Westwood MECHANICAL INC.

#15-HOISTING-SAFE JOB PROCEDURE (September/07))

1. PURPOSE:

To ensure the safety of all personnel involved or in the vicinity in the hoisting of equipment/materials, and provide information for the safe hoisting in the workplace.

2. GENERAL:

The versatility of hoisting equipment/materials makes it extremely useful on construction projects. Improper and unsafe use, however, can result in serious accidents.

This procedure outlines the requirements of the standards applicable to the use of hoisting equipment/materials at construction projects.

Hoisting may look like an easy operation that requires no particular skill or experience. Too many workers have lost fingers or hands or have suffered more serious injuries because they thought "Anybody can do that and there is no training involved ".

3. SCOPE AND DEFINITIONS:

In hoisting you have to evaluate the load, confirm that your lifting equipment can handle the load, balance the load, and land it safely.

Hoist:
Is the device that applies a force for lifting or lowering a load.

Rigging:
Is the operation of fastening the load to the hoisting equipment.

Load:
Is the equipment/material that is to be hoisted (raised or lowered)

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Taglines:

Is a line usually a rope, which is attached to the suspended load to guide and manipulate the load and is controlled by a worker.

Slings (choker):

Maybe a rope, synthetic/nylon web, wire rope, chain which secures the load to the hoist which is attached to the shackles.

Center of Gravity:

Is the location on the load where the sling when place correctly balances the load perfectly. And this is also the location where the hoist should be.

Rigger:

The person who fastens the load to the hoisting apparatus and understands rigging principles as applied to the job for which they are to be qualified.

Shackles:

Is the device usually a metal U with a pin or screw for coupling the sling to the eyebolts.

Eye Bolts:

Is the device usually metal shaped like an eye that is fastened to the equipment and or the anchorage for the hoist and the shackle is attached to it.

Anchorage:

Is the point at which your hoist is secured to support the load.

Signal person:

Is the person in charge who shall have the necessary knowledge and experience of the specific type of equipment/materials and the hazards of critical lifts to direct the safe completion of the operation.

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4. PROCEDURE:

1. **Secure the Area**:

   Survey the lift site for hazardous /unsafe conditions.
   Make sure the area around the hoist is clean and free of obstruction.
   The swinging movement of the load or any part of the lifting equipment can create a hazard; no person shall remain within the range.
   Barricade area with re caution ribbon, barricades or warning signs.

2. **Check Equipment:**

   Inspect for possibility of broken mechanical devices, worn cable or rope.
   Insure that equipment is properly set up and positioned.

3. **Evaluate load**:

   Determine the weight of the item prior to the lift, if not labeled use a Materials Table to calculate it and that the rated capacity of the hoist/anchorage is not exceeded.
   DO NOT GUESS

4. **Balance load/ center of odd shapes:**

   Estimate the center of gravity or points of balance where the item is to be hoisted.
   If only one point of contact position the lift device immediately above the estimated center of gravity.

5. **Anchorage**:

   Install anchors as per manufacturers specifications providing the quantity to provide the specified safety factor.
   Pad any sharp edges that you may be anchoring to with wood , rubber, etc. do not wrap your anchor device around a sharp edge (beam, etc.) without padding.
   If using existing anchorage confirm it can handle load safely.
   Test anchorage if unable to determine capacity.

6. **Attach Load:**

   Use the proper connectors to attach the hoist to the anchorage (eye bolts, shackles etc.)

Tagline shall be rigged to the load, to control swinging of the load and of sufficient length so that the operator is not directly below the load.

The hoist chain or cable shall not be wrapped around the load. The load shall be attached to the hoist by slings or other approved device.

If the equipment has lifting lugs use them.

7. **Landing/Lifting**

Confirm that the load is well secured and properly balanced before it is lifted more than a few inches off its support.

Never permit anyone to ride the lifting hook or the load.

Confirm that all personnel are clear from the load being lifted.

Confirm that the landing area is prepared for the load.

Confirm that the load is stable or secured before slacking.

No suspended load shall be left unattended.

Inspect for any loose parts before lifting.

8. **Secure Load**:

Confirm that area can handle the full weight of the load, place the load gently on its supports, and attach all supports.

Remove the weight off the hoist gradually. Do not remove hoist until it has been confirmed that the load is safely on its supports or hangers.

Confirm that the load is secured before removing hoist.

9. **Remove Hoist:**

Lifting hooks and fastenings shall not be removed until load is at rest in a stable position or secured by other fastenings.

10. **Person in charge:**

The person in charge shall have the necessary knowledge and experience of the specific type of equipment and the hazards of the lift to direct the safe completion of the operation.

He shall have the proper selection of tools/equipment, recognition and control of hazardous or unsafe conditions and have the authority to start and stop work activities.

5. EQUIPMENT/MATERIALS:

All materials/equipment shall be inspected to ensure that it meets the job requirements.

Slings are marked with the manufacturers code number and the Safe Working Load.

Do not bend the sling around sharp edges. Protect by means of corner saddles, padding or wood blocks.

Check for visible faults in links or hooks, hang the chain up or stretch the chain out on a level floor, remove all twists, measure the sling length, discard if sling has been stretched. Make a link-by-link inspection; refer to information on chain slings.

Refer to manufacturers tables for safe working loads of shackles; refer to the information on the use of shackles.

Use plain or shoulderless eyebolts for vertical loading only. Refer to information on lifting with eyebolts.

Safety latches on hooks shall not be deactivated or made inoperable.

Makeshift repair or lifting equipment is prohibited.

Any materials that appear to be cut, frayed, kinked or rusted shall not be used., discard immediately and return to shop with do not use tag.

6. SPECIAL CONSIDERATIONS:

Workers who are trained and authorized to operate such equipment shall only operate hoists.

Multiple hoists' lift:

A multiple hoist lift must only use hoists which are identical in ever way so as to provide a uniform lifting system.

Do not use a single leg hitch on a load that cannot be controlled. Rotation of a load can swing out of control can undo wire rope strands, and weaken the rope.

Consideration must be given to the fact that stress is greatly increased if the leg of the hoisting chain is rigged at an angle of less than 90 degrees with the horizontal. Avoid angles, side pull is prohibited.

7. SUMMARY:

- Secure the area
- Check equipment
- Evaluate the load
- Balance Load
- Check anchorage
- Determine center of gravity of the load
- Attach the load
- Land/lift the load
- Secure the load
- Remove hoist

8. ADDITIONAL INFORMATION:

The following Infograms are included herein:

- B05-Synthetic web slings
- B06-Hoist wire rope
- B08-chain Slings
- B13-Use of materials hoists
- B16-Lifting with eye bolts
- B17-use of shackles

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SYNTHETIC WEB SLINGS

CCINFOGRAM

Slings are marked with the manufacturer's code number and rated capacity. Reference charts showing sling and hitch rated capacities are available from manufacturers. Keep an inspection record for each sling.

Before using any sling inspect it to ensure that the sling meets the job requirements.

Synthetic web slings are easily cut and have poor abrasion resistance when compared to chain and wire rope slings.

Nylon slings are damaged by acids, but resist caustics. Polyester slings are damaged by caustics but resist acids.

Both are damaged by sunlight, moisture, and temperatures above 90°C (194°F).

REJECTABLE DEFECTS

Remove from service slings with the following:

- Increased stiffness of sling material.
- Acid or caustic burns.
- Melted, burned or weld spattered.
- Holes, tears, cuts, snags.
- Broken or worn stitching.
- Excessive abrasive wear.
- Knots in any part of the sling.
- Crushed webbing or embedded particles.
- Bleached sling colour.

CHECK-LIST

DO:

- REFER to the manufacturer's reference chart.
- CHECK sling each time it is used.
- DETERMINE the weight of the load.
- PREVENT loading in excess of the rated capacity by considering sling angle.
- PROTECT webbing from sharp corners, protrusions, or abrasive surfaces.
- ENSURE that the sling choking action is on the webbing, not the hardware.
- HAVE slings repaired only by a sling manufacturer.

DO NOT:

- DO NOT DRAG slings across floors or other abrasive surfaces.
- DO NOT DROP slings with metal fittings.
- DO NOT SET loads down on top of slings.
- DO NOT PULL slings from under loads when the load is resting on the sling.
- DO NOT WELD anything hung from a sling.
- DO NOT LENGTHEN or SHORTEN slings by tying knots.
- DO NOT PLACE Stitch Patterns (laps) on hooks, around sharp corners, or at choker bearing points.

For further information on sling hitches refer to CCINFOGRAMs - B03 and B04.

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B06
HOIST WIRE ROPE

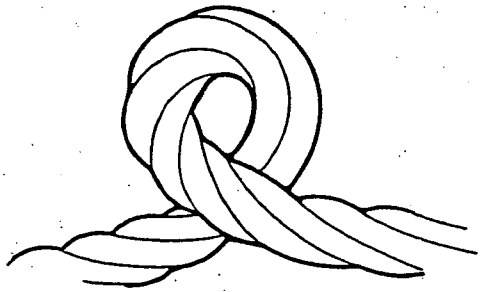
SAFETY INFOGRAM

Wire rope is made of steel wire strands with a fibre or wire core. Select wire rope according to manufacturers' recommendations.

Wire rope breaks can cause serious injuries.

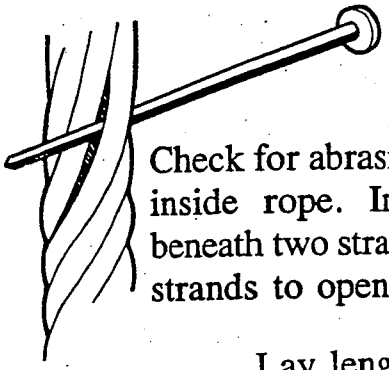
BREAKS CAN BE CAUSED BY:

- WEAR mainly on areas in contact with hoist sheaves and drums.
- CORROSION from lack of lubrication and exposure to heat or moisture. Shown by pitting. A fibre core rope will dry out and break at temperatures above 120°C (250°F). Use wire core rope.
- FATIGUE from repeated bending even under normal operating conditions.
- OVERLOADING 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. Discard kinked rope.

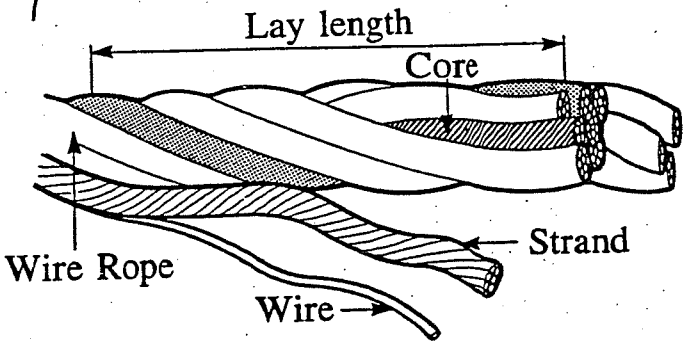


WIRE ROPE INSPECTION

Check wire rope every working day. Ensure rope is well lubricated. All ropes must be inspected by trained personnel, with a written, dated, and signed report of rope condition.



Check for abrasions and lubrication inside rope. Insert marlin spike beneath two strands and rotate to lift strands to open rope.



Estimate rope condition at section showing the most wear. Discard wire rope when there is:

- In running rope (wind on drums or pass 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.
- Heat damage.
- Excessive stretch or sharp reduction in diameter.

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B08
CHAIN SLINGS

SAFETY INFOGRAM

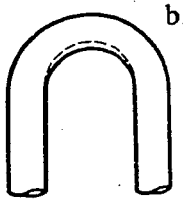
INSPECTION

1. Daily check for visible faults in links or hooks.

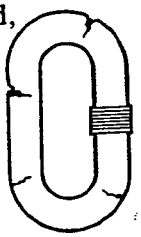
2. Twice a year:

- Clean sling prior to inspection.
- Hang the chain up or stretch the chain out on a level floor. Remove all twists. Measure the sling length. Discard if sling has been stretched.
- Make a link-by-link inspection and discard if:

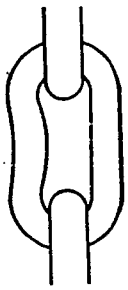
a. Wear exceeds 15% of link diameter.



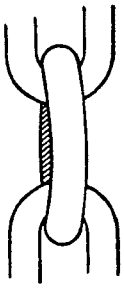
b. Cut, nicked, cracked, gouged, burned, or corrosion pitted.



c. Twisted or bent.



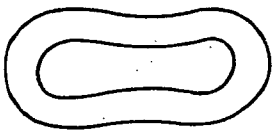
Bent



Bent

Twisted

d. Stretched. Links tend to close up and get longer.



- Check master link, load pins and hooks for any of the above faults. Hooks should be removed from service if they have been opened more than 15% of the normal throat opening, measured at the narrowest point, or twisted more than 10° from the plane of the unbent hook.

Manufacturers' reference charts show sling and hitch capacities. Record manufacturer, type, load limit and inspection dates.

CHECK-LIST LIFTING PRACTICES

DO:

- FIND out load weight before lifting.
- LOWER working load limit if there may be severe impact.
- BALANCE the load to avoid overstress on one sling arm or the load slipping free.
- PAD sharp corners to prevent bending links.
- REPLACE broken safety latches.
- REDUCE the load limit when using chain in temperatures above 425°C (800°F).
- KEEP hands and fingers from between load and chain.
- STORE chain sling arms on racks in assigned areas.

DO NOT:

- DO NOT JERK the load when lifting or lowering the sling. This increases the actual stress on the sling.
- DO NOT DRAG chains.
- DO NOT SPLICE a chain by inserting a bolt between two links.
- DO NOT SHORTEN a chain with knots.
- DO NOT FORCE a hook over a link.
- DO NOT USE homemade connections. Use only attachments designed for the chain.

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B13 USE OF MATERIALS HOISTS

SAFETY INFOGRAM

INSPECTION

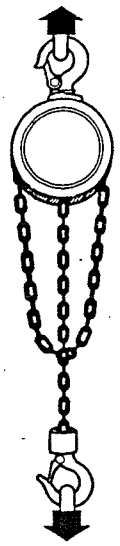
Schedule detailed inspection of all hoists. Follow manufacturers' recommended maintenance schedules. Inspect hooks, ropes, brakes and limit switches for wear and damage. Repair or replace items not operating properly. Post safe load limit on the hoist.

OPERATION

Hoist from directly over the load. If not centred, the load may swing when lifted.

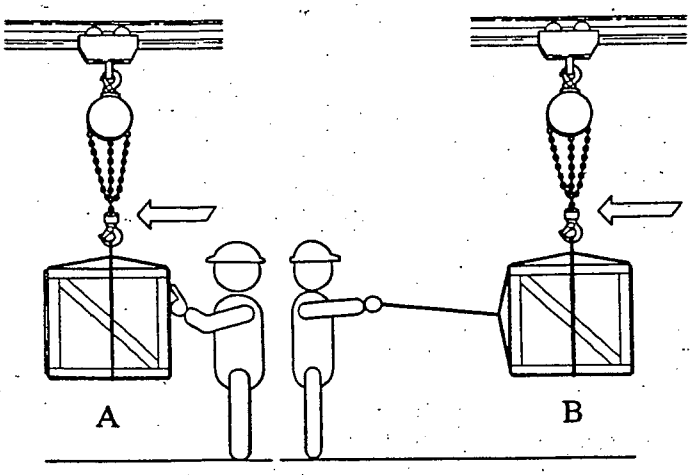
Lever operated hoists can be used to pull in any direction, but a straight line pull must be maintained. Side pulling or lifting increases wear and sets up dangerous stress levels on hoist parts. Only one person should pull on hand, chain and lever hoists.

Hang hoists solidly in the highest part of the hook area. Rigged this way, the hook support is directly in line with the hook shank.



When loading the lower hook, place the load directly in line with the hook shank. Loaded this way, the load chain makes a straight line from hook shank to hook shank.

Pushing a loaded hoist is safer (A). If it must be pulled, use a rope (B).



CHECK-LIST

DO:

- INSPECT the hoist before lifting a load. Check the upper and lower hooks to see that they swivel. Repair or replace worn chain or wire rope immediately.
- KEEP wire rope and chain lubricated.
- STAND completely clear of the load.
- SEAT the load properly in the hook.
- MOVE hoist controls smoothly. Avoid abrupt, jerky movements of the load. Remove slack from the sling and hoisting ropes before the load is lifted.
- ENSURE all loose materials, parts, blocking and packing have been removed from the load before starting the lift.
- MAKE SURE everyone is away from the load before starting to hoist.

DO NOT:

- DO NOT USE hoisting equipment for lifting people.
- DO NOT PASS a load over workers.
- DO NOT TIP LOAD. The load is unstable and harms the hook and hoist.
- DO NOT INSERT the point of the hook in a link of the chain.
- DO NOT HAMMER a sling into place.
- DO NOT LEAVE slings dangling from the load hook. Place sling hooks on the sling ring when carrying slings to the load.
- DO NOT RAISE loads higher than necessary to clear objects.
- DO NOT EXCEED hoist load limit.

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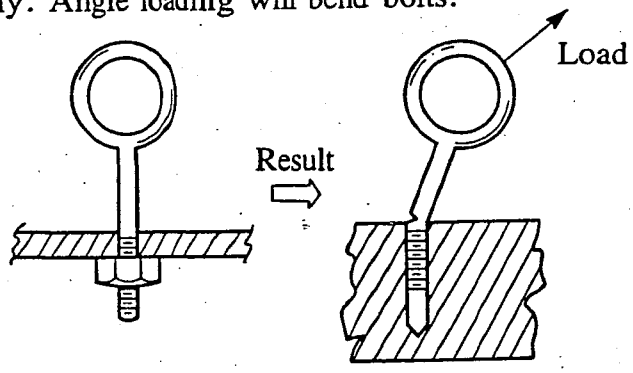
LIFTING WITH EYE BOLTS

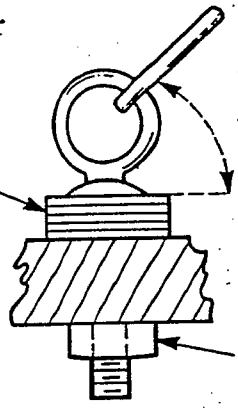
SAFETY INFOGRAM

Use plain or shoulderless eye bolts for vertical loading only. Angle loading will bend bolts.

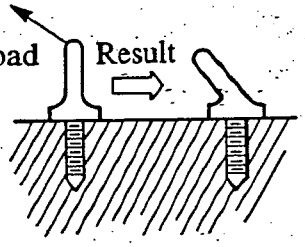


Use shoulder eye bolts for vertical or angle loading.

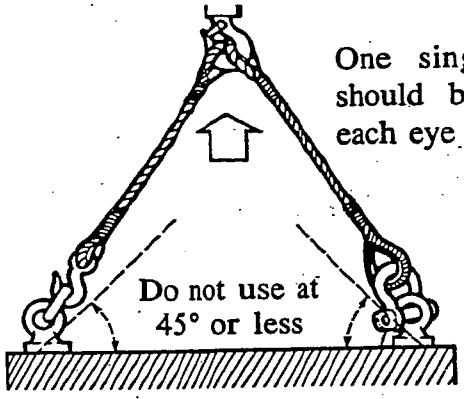
Pack with washers to ensure that shoulder is firmly in contact with surface.



Incorrect.
When the load is applied to the eye in this direction it will bend.



One single sling leg should be attached to each eye bolt.



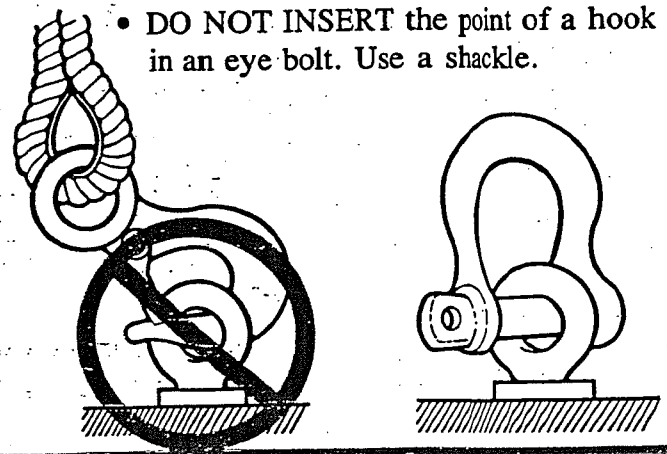
CHECK-LIST

DO:

- ENGAGE at least 90% of threads in receiving hole when using shims or washers.
- 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 screw eye bolts (body bolts) has a minimum depth of 1 1/2 times the bolt diameter.
- INSTALL the shoulder at right angles to the axis of the hole.

DO NOT:

- DO NOT PUT a sling through eye bolts.
- DO NOT GRIND, machine or stamp eye bolts.
- DO NOT PAINT an eye bolt. This could cover up flaws.
- DO NOT USE eye bolts which have worn threads or other flaws.
- DO NOT INSERT the point of a hook in an eye bolt. Use a shackle.



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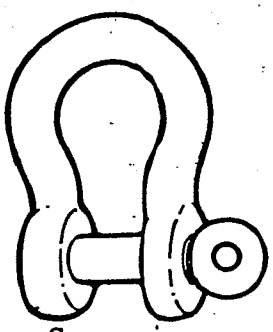
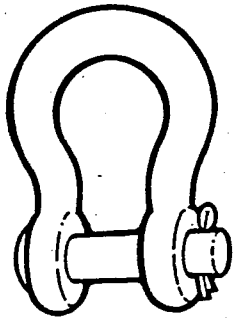
USE OF SHACKLES

SAFETY INFOGRAM

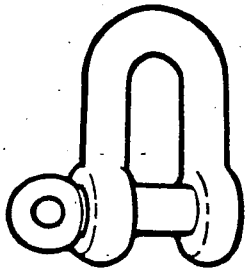
Anchor (bow type) and chain ('D' type) shackles are used with screw or round pins.



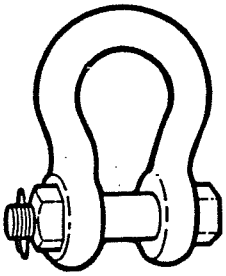
Screw pin anchor shackle



Round pin anchor shackle



Screw pin chain shackle



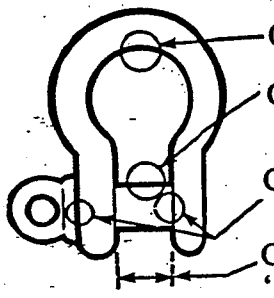
Safety type anchor shackle

Refer to manufacturers' tables for safe working loads of shackles. Shackles are sized by 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 table.

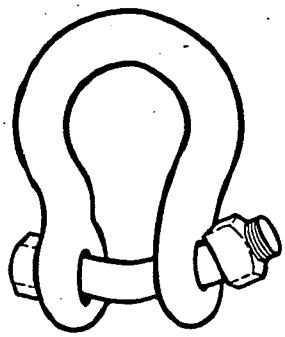
All pins must be straight and all screw pins must be completely seated. Cotter pins must be used with all round pin shackles.

Replace shackles worn in the crown or the pin by more than 10% of the original diameter.

SHACKLE INSPECTION AREAS

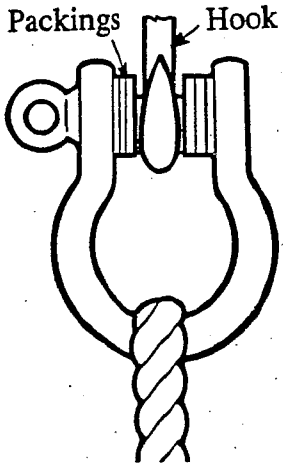


Do not replace the shackle pin with a bolt. A load will bend the bolt.

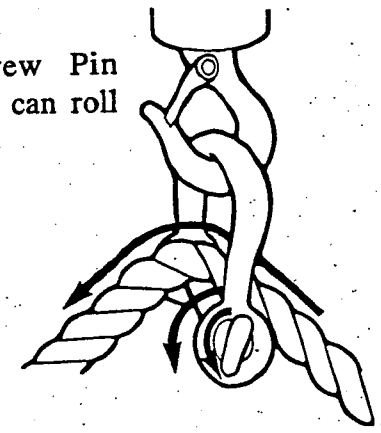


Do not allow shackle to be pulled at an angle – the legs will open up.

Pack the pin with washers to centre 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.

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