padding, or wooden blocks.
- Warn all people out of the load area before starting the lift.
- Protect your hands and fingers: when slack is being taken out of a sling, keep them from between the sling and load so they will not be trapped and crushed. Step away before the lift is made.
- Make sure a load is high enough to clear all objects before signaling for the crane to move.
- Walk ahead of the moving load and warn people to keep clear. Use guide ropes to prevent rotation or other uncontrolled motion.
- Hook unused sling legs to the sling ring.

### **What should you avoid when slinging a load?**

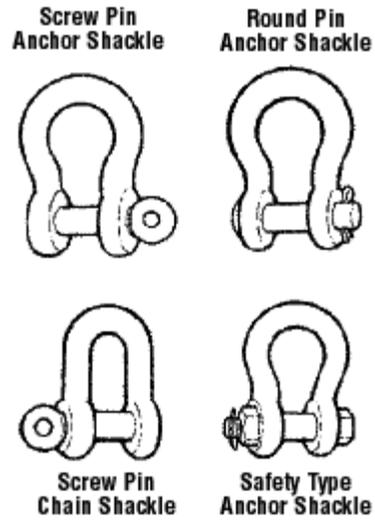
- Do not exceed the capacities of slings, fixtures and cranes.
- Do not twist or tie knots in slings or use bolts, nails or pieces of wire to shorten slings.
- Do not splice together broken slings.
- Do not ride on hooks or loads.
- Do not allow workers to walk or work under a load.
- Do not attempt to pull or push loads to a spot that is not under the hoist.
- Do not drag slings. Avoid pulling slings out from under loads by crane. Set down loads on blocking, never directly on a sling.
- Do not leave unused slings, accessories, or blocking lying on the floor. Hang on racks or store in a proper place.
- Do not carry a load by inserting the point of the hook into a link of the chain.
- Do not hammer a sling into place.
- Do not leave loose materials on a load.
- Do not use slings that are stretched, broken, or defective. Tag them as defective and dispose of any damaged slings.
- Do not leave suspended loads unattended.

### **Use of Shackles**

#### **What are the types of shackles that you can choose?**

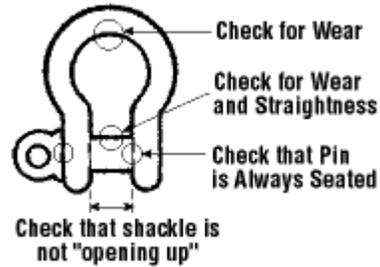
Anchor (bow type) and chain ("D" type) shackles are used with screw or round pins.

- When selecting the right shackle, refer to manufacturers' tables for the safe working loads of the shackles.
- Shackles are sized according to the diameter of the bow section rather than the pin size. Never use a shackle if the distance between the eyes is greater than listed in the manufacturers' tables.



### How should you inspect shackles?

- All pins must be straight and all screw pins must be completely seated. Cotter pins must be used with all round pin shackles.
- Replace shackles worn in the crown or the pin by more than 10% of the original diameter.

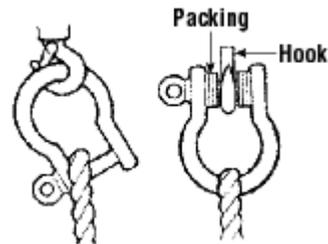


### What should you avoid when using shackles?

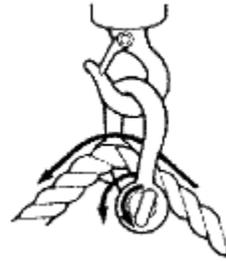
- Do not replace the shackle pin with a bolt. A load will bend the bolt.



- Do not allow a shackle to be pulled at an angle. The legs will open. Pack the pin with washers to center the shackle.



- Do not use screw pin shackles if the pin can roll and unscrew. If the load shifts, the sling will unscrew the shackle pin.

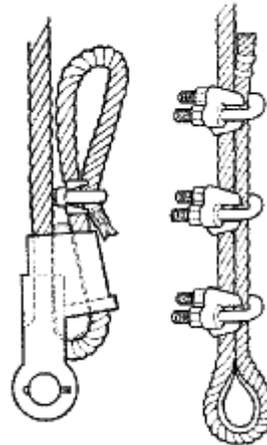


## Wire Rope Slings

### How should you select the proper wire rope sling?

- Follow the manufacturers' charts and tables on sling types, angles, and rope diameters.
- Follow the manufacturers' recommendations on clips and clamps of suitable size and design for ropes of different size.

- Attach using methods outlined by the manufacturer.
- Remember that a socket and clip fittings used to attach the rope determine the sling's load limit. Fittings have 75% to 100% of the breaking load of the rope.
- Remember that the safe load limit of a sling also depends on the hitch (method of applying a sling to the load). The type of hitch depends on the kind of material to be lifted, the safe load limit of the sling, the presence (or absence) of lugs on the load, the headroom, and other factors. Check with the manufacturers instructions.



### How should you use wire rope slings safely?

- Use wire rope slings at rated limits.
- Examine slings for wear, fatigue, crushed or broken wires, kinking, ballooning or "bird-caging", heat damage, etc. Check both before and after using slings to detect any damage or defects.
- Inspect and tighten fittings regularly.
- Check the manufacturer's chart for sling properties.
- Reduce rope stress with slow starts and stops.
- Keep wire rope slings well lubricated and inspect them often.
- Remove damaged slings from service and tag appropriately.
- Store slings on racks in a clean, dry place.
- Center the sling load to prevent the load from shifting suddenly and causing a high impact load.

### What should you avoid when using wire rope slings?

- Do not bend slings around sharp edges. Protect them by using corner saddles, padding, or wood blocks.
- Do not use slings with knots.
- Do not slide the load along a rope.
- Do not use a single leg hitch on a load that cannot be controlled. Rotation of a load can undo the wire rope strands and weaken the rope.