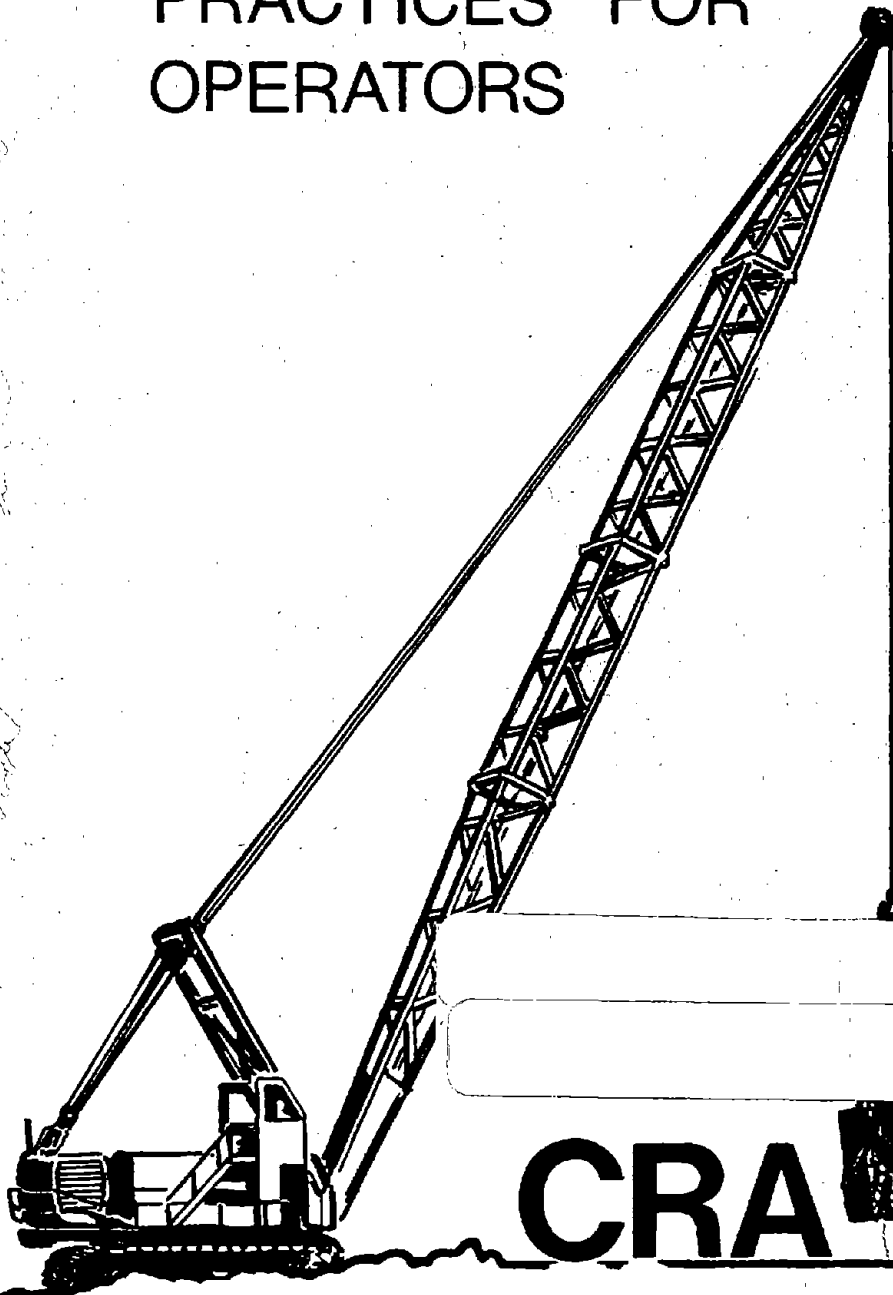


**NIOSH**

A GUIDE TO GOOD WORK PRACTICES FOR OPERATORS



CRADES

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

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National Technical Information Service
Springfield, Virginia 22161

NTIS

CRANES

A Guide to Good Work Practices for Operators

**U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Technical Services
Cincinnati, Ohio**

September 1978

ACKNOWLEDGMENT

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DHEW (NIOSH) Publication No. 78-192

INTRODUCTION

Cranes are the workhorses of industry. They help to lift and place weights of many tons with relative ease and in a matter of minutes. One operator can now do a job that previously would have required many workers — if it could have been done at all. Cranes succeed at this work if you, the operator, use them properly and respect them as you would any other labor-saving device. The first time you bend a rule or take a short cut, disaster can quickly result.

As a crane operator, your job is to move materials — quickly, efficiently, and *safely*. When you're in the cab of a crane, you have a responsibility to protect yourself and other workers. To do this, you must have safe equipment and follow safety rules. You can keep your equipment in good working condition by operating it correctly, inspecting it regularly, and reporting any problems. Developing safe work habits is a more complex task.

One crane manufacturer estimated that 99% of all crane accidents are the result of improper use of cranes by careless or unskilled operators. Although safe equipment and workplaces are very important in establishing a healthful work environment, it is the operators and riggers who contribute the most to safe operations. This booklet will help explain what crane safety involves and what you can do to prevent accidents. This booklet contains only general guidelines; your supervisor can supply you with more specific information.

Requirements for Operators

Before becoming an operator you must have:

- A physical examination. Persons with illnesses or conditions which may cause a sudden loss of consciousness (for instance, diabetes or a heart ailment) should not operate cranes. The examination should include an eye test because color and depth perception, as well as general good vision, are required. A hearing test is a good idea, too.

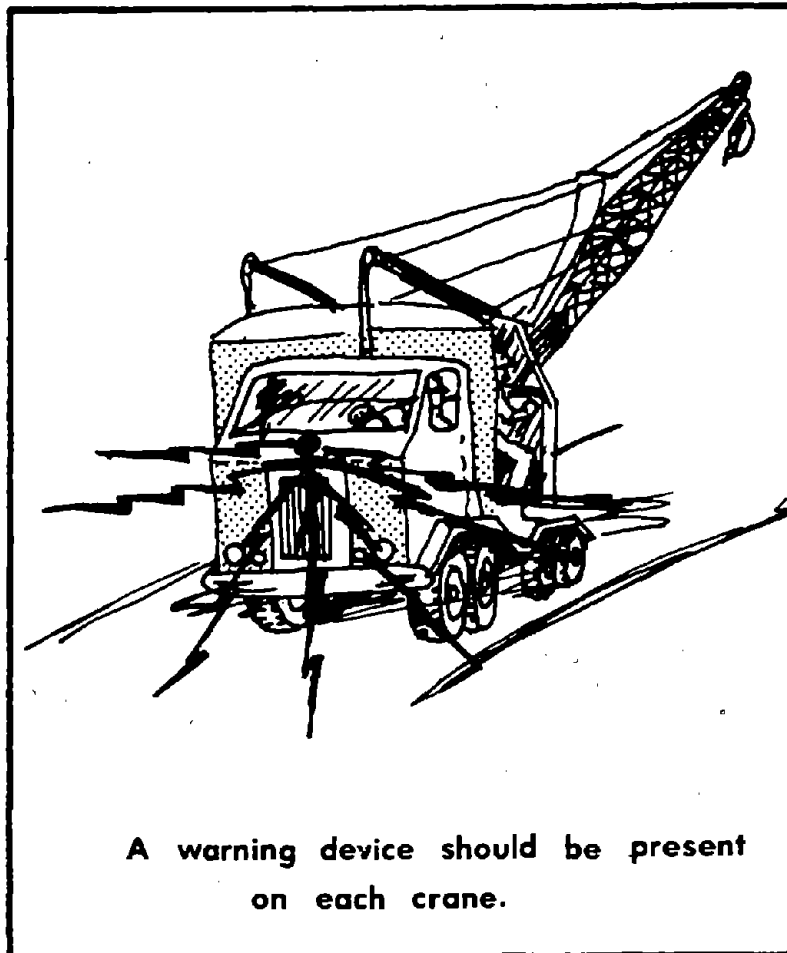
- A thorough understanding of technical and other job-related terms.
- Proper training in the correct operating procedures for all cranes you will operate. You should know all the main parts, controls, and safety features of cranes. Your employer should also provide adequate training in the inspection of cranes and their attachments. Remember that safety always comes first. You are directly responsible for the safe operation of your crane. If you have any questions about safety, ask your supervisor.

Safe Operating Conditions

Whenever possible, use hoists or cranes to do materials lifting tasks.

Safe operations depend mainly on the operator's habits, but your employer must also provide safe operating conditions. Regardless of the type of crane you are using, you should always be aware that:

- ONLY INDIVIDUALS DESIGNATED, ADEQUATELY TRAINED, AND AUTHORIZED BY THEIR EMPLOYER SHOULD OPERATE CRANES.
- A gong, bell, or other warning device must be provided and used on each crane.



- Cranes should be equipped with load limiting devices to prevent overloading.
- Access to the cab of the crane must be by a fixed ladder, stairs, or platform. You should not have to step over any gaps wider than 12 inches between the cab and the step or platform.
- Seats for crane operators should provide padding from small bumps and jerks and provide lower back support.
- All cabs must be equipped with a suitable fire extinguisher.
- All machinery operating on rails, tracks, or trolleys should have positive stops or limiting devices and overspeed devices.
- All exposed moving parts (gears, chains, etc.) must have securely fastened guards. Electrical equipment must also be guarded. Platforms, footwalks, steps, handholds, guardrails, and toeboards must be provided with nonslip surfaces.
- Controls in the cab must be within convenient reach when the operator is facing in the direction of the load hook or in the direction of the load hook or in the direction of travel. The operator must have a full view of the hook in all positions.
- If the crane has foot brakes, the pedals must have a nonslip surface.

Overhead Cranes

Safety features that should be present in the operation of overhead-type cranes (overhead, gantry, semigantry, cantilever gantry, wall, and storage bridge cranes):

- The rated load of the crane must be clearly marked on each side of the crane and on each hoist.
- Outdoor storage bridges must have automatic rail clamps and wind-indicating devices.
- Adequate clearance must be maintained between a crane and obstructions.

- The bridge and trolley must be equipped with bumpers adequate to stop travel. They must be designed and installed to prevent crane parts from falling in case of breakage.
- Where visibility around a load or the load's destination is restricted for the person directing the load from the floor, he or she should be elevated to a cab or some stable platform.

Mobile Cranes

Safety features that should be present in the operation of mobile cranes (crawler, truck, and locomotive cranes):

- The cab of a mobile crane must have a readily available, easy-to-read load rating chart. Know the limits of your crane.
- A crane that will be used after dark must be equipped with clearance lights.
- All sheaves should be guarded. If it is impossible to guard them, some type of warning device should be installed to alert anyone of the hazard.

Inspection

A careful inspection of cranes and load lifting attachments is essential to safe operations. Your employer should have an established schedule for inspections that should include a daily checklist for the operator to follow. The operator and rigger must inspect equipment at the start of every shift and whenever additional equipment is used. Periodic inspections by specially trained personnel must be scheduled by your supervisor. You should never try to make any repairs yourself but should report any problems, malfunctions, damage, or unusual noises to your supervisor immediately.

Before operating the crane, the operator should inspect and check guards, limit switches, warning signals, rigging, gauges, the fire extinguisher, blocks, end stops on trolleys, footwalks, gears, rails and wheels, and bearings. In addition, before beginning operations the operator should also check very carefully the following:

Brakes

Brakes must be tested at the beginning of each shift and whenever a near-capacity load is handled. Test them by raising the load a few inches and then applying the brakes.

Lubrication

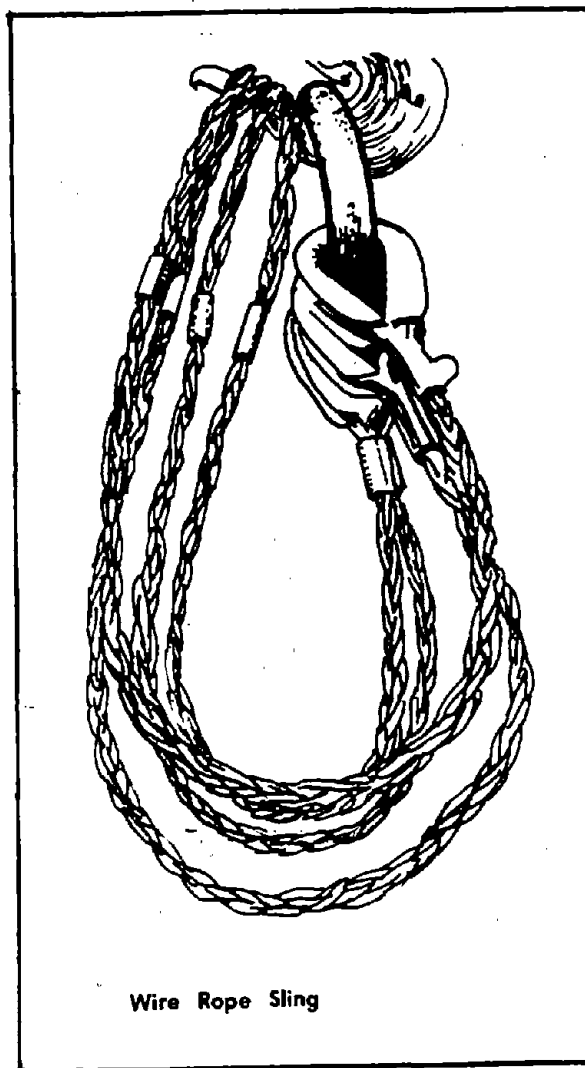
Operators should regularly (daily) lubricate levers and other controls to maintain their smooth operation. Any irregularities in the smooth operation of the crane should be reported quickly.

Wire Rope

Wire rope is actually a complicated machine. It is composed of many individual wires. For example, a 6 x 25 rope is made up of 150 wires in the strands — plus the core.

Wire rope is only as strong as each of its wires. When you use the rope, those wires work independently and together. The wires and strands bend and slide — the rope moves. The wires and strands move in relation to each other and to the support core every time a rope flexes.

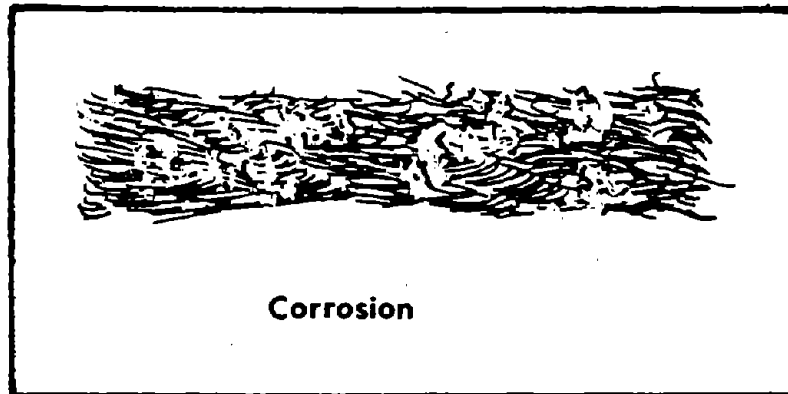
All standing and running ropes in use must be inspected at least once each month. Your employer must appoint or authorize someone to do this job. Your employer is also required to keep written, dated, and signed reports of rope conditions.



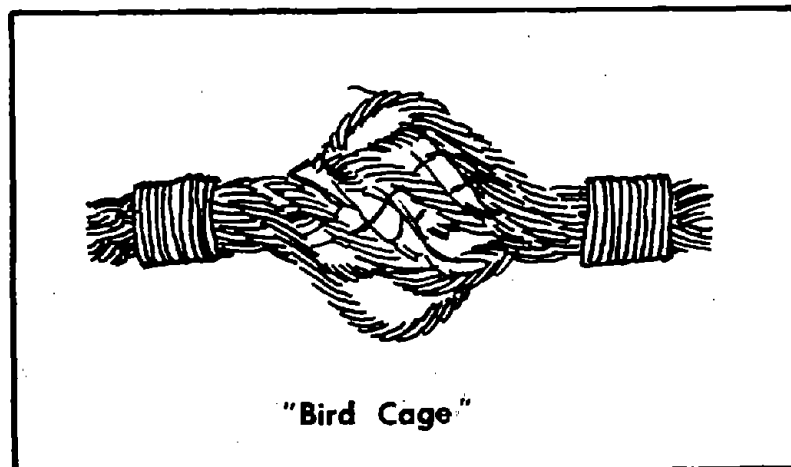
Wire Rope Sling

You should give ropes a visual inspection each day or at the start of your shift. Damage you should look for includes:

- broken wires along the length
- broken wires at end connections
- corrosion, rust, cracks, and wear of end connections



- inadequate lubrication
- kinking
- crushing
- bird-caging



- cutting
- unstranding

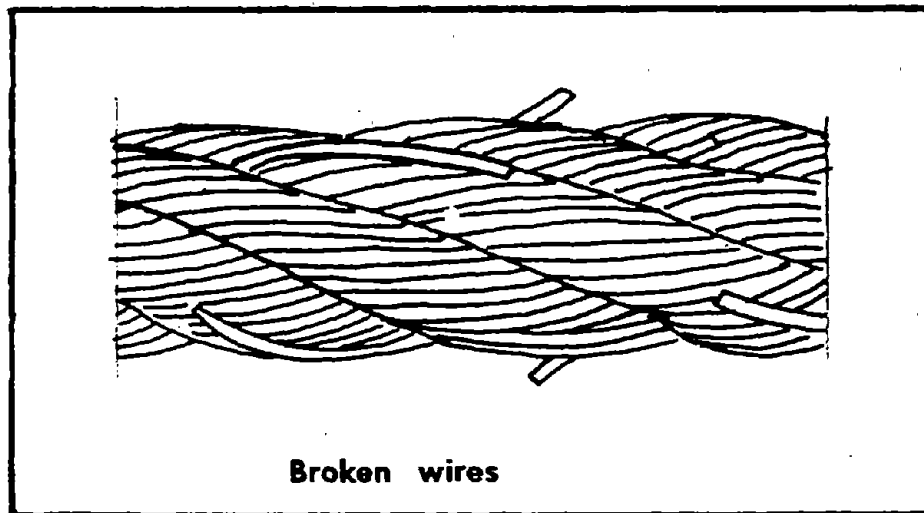
To do a monthly, detailed inspection of wire rope, follow these recommendations:

Inspect all ropes while they are at rest (that is, not bearing a load). Stretch the rope out as far as possible on flat surface. Remove the pick-up points from the sheaves.

Clean the surface of the "critical points" of the rope of any grease, oil, or mud. Some of these critical points are end attachments, pick-up points, equalizing sheaves, and saddles.

The rope at these points is subject to greater stress. Rope failure could easily occur at these critical points; therefore, they need more attention.

Measure the diameter of the rope with a caliper. A record of the rope diameter should be kept. It's important to measure the rope diameter at the critical points. Be sure to measure the rope at its widest point. Position your caliper so that you're holding the rope as shown below.



Rope diameter can be reduced to below outside (nominal) diameter due to loss of core support, internal or external corrosion, or wear of the outside wires. Wire rope must be taken out of service if the diameter of individual outside wires is reduced to less than two-thirds of its original measurement.

Check all of the end connections. Remember that only *one* broken wire is allowed in any end connection. Check for broken wires along the rope. Broken wires are the most common sign of "weakening" or failure in wire rope. The rope must be taken out of service if the indicated number of broken wires is found in these situations:

- In running rope:

six randomly distributed broken wires in one lay, or three broken wires in one strand in one lay

- In standing rope:

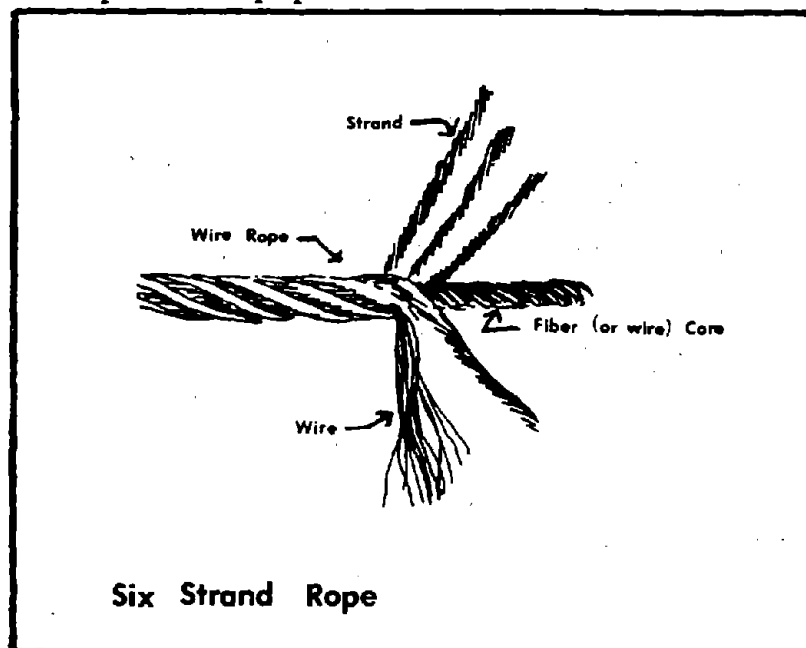
three broken wires in one lay

- In end connections:

two broken wires

Measure the lay length at least monthly. The lay of the rope describes the direction of the wire in relation to the direction of the strand.

To measure rope lay, you need paper, a pencil, and carbon paper. Place the carbon on top of the paper and hold the paper on the rope. Rub the side of the pencil on the carbon paper and rope. This makes a print of the rope on the paper.



Mark off one end of a strand on the paper. Count off the number of strands in the rope. (For example, in the illustration above there are six strands. Six groups of marks are counted off as shown.) Mark off where this strand ends. The distance between the marks is one lay.

To determine the average lay length, mark off several lays. Keep a record of the average lay length from month to month.

If the average lay length increases but the diameter decreases, look for internal broken strands or core damage.

If the average lay length increases and the diameter of the rope is the same, the stretching or "unlaying" of the rope has another cause. Look for worn sheave grooves. They can cause extra twist and unlaying in the rope. You can also make sure that the rope ends are secured to prevent rotation.

Any unlaying is a sign of damage. Its cause must be checked.

The rope should also be inspected internally. This inspection is only to be performed by operators who are well trained or skilled in this specific area. NOTE: DO NOT perform internal inspections on nonrotating ropes.

Check lubrication of the rope along its length. Lubrication prevents corrosion and wear from friction, and also protects from rust and weather damage. Give special attention to the inside of the rope where it is sheaved or wrapped. Tight sheaves and nicked or damaged sheaves and drums can damage the rope.

Drums

After you visually inspect the rope, you should examine the drums and sheaves. The way the rope wraps or is seated affects its performance and life. There must always be two wraps of rope left on the drum when it is lowered as far as possible.

Check the condition of the end flanges. Distortions can damage the rope and affect the way the rope spools.

Examine the surface of the drum. If the surface is smooth, look for burrs which can catch the rope, rough surfaces which can cause damage, and imprints of the rope on the drum. If the drum surface is grooved, you should check the depth and width with a groove gauge, and look for proper spacing of grooves. (Overlapping causes the rope to rub against itself as it spools.) Also, examine the surfaces of the grooves for roughening, burrs, imprinting, or other damage.

Drums that are damaged must be repaired or replaced, according to the manufacturer's recommendations.

After examining the drum itself, check the wrap of the rope as it spools onto the drum. The first wrap is the base on which the rest of the wrap is built.

Sheaves

The sheaves must also be checked. Some of the things to look for are cracks and any deformations, smoothness of flanges, worn bearings, and skipping or wobbling on the shaft.

Examine the general condition of the grooves of the sheaves. First, look for a smooth surface — burrs, rope prints, cracks, and pits can damage the rope. The depth, width, and contour of the sheave all affect the way the rope is seated.

The crane manufacturer or wire rope supplier may provide a set of groove gauges. These gauges are made to show the condition of groove wear. To use the gauge, insert it into the groove. If your gauge fits into the groove perfectly, the sheave is at its minimum permissible contour. If the groove is narrower or wider, the sheave should be removed from service.

There must be guards on the sheaves to prevent the rope from coming out of the grooves. Sheaves in the bottom block may need guards to keep the ropes from fouling. If chains are used in hoisting, the pockets and flanges must be wide enough so that the chain doesn't catch or bind.

When the rope has been placed back on the proper sheaves, check that sheaves turn smoothly as the rope passes over them, and that the rope does not rub or snag in the sheaves or on the guards.

Hooks

All hooks must be inspected at the start of each shift. Check for cracks, heat damage, wear at bearing points in the eye and saddle, and nicks and gouges.

Your employer must perform monthly inspections which must be written, dated, and signed. Magnetic particle testing, X-rays, or other similar tests of hooks should be done at least once a year.

Slings

Slings and their fastenings should be inspected before each shift by the rigger. If any damage or defect is noted, remove the sling from service. Do not use knots, bolts, or hook wraps to shorten slings.

There are five major types of slings: alloy steel chain, wire rope, metal mesh, natural and synthetic fiber rope, and synthetic web. Slings and all fastenings and attachments should be inspected carefully at the start of each shift or before being put into use, and whenever damage after a lift is suspected. Damaged or defective slings must be removed from service immediately.

Slings should be stored neatly on free-standing or wall racks, A-frames, or shelves. Keeping them off the floor prevents abrasion from dirt and also prevents tripping hazards. Slings should not be kept on wet or damp floors or in corrosive atmospheres.

Chain Slings

All alloy steel chain slings must have the size, grade, reach, and rated load capacity permanently marked on the sling.

To inspect the chain sling:

- Stretch the sling out on a level surface.
- Check the master link and coupling links for any signs of wear.
- Examine each link of the legs of the sling. Check the barrels and the shoulders of all links for signs of wear, cracks, nicks, gouges, or other damage.
- Measure the bearing points of the links to be sure they have not stretched. Check the hooks or other load-handling attachments for twisting or distortions. Suspend the sling, and measure the reach. All legs should measure the same. If stretching has occurred, the sling must be taken out of service.
- Any sling that shows excessive wear such as heat damage, nicks, burns, gouges or pits, or stretching must be immediately removed from service for repair.

Wire Rope Slings

Wire rope slings must be removed from service if any of the following conditions exist:

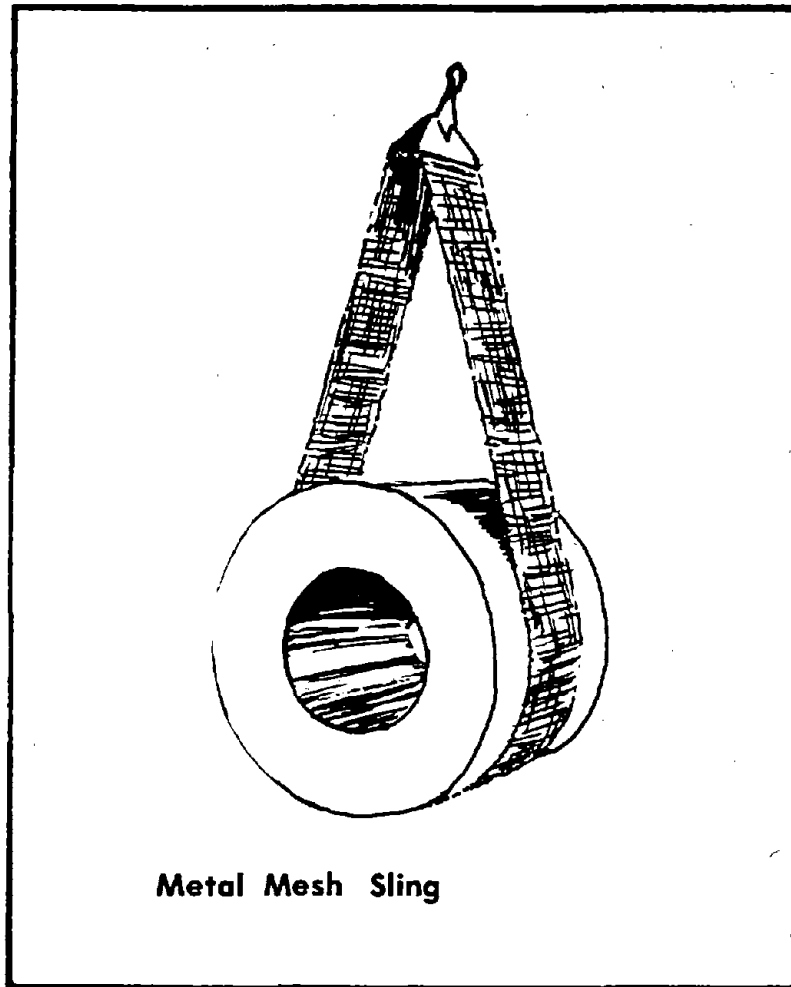
- Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
- Wear or scraping of one-third the original diameter of outside individual wires.
- Kinking, crushing, bird caging, or any other damage resulting in distortion of the wire rope structure.
- Evidence of heat damage.
- End attachments that are cracked, deformed, or worn.
- Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.
- Corrosion of the rope or end attachments.

Metal Mesh Slings

Metal mesh slings must have the rated capacity for vertical basket hitch and choker hitch loadings permanently marked on the sling. Metal mesh slings must be removed from service if any of the following conditions exist:

- A broken weld or broken brazed joint along the sling edge.
- Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion.
- Lack of flexibility due to distortion of the fabric.
- Distortion of the female handle so that the depth of the slot is increased more than 10 percent.
- Distortion of either handle so that the width of the eye is decreased more than 10 percent.

- A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.
- Distortion of either handle out of its plane.



Natural or Synthetic Fiber Rope Slings

These slings must not be used if any of the following conditions are found during inspection:

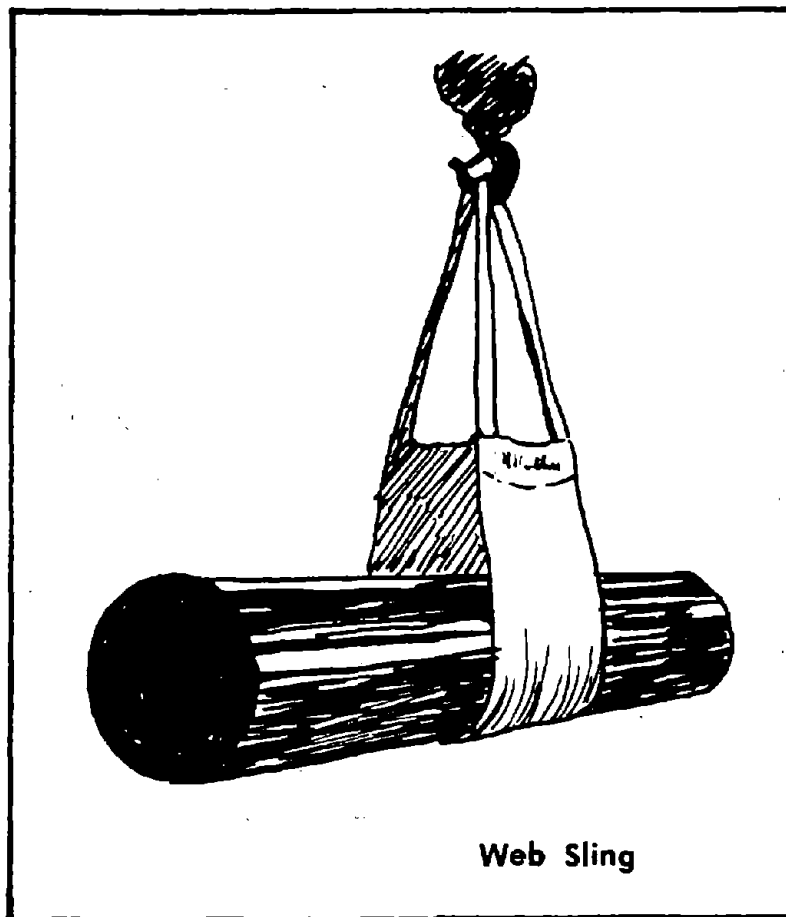
- Abnormal wear.
- Powdered fiber between strands.
- Broken or cut fibers.
- Variations in the size or roundness of strands.

- Discoloration or rotting.
- Distortion of hardware in the sling.

Synthetic Web Slings

Each sling must be marked or coded to show the type of synthetic web material and the rated capacities for each type of hitch. They must be removed from service if any of the following conditions exist:

- Acid or caustic burns.
- Melting or charring of any part of the sling surface.
- Snags, punctures, tears, or cuts.
- Broken or worn stitches.
- Distortion of fittings.



Planning Lifts

After a careful inspection of all equipment is completed each day, your concern is for the safety of other workers and for your own safety. Lifts must be carefully planned and executed to prevent accidents. Do not operate a crane if you are physically unfit to handle it correctly. If you feel ill, report at once to your supervisor.

Plan all lifts properly — know the weight and shape of the object to be lifted and the capacity of the crane. You must be familiar with the limits of your crane and slings. Always use the boom angle indicator and load charts provided by the manufacturer. Never overload.

Hitchers and operators should have a lift signalling system worked out that allows the hitcher to indicate to the operator when the load is ready to lift. Suggested signals are illustrated in the chart at the end of this booklet.

Prior to lifting, select the path for the load to travel and check the load path for obstructions or floor traffic (pedestrians, lift trucks, etc.).

Determine the height of the lift and the position the load will take when lifted.

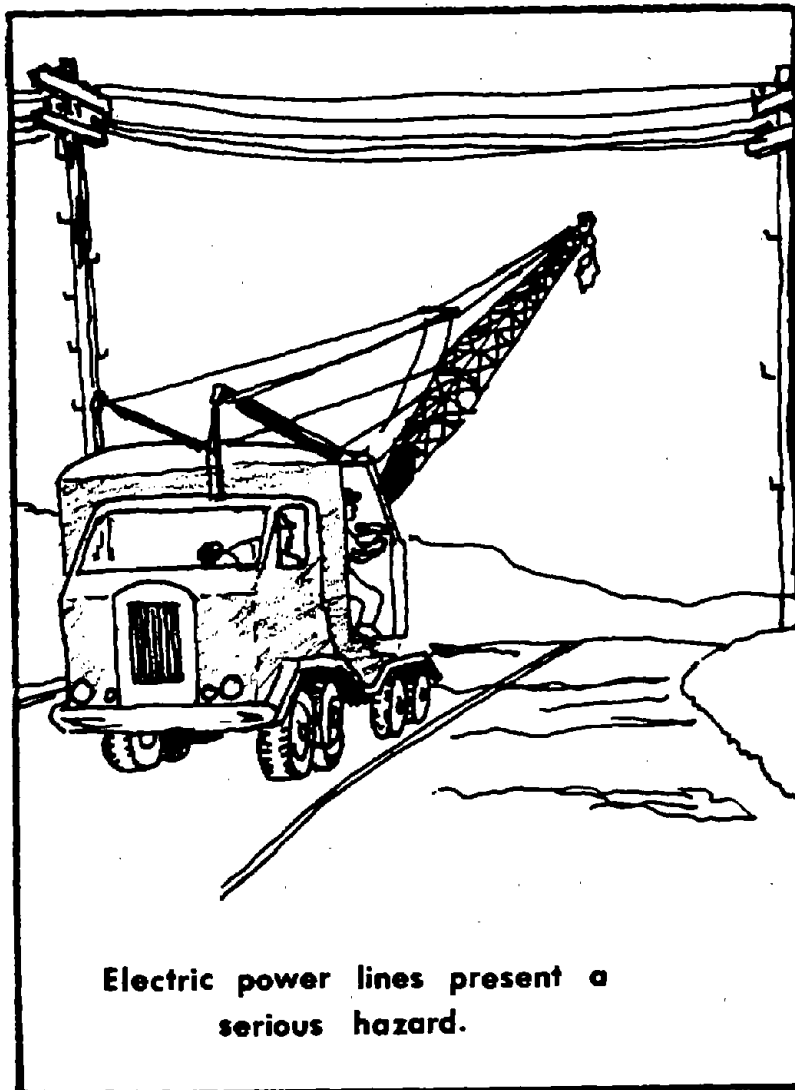
If eye bots are used, be sure that the sling is attached securely. Check the rope for kinking or twisting. Don't use homemade rigging, load attachment devices, or lifting devices. Remember that all repairs to cranes must be authorized by the crane manufacturer. Cranes that have been altered or repaired must be tested and certified before they may be placed back in service.

Before making a lift on a mobile crane, check:

- that the crane is level and on firm ground,
- the placement of outriggers,
- the placement of the counterweight, and
- the condition of the wood blocks.

Be sure that the crane is blocked properly and that the area of rotation is barricaded. If you're operating at a fixed radius, lock the boom hoist pawl.

Electric power lines (overhead or other) present a serious hazard for mobile crane operations. A minimum distance between any part of your crane and these power lines must be established by your employer and carefully observed by all operators, unless the lines have been disconnected and grounded. Contact with overhead lines is one of the most common causes of fatal crane accidents. Operators must be aware of these dangers to protect other workers as well as themselves.



Lifting

It is important to use common sense when lifting loads. If you have any questions about the safety of making a lift, check with your supervisor. If a problem develops while lifting, try to lower the load quickly and safely. Never leave your cab while a load is suspended.

After you have planned your route and determined the best way to lift it, proceed slowly with your lift.

Follow commands from the head rigger only, but *always obey a signal to stop*, no matter where it comes from. Move the hook in a way to prevent swinging. Center hoists and boom tips above loads before lifting to avoid side loads on booms or running ropes. You must be sure that loads are properly seated and well balanced in the sling. Sound the horn or alarm to warn floor personnel. Make sure hitchers are clear of the load when it is lifted. Do not move the load quickly. Lift the load only a few inches at first to check hitch before raising to travel height.

Loads should be moved at as low a level as surrounding obstructions permit so that if loads slip, they can be lowered quickly or will fall only a short distance.

Keeping loads low when moving them and maintaining a length of cable between the load and the hoist and boom tip will help absorb some of the shocks and jerks. Do not lower the load beyond the point where two full wraps remain on the hoist drum.

While lifting or traveling, several basic rules should be remembered:

- Never hoist or move loads over personnel.
- Never hoist, lower, or travel if anyone is on the crane, sling, load, or hook.
- Do not attempt to sideload unless it is approved by your supervisor.
- When necessary, a tag-line should be attached to prevent the load from swinging.

- Do not drag slings, chains, load blocks, or loads.
- Use padding to protect the sling from any sharp corners of the load if you are using a mesh sling.
- Never place your hands or fingers between the load and a tightening sling.
- Use warning devices to alert floor traffic — watch for pedestrians or other workers who seem unaware of the load's presence.
- Do not use lifting machinery in areas where there may be flammable or explosive substances unless the equipment is approved for use in such an atmosphere.
- Avoid haste. If you feel you are working at an unsafe speed, discuss it with your supervisor.
- Any change in operating procedures must be approved by your supervisor.
- Before leaving the crane, be sure the load has been safely unloaded and the equipment is locked.

When traveling from site to site in a mobile crane, there are several precautions that should be taken for safe moving. These include securing the superstructure to prevent rotation, lashing the hook down to prevent swinging, keeping the boom facing in the direction of travel, following the instructions of the person in charge, and planning the move to set up the best travel route.

IF YOU HAVE ANY DOUBTS ABOUT THE SAFETY OF YOUR EQUIPMENT OR A LIFT, ASK YOUR SUPERVISOR FOR ADVICE.

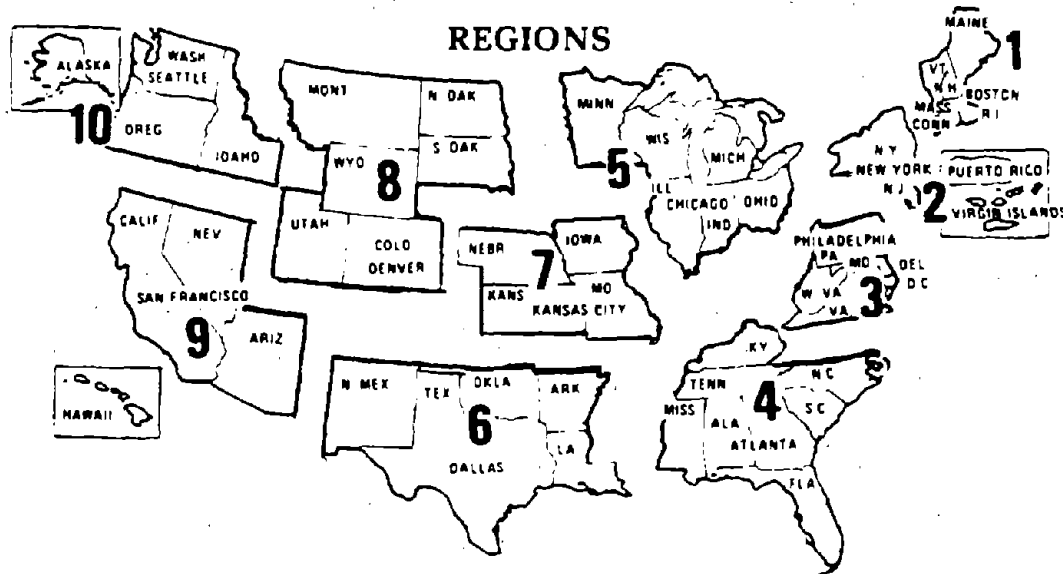
CONCLUSION

This booklet has explained some of the basics of safe crane operation. If you have any questions about the points discussed in this book, or any questions about safe operating practices, ASK YOUR SUPERVISOR.

If you think you need training in operating or in inspecting your crane or the rigging, let your supervisor know. Many crane manufacturers, rope and sling manufacturers, trade associations, and unions have films, booklets, and training materials available. Perhaps your supervisor or safety committee could contact them to present some safety training programs for you.

NIOSH AND OSHA REGIONAL OFFICES

The following pages list NIOSH and OSHA regional offices. Either of these facilities serving the state can provide information on the Occupational Safety and Health Act including questions on standards interpretations, voluntary compliance information, copies of the OSHA Standards, OSH Act Employee Rights Posting Notice, and other OSHA publications.



NIOSH REGIONAL OFFICES

DHEW, Region I
JFK Federal Bldg.
Room 1401
Boston, Massachusetts 02203
617/223-6668

DHEW, Region II
26 Federal Plaza, Room 3300
New York, New York 10007
212/264-2485

DHEW, Region III
P. O. Box 13716
Philadelphia, PA 19101
215/596-6716

DHEW, Region IV
101 Marietta Tower
Atlanta, GA 30323
404/221-2396

DHEW, Region V
300 South Wacker Dr.
33rd Floor
Chicago, IL 60606
312/886-3651

DHEW, Region VI
1200 Main Tower Bldg.
Dallas, Texas 75202
214/655-3081

DHEW, Region VII
601 E. 12th St.
5th Floor West
Kansas City, Missouri 64106
816/374-5332

DHEW, Region VIII
11037 Federal Bldg.
Denver, Colorado 80294
303/837-3979

DHEW, Region IX
50 United Nation Plaza, Rm. 231
San Francisco, CA 94102
415/556-3781

DHEW, Region X
1321 Second Ave., Mail Stop 502
Seattle, Washington 98101
206/442-0530

OSHA REGIONAL OFFICES

Region I

U.S. Department of Labor
Occupational Safety and Health Administration
JFK Building, Room 1804
Boston, Massachusetts 02203 Telephone: 617/223-6712/3

Region II

U.S. Department of Labor
Occupational Safety and Health Administration
1515 Broadway (1 Astor Plaza), Room 3445
New York, New York 10036 Telephone: 212/971-5941/2

Region III

U.S. Department of Labor
Occupational Safety and Health Administration
15220 Gateway Center, 3535 Market Street
Philadelphia, Pennsylvania 19104 Telephone: 215/596-1201

Region IV

U.S. Department of Labor
Occupational Safety and Health Administration
1375 Peachtree Street, N.E., Suite 587
Atlanta, Georgia 30309 Telephone: 404/526-3573/4 or 2281/2

Region V

U.S. Department of Labor
Occupational Safety and Health Administration
230 S. Dearborn, 32nd Floor
Chicago, Illinois 60604 Telephone: 312/353-4716/7

Region VI

U.S. Department of Labor
Occupational Safety and Health Administration
555 Griffin Square Building, Room 602
Dallas, Texas 75202 Telephone: 214/749-2477/8/9 or 2567

Region VII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 3000, 911 Walnut Street
Kansas City, Missouri 64106 Telephone: 816/374-5861

Region VIII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 15010, 1961 Stout Street
Denver, Colorado 80202 Telephone: 303/837-3883

Region IX

U.S. Department of Labor
Occupational Safety and Health Administration
9470 Federal Building, 450 Golden Gate Avenue
Post Office Box 36017
San Francisco, California 94102 Telephone: 415/556-0584

Region X

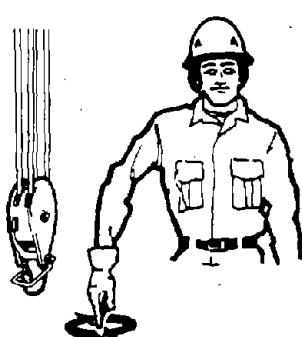
U.S. Department of Labor
Occupational Safety and Health Administration
6048 Federal Office Building, 909 First Avenue
Seattle, Washington 98174 Telephone: 206/442-5930

STANDARD HAND SIGNALS FOR OVERHEAD AND GANTRY CRANES



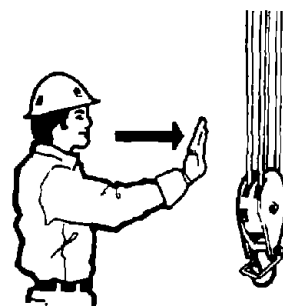
HOIST

With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



LOWER

With arm extended downward, forefinger pointing down, move hand in small horizontal circle.



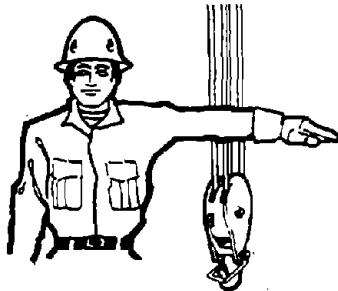
BRIDGE TRAVEL

Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



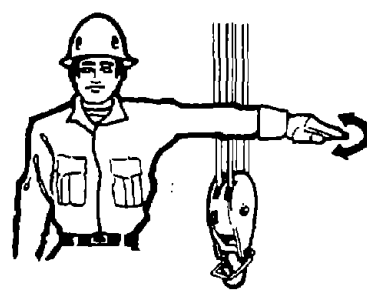
TROLLEY TRAVEL

Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.



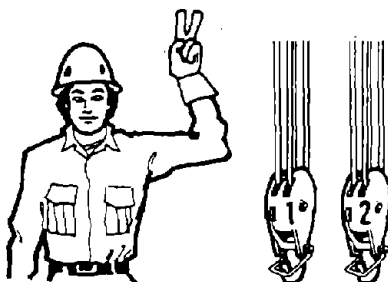
STOP

Arm extended, palm down, hold position rigidly.



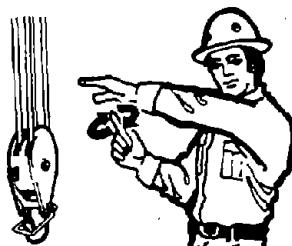
EMERGENCY STOP

Arm extended, palm down, move hand rapidly right and left.



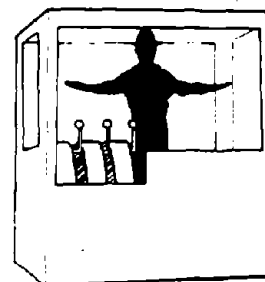
MULTIPLE TROLLEYS

Hold up one finger for block marked "1" and two fingers for block marked "2". Regular signals follow.



MOVE SLOWLY

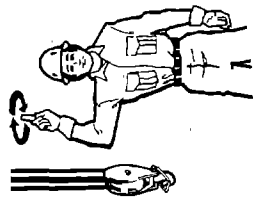
Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown as example)



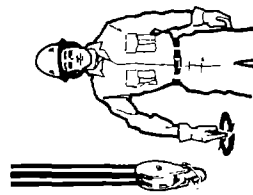
MAGNET IS DISCONNECTED

Crane operator spreads both hands apart—palms up.

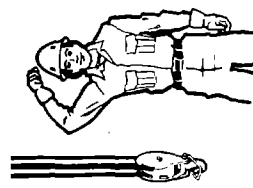
STANDARD HAND SIGNALS FOR CONTROLLING CRAWLER, LOCOMOTIVE, AND TRUCK CRANE OPERATIONS



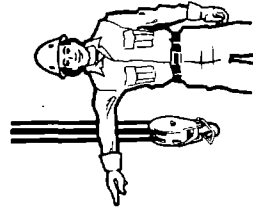
HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



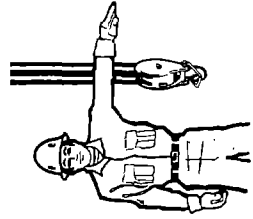
LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.



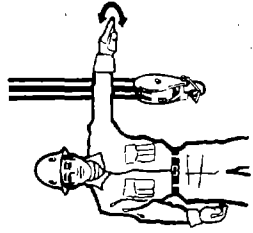
USE MAIN HOIST. Tap fist on head, then use regular signals.



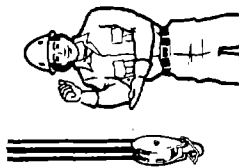
SWING. Arm extended point with finger in direction of swing of boom.



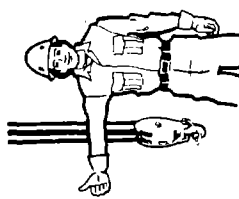
STOP. Arm extended, palm down, hold position rigidly.



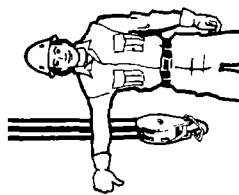
EMERGENCY STOP. Arm extended, palm down, move hand rapidly right and left.



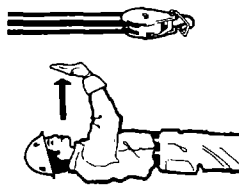
USE WHIPLINE (Auxiliary Hoist). Tap elbow with one hand, then use regular signals.



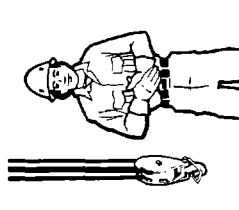
RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.



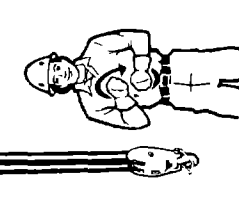
LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.



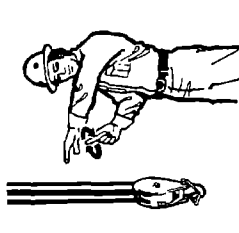
TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



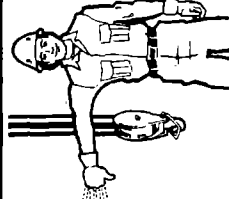
TRAVEL (Both Tracks). Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward (For crawler cranes only).



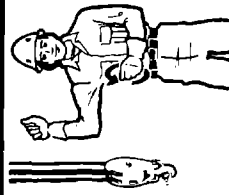
MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example).



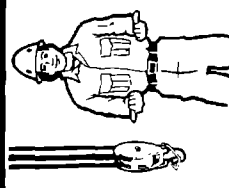
EXTEND BOOM. (Telescoping Boom). One hand Signal. One fist in front of chest with thumb tapping chest.



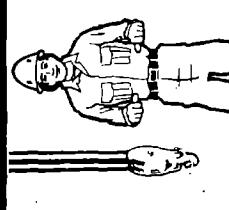
LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



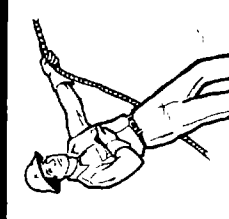
RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



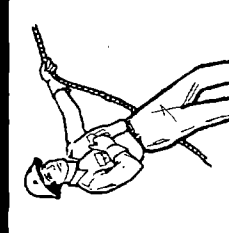
RETRACT BOOM. (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.



RETRACT BOOM. (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.



RETRACT BOOM. (Telescoping Boom). One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.



EXTEND BOOM. (Telescoping Boom). One Hand Signal. One fist in front of chest with thumb tapping chest.

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Guidelines for safe work practices for crane operators (SIC-1623) are presented. Hazards are identified and specific preventive measures are proposed. Safe operating conditions for mobile cranes and overhead cranes are listed, and inspection procedures for brakes, lubrication, wire rope, drums, sheaves, hooks, and slings are detailed. Lift planning and safe lifting operations are described. A chart showing standard hand signals for overhead and gantry cranes is provided.

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