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14.0 MOBILE CRANES

14.1 SCOPE

This chapter covers operation, inspection, maintenance, and testing requirements for mobile and locomotive cranes. It applies to crawler cranes, locomotive cranes, wheel-mounted cranes, and variations that retain the same fundamental characteristics. These cranes rotate 360 degrees and have boom-luffing capabilities. (See Attachment 14.1, "Mobile Crane Types.")

14.2 OPERATOR QUALIFICATIONS

Equipment within the scope of this chapter shall be operated only by:

a. Qualified operators (see Chapter 4.0, "Personnel Qualifications and Training Requirements.")

b. Trainees--When under the direct supervision of a designated qualified operator.

c. Maintenance, inspection, and test personnel--Limited to those functions necessary to perform maintenance and to verify performance after maintenance.

CAUTION: During crane operations, do not enter a crane cab without the knowledge and expressed consent of the operator.

14.3 CONDUCT OF OPERATORS

Mobile crane operations can be complex and subject to hazards beyond those experienced with fixed equipment. In addition to knowing the following rules, mobile crane operators require applicable experience and must exercise intelligence, care, and common sense.

a. Do not engage in any attention-diverting activity while operating the crane.

b. When physically or mentally unfit, do not engage in the operation of equipment.

c. Respond to signals from the appointed signal person. Obey a stop signal no matter who gives it. (See Attachment 14.2, "Hand Signals.")

d. Operators are responsible for those operations under their direct control. Whenever there is any doubt as to safety, consult with the supervisor before handling the loads.

e. Before leaving the crane unattended, perform the following tasks:

(1) Land any load, bucket, lifting magnet, or other device

(2) Disengage the master clutch

(3) Set travel, swing, boom brakes, and other locking devices

(4) Put controls in the off or neutral position

(5) Secure the crane against accidental travel

(6) Stop the engine

(7) An exception to para 14.3.e.(6), above, may exist when crane operation is frequently interrupted during a shift and the operator must leave the crane. Under these circumstances, the engine may remain running and the following conditions, including paras 14.3.e.(1) through (5), above, shall apply:

(a) Be situated where unauthorized entry of the crane can be observed, and

(b) The crane is located within an area protected from unauthorized entry.

(8) When a local weather storm warning exists, follow the recommendations of the manufacturer for securing the crane.

f. If there is a warning sign on the switch or engine starting controls, do not close the switch or start the engine until the warning sign has been removed by the person who placed it or an appointed person.

g. Before starting the crane, see that all controls are in the off or neutral position and that all personnel are in the clear.

h. If power fails during operations:

(1) Set all brakes and locking devices
(2) Move all clutches or power controls to the neutral position
(3) If practical, land the suspended load under brake control.

i. Be familiar with the equipment and its proper care. If adjustments or repairs are necessary, promptly report this to the appointed person and notify the next operator.

j. Test all controls at the start of a new shift. If any controls fail to operate properly, they require adjustment or repair before operations begin.

k. Follow the manufacturer's boom assembly and disassembly procedures. Any deviation from the manufacturer's procedure shall require blocking of the boom or boom sections to prevent inadvertent dropping of the boom.

l. When removing pins or bolts from a boom, workers should stay out from under the boom.

m. Each outrigger shall be visible to the operator or to a signaler during extension or setting.

14.4 OPERATING PRACTICES

14.4.1 Swing Radius--Pinch Point Clearance

When the crane is in operation, maintain a minimum clearance of 30 inches (76 centimeters) between the swing radius of the crane superstructure or counterweights and any stationary object. When this clearance cannot be maintained, isolate pinch point hazards with barricades or safeguards. Where possible, flag or barricade the swing radius.

14.4.2 Handling the Load

a. Load no crane beyond the specifications of the load rating chart, except for test purposes.

CAUTION: Total load always includes the lifted item and the rigging. Additionally, the crane hook, block, and load line may also be considered part of the load. Attachments to the boom such as a jib or auxiliary whip lines affect crane stability and may be considered part of the load. Consult the manufacturer's operating manual for direction.

b. When the precise load weight is not known, the person responsible for the lift shall ascertain that the weight does not exceed the crane rating at the radius at which the load is to be lifted.

CAUTION: If a load of unknown weight is potentially near the crane's capacity, a load-indicating device should be used. If a load must "break-loose" before lifting, or while being handled, or if it may meet an obstruction, a load-indicating device should be used.

c. If a lift is potentially limited by structural competence of the crane, rather than by stability, the load shall be determined within plus or minus 10 percent before it is lifted.

d. Use regular lay wire rope for crane load lines with an operating design factor of no less than 3.5. Load lines with rotation-resistant ropes require an operating design factor of no less than 5.

NOTE: Standard ASME B30.5-3.2.1 grants special provisions for the use of rotation-resistant ropes with an operating design factor less than 5, but no less than 3.5. These provisions are not intended for duty cycle of repetitive lifts. The crane manufacturer shall be consulted and strict compliance with ASME B30.5 is required if such special provisions are implemented.

14.4.3 Attaching the Load

a. Never wrap the hoist rope around the load.

b. Attach the load to the hook by means of slings or other devices of sufficient capacity.

c. If the crane is not equipped with automatic drum and boom braking systems and the load is to remain suspended for any considerable length of time, set the drum and boom brakes to hold the load.

14.4.4 Holding the Load

a. Do not leave the controls while the load is suspended.

b. As an exception to para 14.4.4.a, above, when a load is to be held suspended for a period exceeding normal lifting operations, the operator may leave the controls provided:

(1) The supervisor and the operator establish requirements for restraining the boom hoist, telescoping, load, swing, and outrigger functions

(2) Barricades, or whatever other precautions may be necessary, are taken.

c. No person should be permitted to stand or pass under a suspended load.

14.4.5 Moving the Load

CAUTION: It is important to ensure that no underground hazards exist, such as electrical vaults, conduit banks, tanks, and piping. If soil stability is questionable, soil tests may be necessary to determine stability.

14.4.5.1 Preconditions. The person directing the lift (supervisor or designated leader) shall ensure:

a. The crane is level and, where necessary, blocked.

b. The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches.

c. The lift and swing path is clear of obstructions.

d. All persons are clear of the swing radius of the crane counterweight.

14.4.5.2 Before Starting the Lift. Before starting the lift, the operator shall ensure:

a. The hoist rope is not kinked.

b. Multiple-part lines are not twisted around each other.

c. The hook is over the load in such a manner as to minimize swinging.

d. If there is a slack rope condition, the rope is seated on the drum and in the sheaves as the slack is removed.

e. Wind speed and other weather conditions shall be considered. Do not attempt lifts if weather conditions are adverse to safe load-handling operations.

f. The load line is plumb so the cranes will not drag the load sideways.

14.4.5.3 During Lifting Operations. During lifting operations, care shall be taken to ensure:

a. No sudden acceleration or deceleration of the moving load.

b. Load, boom, or other parts of the machine do not contact any obstructions or enter the Danger Zone around electrical transmission lines (see para 14.4.7) or a transmitter tower (see para 14.4.7.1).

CAUTION: When landing loads on blocking, the loads must be set on adequate blocking to prevent damage to the slings and the loads must be safely landed and properly blocked to avoid unexpected roll over or tipping before being unhooked and unslung.

14.4.5.4 Side Loading. Side loading of booms shall be limited to freely suspended loads. Do not drag loads sideways.

14.4.5.5 Avoid Loads Over People. The operator should avoid carrying loads over people.

14.4.5.6 Wheel-Mounted Cranes - Lifting Over Front. On wheel-mounted cranes, do not lift over the front area, except as specified by the manufacturer.

14.4.5.7 Brake Test - When Load Approaching Rated Load. Whenever a load approaching the rated load is handled, the operator shall test the brakes by lifting the load a few inches and applying the brakes.

14.4.5.8 Outriggers. Anytime the load or radius requires the use of outriggers, fully extend or deploy them per the load rating chart specifications. Outriggers are set to remove the machine weight from wheels, except for locomotive cranes (see para 14.4.5.10). When outrigger floats are used, they shall be attached to the outriggers. Blocking under outrigger floats, shall meet the following conditions:

a. Have sufficient strength to prevent crushing, bending, or shear failure.

b. Be of adequate size and thickness to completely support the float, transmit the load to the supporting surface, and prevent shifting, toppling, or excessive settlement under load.

c. Use blocking only under the bearing surface of the outrigger.

14.4.5.9 Minimum Two Wraps on Drums. Neither the load nor the boom shall be lowered below the point where less than two full wraps of rope remain on the respective drums.

14.4.5.10 Locomotive Crane--Outriggers. For locomotive cranes, the manufacturer's instructions for lifting with or without outriggers shall be followed.

14.4.5.11 Lifts with Two or More Cranes. When two or more cranes are used to lift a load, a designated person shall direct the lifting operation. That person analyzes the operation and instructs involved personnel in the proper crane positioning, rigging, and the movements that will be accomplished. Decisions, such as the necessity to reduce crane ratings, load position, boom location, ground support, and speed of movement shall be made. A pre-lift meeting shall be held by the designated person with the crane operators and other involved personnel in attendance. The plan/procedure shall be reviewed and questions shall be resolved.

14.4.5.12 Moving Cranes From One Job Site to Another (Transit). Prepare the crane for transit in accordance with the manufacturer's instructions. (See Attachment 14.3 concerning lattice boom dismantling/assembly.) The following additional precautions shall be exercised while the crane is in transit from job to job:

a. Carry the boom in line with the direction of motion.

b. Secure the superstructure against rotation (or place the boom in a boom rack mounted on the carrier), except when negotiating turns when there is an operator in the cab or the boom is supported on a dolly.

c. Lash down or otherwise secure empty hook(s) to restrain them from swinging freely. If questions arise about this provision, the manufacturer's instructions shall govern.

d. Oversize vehicles, more than 8 feet - 6 inches (2.6 meters) wide or 14 feet (4.3 meters) high, shall require an oversize load permit. Contact Hanford Transportation Operations at 376-6654 or 372-2946 for oversize/overweight load permits.

e. Before equipment more than 14 feet (4.3 meters) high is transported, coordinate routes and schedules with Electrical Utilities Operations. Electrical utilities can be contacted at the Electrical Utilities Control Dispatch Center, telephone 373-2320 or 373-2321.

f. In transit with no load and boom lowered, the minimum equipment clearance is 4 feet (1.2 meters) for voltages less than 50 kilovolts, 10 feet (3 meters) up to and including 345 kilovolts, and 16 feet (4.9 meters) for voltages up to and including 750 kilovolts.

NOTES:

(1) When the machine moves under its own power from one location to another on a job site, the supervisor and/or crane operator shall determine the machine's condition for travel.

(2) See Appendix A, Definitions and Acronyms, "Travel" and "Transit."

14.4.5.13 Traveling with a Load.

a. Traveling with suspended loads entails many variables; i.e., the type of terrain, boom length, momentum in starting and stopping, etc. Therefore, it is impossible to formulate a single standard procedure with any assurance of safety. Thus, while traveling with a load, a designated person, in coordination with the crane operator, must evaluate prevailing conditions and determine applicable safety precautions.

b. Before a crane travels with a load, determine that the manufacturer does not prohibit this practice. If the manufacturer has approved traveling with a load, a designated person shall be responsible for the operations. Decisions such as the necessity to reduce crane ratings, load position, boom location, ground support, travel route, speed of movement, and outrigger position shall be in accordance with that person's determination and the manufacturer's instructions. No person shall ride on the machine during "pick and carry" operations. Unless allowed by the manufacturer's operating instructions or written approval from the manufacturer, do not place the load on any part of the crane. Check the specified tire pressure and travel with the boom in line with the direction of travel. Avoid sudden starts and stops. Use tag or restraint lines as necessary to control swinging of the load.

CAUTION: The travel path should be smooth, firm, and level. If soil stability is questionable, soil tests may be necessary to determine stability. Where potential underground hazards exist (such as electrical vaults, conduit banks, tanks, and piping), they must be evaluated and action must be taken to make sure mobile crane operations can be accomplished safely.

c. A crane with or without a load must not travel with the boom so high that it may bounce back over the cab.

d. During "pick and carry" operations, exercise extra caution to avoid electrical hazards from working near energized transmitters or power lines (see para 14.4.7).

e. During "pick and carry" operations, always use a minimum of two helpers to assist the crane operator; one helper will serve as the flagger with key responsibility for watching the load and signaling as necessary to control load movement. The second helper will serve as the spotter, with key responsibility to watch for and signal as necessary to avoid hazards involving the crane's movement. Typical obstructions and hangups include power lines and any other obstructions for which the crane operator may not have a clear line of sight.

14.4.5.14 Rotational Speed. When the crane is rotated, avoid sudden starts and stops. Limit the rotational speed such that the load does not swing out beyond the radius at which it can be controlled. Use tag or restraint lines as necessary to control the load.

14.4.5.15 Boom at Fixed Angle. When a crane is to be operated with the boom at a fixed angle, the boom-hoist pawl or other positive holding device shall be engaged.

14.4.5.16 Use of Winch Heads.

a. A winch head shall not be used without the knowledge of the operator.

b. While a winch head is being used, the operator shall be within convenient reach of the power unit control lever.

14.4.5.17 Riding Hook or Load--Not Permitted. Personnel are not permitted to ride the bare hook, hook ball or a suspended load. (For personnel lifting, see Chapter 15, "Personnel Lifting.")

14.4.5.18 Footing. A firm footing under both crawler tracks, all tires, or individual outrigger pads should be provided. Where such a footing does not exist, timbers, cribbing, or other structural members shall be provided to distribute the load. Do not exceed the bearing capacity of the underlying material. See Caution note at para 14.4.5. The crane must be level within tolerances and in accordance with the instructions from the manufacturer.

14.4.5.19 Ballast or Counterweight. Ensure ballast or counterweight is in place as specified by the crane manufacturer. The addition of ballast or counterweight other than that specified by the crane manufacturer is dangerous and not allowed.

14.4.6 Personnel Lifting. (See Chapter 15, "Personnel Lifting.")

14.4.7 Operating Cranes Near Energized Transmitters or Electric Power Lines

It is recognized that operating mobile cranes where they can become electrified from electric power lines and transmitter towers is an extremely hazardous practice. It is advisable to perform the work so there is no possibility of the crane, load line, or load becoming a conductive path.

NOTE: A sign warning of electrocution hazards is required on cranes, see para 14.6.6.5(a).

14.4.7.1 Operating Near a Transmitter Tower. Before initiating work near a transmitter tower (e.g., radio, microwave) where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be de-energized or tests shall be made to determine if electrical charge is induced on the crane. If an electrical charge is induced and the transmitter cannot be de-energized, the following shall be done:

a. The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom.

b. Ground jumper cables shall be attached to the materials that are being handled.

c. Combustible and flammable materials shall be removed from the immediate area before operations.

14.4.7.2 Operating Near Electric Power Lines (See Figure 14-1). Any overhead wire shall be considered to be an energized line unless and until the owner of the line or the electrical utility authorities indicate that it is not an energized line. Do not rely on the coverings of wires for protection.
The following four conditions must be considered when operating a mobile crane near electric power lines:

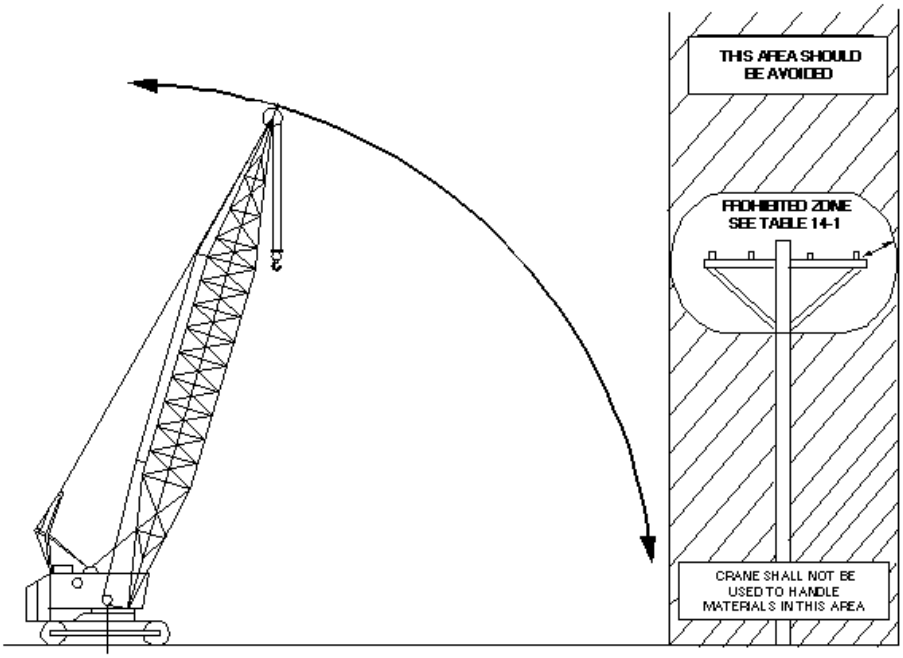
a. Power lines de-energized and grounded as in para 14.4.7.4.

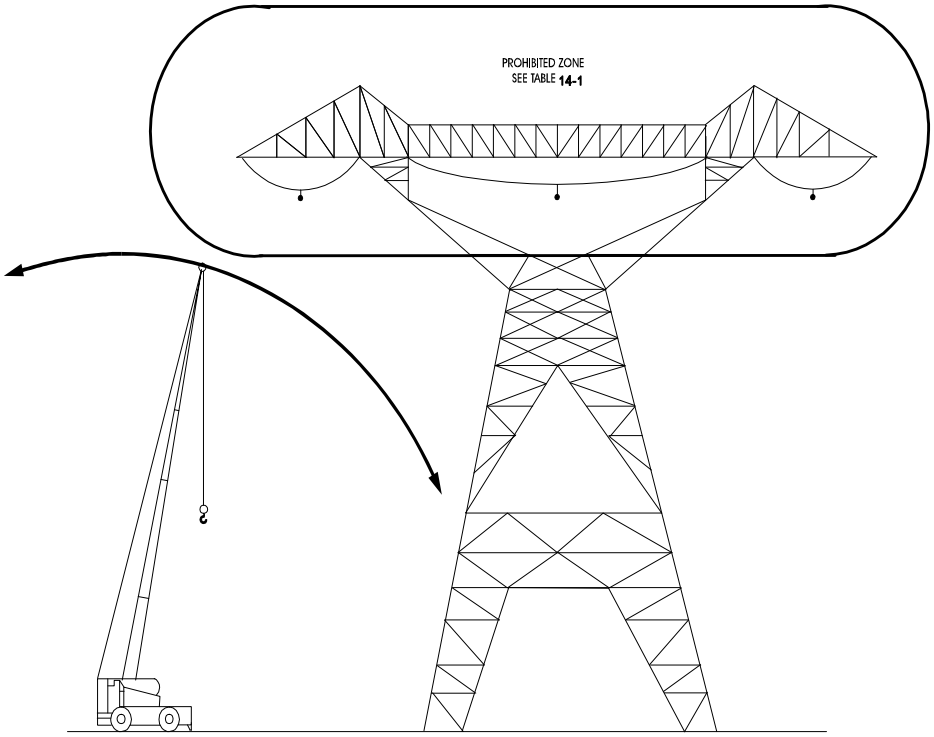
b. Power lines energized, crane operating less than the erected/fully extended boom length away as in para 14.4.7.5.

c. Power lines energized, crane within prohibited zone as in para 14.4.7.6.

d. Crane in transit, no load and boom lowered as in para 14.4.7.7.

Figure 14-1. Operating Cranes Near Electrical Power Lines
Not Within a Boom Length of Prohibited Zone.





14.4.7.3 Required Notification Before Work.

a. Before commencement of operations near electric power lines, notify the electrical utility and ensure their cooperation (one week advanced notice is requested). The electrical utility points of contact are:

Hanford Electrical Utilities Control Dispatch Center
Building 251W, telephone 373-2320 or 373-2321

City of Richland Dispatch Center
telephone 943-4428.

b. Before commencement of operations near a transmitter tower, notify Hanford Network Maintenance and ensure their cooperation (one week advanced notice is requested). The Network Maintenance point of contact is:

Hanford Network Maintenance
1100 Area, Building MO-404, telephone 376-0789.

14.4.7.4 Crane Operation Near De-energized and Grounded Electric Power Lines. This describes the preferred condition under which the operation can be performed safely. The hazard of injury or death due to electrocution has been removed. The following steps shall be taken to ensure that de-energization of the power lines has occurred:

a. The power company or owner of the power lines shall de-energize the lines.

b. The lines shall be visibly grounded to avoid electrical feedback and appropriately marked at the job-site location.

c. A qualified representative of the owner of the lines or a designated representative of the electrical utility shall be on site to verify that steps (a) and (b) have been completed and that the lines are not energized.

d. If cage-type boom guards, insulating links, or other proximity warning devices are used on cranes, such devices shall not be used as a substitute for requirements of para 14.4.7. If such devices are used, due to the lethal nature of electrical hazards and to lessen the potential of false security, the crane operator, crew, and load handling personnel shall receive instructions and have an understanding of:

(1) The electrical hazard involved,
(2) Operating conditions for the devices,
(3) Limitations of such devices, and
(4) Testing requirements prescribed by the device manufacturer.

14.4.7.5 Power Lines Energized, Crane Operating Within the Erected/Fully Extended Boom Length of the Prohibited Zone (see Figure 14-2).

a. An onsite meeting between project management and a qualified representative of the owner of the power lines or a designated representative of the electrical utility shall take place to establish the procedures to safely complete the operations.

b. The specified clearance between the power lines and the crane, load line, and load shall be maintained at all times as specified in Table 14-1 and shown in Figure 14-3.

c. Load control, when required, shall utilize tag lines of a nonconductive type. (A recommended choice for a nonconductive tag line is dry rope made of polypropylene or polyethylene fiber.)

d. A qualified signaler, whose sole responsibility is to verify that the required clearance is maintained, shall be in constant contact with the crane operator.

e. No one shall be permitted to touch the crane or the load unless the signaler indicates it is safe to do so.

f. Operation of boom and load over electric power lines is extremely dangerous due to limited perception of distance and multiple contact points as viewed from the position of the operator and/or position of the signaler. The operator should avoid operating the crane, with or without a load, in this area.

g. The horizontal and vertical distance of movement of long span lines due to the wind shall be added to the minimum clearance distance as specified in Table 14-1. A qualified representative of the owner of the power lines or a designated representative of the electrical utility shall be consulted for specific distances.

h. A qualified person should attach devices such as ribbons, balls, etc., to the power lines to improve visibility, or equivalent means employed to aid in location of the Danger Zone.

i. If cage-type boom guards, insulating links, or other proximity warning devices are used on cranes, such devices shall not be used as a substitute for requirements of para 14.4.7. If such devices are used, due to the lethal nature of electrical hazards and to lessen the potential of false security, the crane operator, crew, and load handling personnel shall receive instructions and have an understanding of the following:

(1) The electrical hazard involved
(2) Operating conditions for the devices
(3) Limitations of such devices
(4) Testing requirements prescribed by the device manufacturer.

Figure 14-2. Danger Zone for Cranes and Lifted Loads Operating Near Electrical Power Lines Within Boom Length of Prohibited Zone.

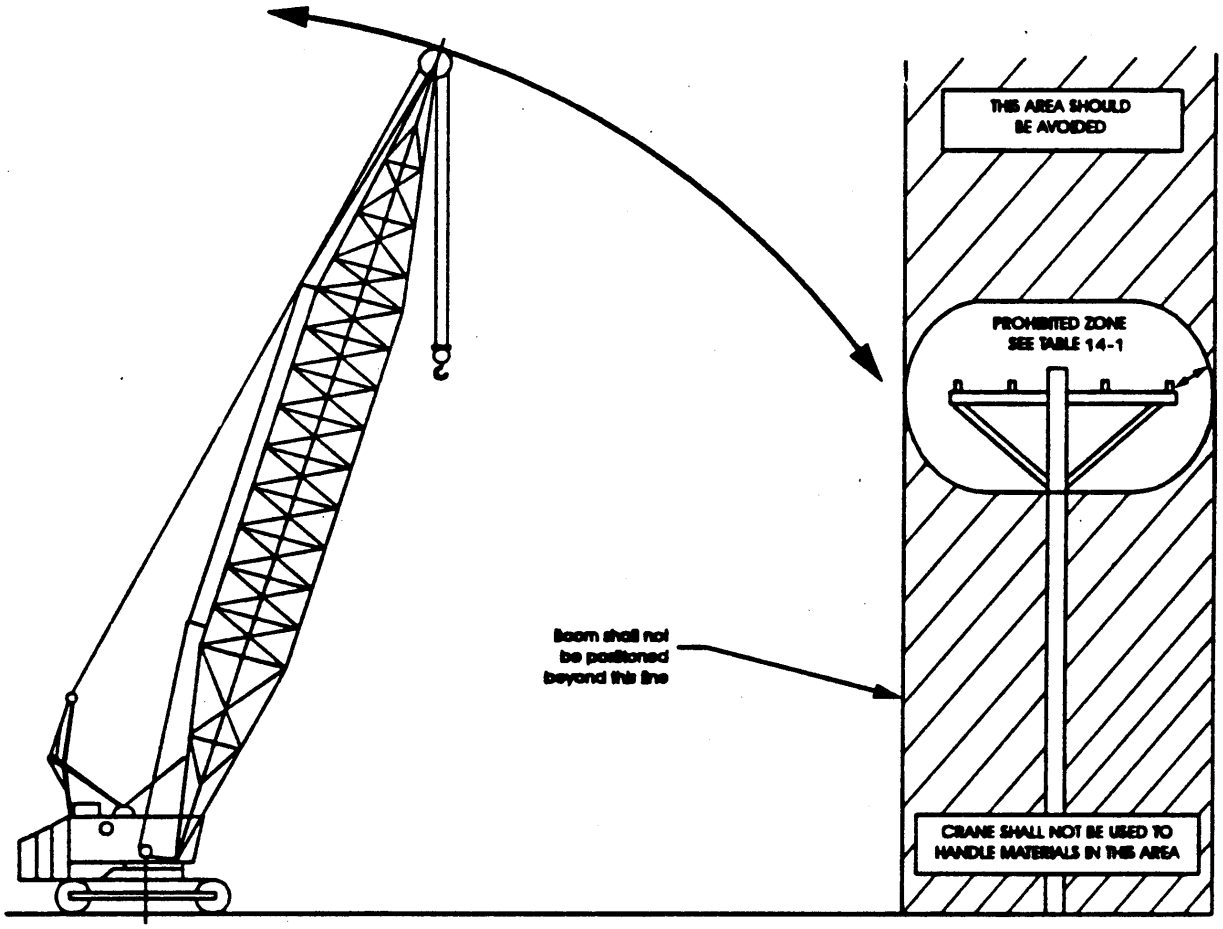
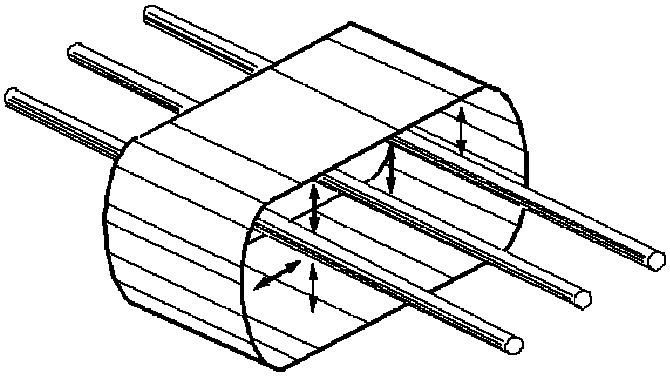


Table14-1. Safe Working Distance from Power Lines.

a. When operating near high-voltage power lines	
Normal voltage (phase to phase)	Minimum required Clearance
To 50 kV	10 ft (3.1 m)
Over 50 to 200 kV	15 ft (4.6 m)
Over 200 to 350 kV	20 ft (6.1 m)
Over 350 to 500 kV	25 ft (7.6 m)
Over 500 to 750 kV	35 ft (10.7 m)
Over 750 to 1000 kV	45 ft (13.7 m)

b. While in transit with no load and boom or mast lowered:	
Normal voltage (phase to phase)	Minimum required Clearance
To 0.75 kV	4 ft (1.2 m)
Over 0.75 to 50 kV	6 ft (1.8 m)
Over 50 to 345 kV	10 ft (3.1 m)
Over 345 to 700 kV	16 ft (4.9 m)
Over 750 to 1000 kV	20 ft (6.1 m)

Figure 14-3. Minimum Radial Distance of Prohibited Zone for Cranes Operating Near Electrical Lines.



14.4.7.6 Crane Operations Within the Prohibited Zone and the Power Lines are Energized.

CAUTION: Working in the prohibited zone with power lines energized requires very disciplined and extraordinary safety precautions, including direct involvement and support from the electric utility organization.

a. Before such operations take place, a qualified person responsible for crane operations and a qualified representative of the utility or an engineer qualified in power line transmission, after visiting the site together, shall determine whether operating the crane within the Prohibited Zone is the most feasible way to complete the job. Both persons shall set minimum required clearances and procedures for safe operations. These operations shall be under their supervision.

   Before crane operations within the Prohibited Zone, the following may be required:

   (1) Crane/load grounding to a neutral line by the utility.

   (2) Electrical system protective devices that automatically re-energize the circuit after a power line contact occurrence blocked or disengaged to inhibit this function.

   (3) Insulated barriers, which are not a part of nor an attachment to the crane and which will not allow contact between the energized electric power lines and the crane, load lines, or load.

   (4) Nonconductive barricades to restrict access to the crane work area.

b. Load control, when required, shall utilize tag lines of a nonconductive type. (A recommended choice for a nonconductive tag line is dry rope made of polypropylene or polyethylene fiber.)

c. A qualified signaler, whose sole responsibility is to verify that the established clearances are maintained, shall be in constant contact with the crane operator.

d. The person responsible for the operation shall alert and warn the crane operator and all persons working around or near the crane about hazard of electrocution or serious injury and instruct those persons on how to avoid the hazard.

e. All non-essential personnel shall be removed from the crane work area.

f. No one shall be permitted to touch the crane or the load unless the signaler indicates it is safe to do so.

g. If cage-type boom guards, insulating links, or other proximity warning devices are used on cranes, such devices shall not be used as a substitute for requirements of para 14.4.7. If such devices are used, due to the lethal nature of electrical hazards and to lessen the potential of false security, the crane operator, crew, and load handling personnel shall receive instructions and have an understanding of the following:

(1) The electrical hazard involved
(2) Operating conditions for the devices
(3) Limitations of such devices
(4) Testing requirements prescribed by the device manufacturer.

14.4.7.7 Crane in Transit With No Load and Boom Lowered

a. Cranes in transit with no load and boom lowered shall maintain the minimum clearance as specified in Table 14-1(b).

b. If during transit there is a reasonable possibility of getting near a power line, a person shall be assigned to observe the clearance and give warning before the crane approaches the minimum required clearance. It is important that this person not be distracted or assigned other duties while observing power line clearance.

c. When planning transit of the crane, the effect of speed and terrain on the boom and crane movement shall be considered.

14.4.8 Signals and Instructions

14.4.8.1 Standard Signals. Standard hand signals are shown in Attachment 14.2, "Hand Signals." In situations where hand signals are not effective, use voice communication equipment (radio or hard wired). When using radio, it is important to have channels devoted exclusively to crane communications. Signals shall be discernible or audible.

14.4.8.2 Special Signals. For operations not covered by standard hand signals or for special operations, additions to or modifications of the standard signals may be required. In such cases, the special signals shall be agreed upon in advance by both the operator and the signal person, and should not conflict with standard signals.

14.4.8.3 Audible Travel Signals. When moving the vehicle, use the following signals:

a. One audible signal--STOP
b. Two audible signals--GO AHEAD
c. Three audible signals--BACK UP.

14.4.8.4 Instructions. If it is desired to give instructions to the operator, other than those provided by the established signal system, the crane motions shall be stopped until instructions are given to and understood by the operator.

14.4.9 Fire Extinguisher

A portable fire extinguisher, with a minimum extinguisher rating of 10 BC, shall be installed in the cab or at the machinery housing. Operating and maintenance personnel shall be familiar with the use and care of the fire extinguisher. Maintain fire extinguishers in a serviceable condition.

14.4.10 Refueling

Engines shall be stopped before refueling, and smoking or open flames within 50 feet (15.2 meters) of the refueling area are prohibited. Portable containers for refueling with gasoline shall be safety-type cans equipped with an automatic closing cap and a flame arrester.

14.5 INFORMATION FROM CRANE MANUFACTURER

14.5.1 Rating Charts

A durable, legible rating chart(s) from the manufacturer shall be provided in the cab of each crane. If the original chart(s) becomes illegible, a new chart(s) shall be obtained only from the crane manufacturer or designee. The crane's serial number should be printed or stamped on the chart by the manufacturer or designee. The custodian shall ensure that the proper load chart(s) are available in the cab.

The rating chart(s) shall be in a location accessible to the operator while the operator is at the controls.

14.5.1.1 Rating Chart Contents. The rating chart(s) shall include a full and complete range of manufacturer's crane load ratings at all stated operating radii, boom angles, work areas, and all stated boom lengths and configurations, jib lengths and angles (or offset). Also included shall be alternative ratings for use and nonuse of optional equipment on the crane, such as outriggers and extra counterweight, which affect ratings. Where ratings are limited by structural, hydraulic, or factors other than stability, the limitations shall be shown and emphasized on the rating charts.

14.5.1.2 Work Area Chart. The manufacturer should and normally will provide a work area chart(s) showing the limiting position of any load within areas indicated (e.g. over side, over rear, over front). Work area configurations deviating from ASME B30.5, Figure 11, shall be defined by diagrams supplied by the crane manufacturer.

14.5.2 Operating Manual

An operating manual, supplied by the manufacturer, shall be readily available to the operator at all times.

14.5.3 Field Assembly, Disassembly, and Maintenance Information

The manufacturer shall furnish field assembly, disassembly, and maintenance information. (See Attachment 14.3 concerning lattice boom dismantling/assembly.)

14.6 EQUIPMENT REQUIREMENTS

14.6.1 Wire Rope

a. For wire rope requirements, see Chapter 8.0, "Wire Rope."

b. Any new poured socket or swaged socket assembly used as a boom pendent shall be proof tested to the crane or fitting manufacturer's recommendations, but in no case greater than 50 percent of the component wire rope's or structural strand's nominal strength.

14.6.2 Reeving Accessories

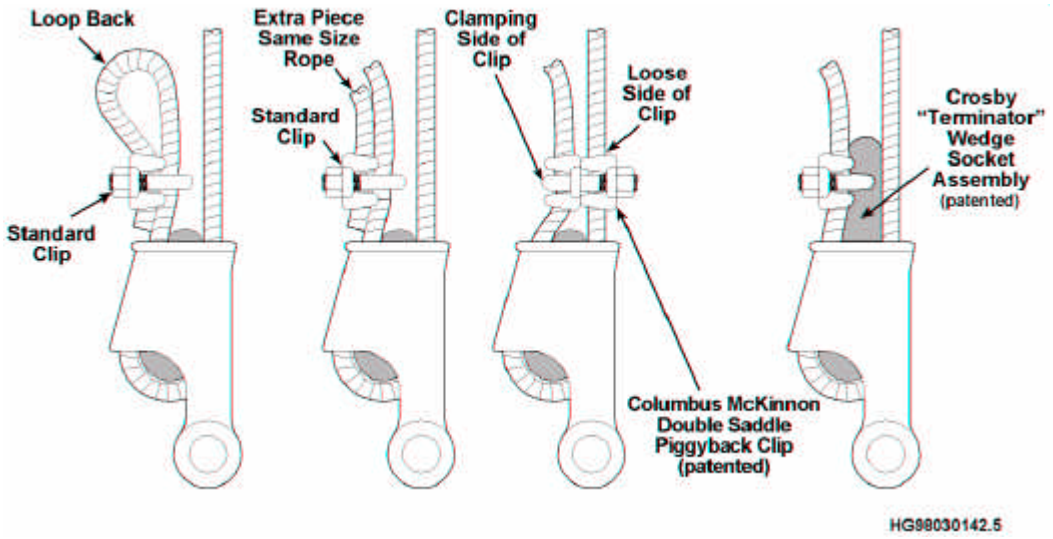
Wire rope clips shall be drop-forged steel of the single- or double-saddle type. Wire rope clips used in conjunction with wedge sockets shall be attached to the unloaded dead end of the rope only (see Figure 14-4). Eye splices shall be made in a manner recommended by the rope or crane manufacturer, and rope thimbles should be used in the eye.

NOTES: a. It is important that wedge socket assemblies consist of a wedge and a socket, matched pair of the correct size, and from the same manufacturer.

b. Crosby® Group, Inc., now manufactures a patented wedge socket assembly that clips the rope to the wedge. This product may be found on new cranes and is suitable as a replacement part on existing cranes.

Tighten wire rope clips evenly to the recommended torque. Rope clip nuts should be periodically checked and tightened as necessary to compensate for any decrease in rope diameter during usage. Swaged, compressed, or wedge-socket fittings shall be applied as recommended by the rope, crane, or fitting manufacturer.

Figure 14- 4. Typical Wedge Sockets.



14.6.3 Sheaves

14.6.3.1 Sheave Grooves. Sheave grooves shall be smooth and free from surface defects that could cause rope damage. The cross-sectional radius at the bottom of the groove shall form a close-fitting saddle for the size of rope used.

14.6.3.2 Sheave Close-Fitting Guards. Sheaves carrying ropes, which can be momentarily unloaded, shall be provided with close-fitting guards or other devices to guide the rope back into the groove when the load is reapplied. The sheaves in the lower load block shall be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with loose ropes.

14.6.4 Load Hook, Ball Assemblies, and Load Blocks

Load hooks, ball assemblies, and load blocks shall be of sufficient weight to overhaul the line from the highest hook position. Hook and ball assemblies and load blocks shall be labeled with their rated capacity and weight.

14.6.4.1 Hook Mousing and Throat Latches. Latch equipped hooks shall be used for hoisting and rigging (H&R) operations unless the application makes use of the latch impractical or unsafe. The absence of a hook throat latch is not indiscriminately allowed. (See Chapter 5.0, "Hooks;" para 5.3, "Throat Latches").

14.6.5 Booms and Jibs

14.6.5.1 Jib Restraint. Jibs shall be restrained from backward overturning. Cable-type belly slings are not acceptable for restraints.

14.6.5.2 Boom-Angle Indicator. A boom-angle indicator, readable from the operator's station, shall be provided.

14.6.5.3 Boom-Length Indicator. A boom length indicator, readable from the operator's station, shall be provided for telescoping booms unless the load rating is independent of the boom length.

14.6.5.4 Boom-Hoist Stop. A boom-hoist disconnect, shutoff, or hydraulic relief shall be provided to automatically stop the boom hoist when the boom reaches a predetermined high angle.

14.6.5.5 Boom and Jib Identification. Booms, boom sections, and jibs shall be clearly identified as to the crane(s) they are assigned.

14.6.6 Miscellaneous Equipment Requirements

14.6.6.1 Two-Blocking Features.

a. Telescopic boom cranes manufactured after February 28, 1992, shall be equipped with an anti-two-block device or a two-block damage prevention feature for all points of two-blocking. Telescopic boom cranes manufactured before February 28, 1992, should be equipped with a two-block warning feature(s), a two-block damage prevention feature, or an anti-two-block device for all points of two-blocking (i.e., jibs, boom extensions, etc.).

b. Lattice boom cranes manufactured after February 28, 1992, shall be equipped with a two-block warning feature which functions for all points of two-blocking. Lattice boom cranes manufactured before February 28, 1992, should be equipped with a two-block warning feature which functions for all points of two-blocking.

c. Cranes used to lift suspended personnel platforms shall have an anti two-block device or a two-block damage prevention feature. A two-block warning feature and/or assigning a person to watch for, and guard against, two-blocking provides insufficient safety for personnel lifting and is not allowed.

14.6.6.2 Load Indicators. Cranes built after November 19, 1993, with a maximum load capacity of 3 tons or more should have load indicators.

14.6.6.3 Horn or Signal Device. An audible horn or signal device shall be provided. The control for the device shall be within reach of the operator.

14.6.6.4 Crane Levelness Indicator. Means shall be provided for the operator to visually determine the levelness of the crane.

14.6.6.5 Signs.

a. Electrocution Hazards Warning Signs. Durable signs shall be installed, visible from the operator's station, warning that electrocution or serious bodily injury may occur unless a minimum clearance of 10 feet (3 meters) is maintained between the crane or the load being handled and energized power lines up to 50 kV, and that greater clearances are required because of higher voltages. Refer to Table 14-1 and Figure 14-3.

b. Hand Signal Posting. It is required to conspicuously post at the job site figures demonstrating standard hand signals for controlling mobile cranes. Posting outside on the crane cab meets this requirement.

c. Posting hand signal charts outside on the crane cab is recommended and will meet the requirement to post hand signals conspicuously at the job site (see para 14.4.8.2, "Hand Signal Posting").

14.6.6.6 Aviation Safety - High Boom. Within 3.5 miles (3 nautical miles) of an airport, crane booms configured 200 feet or more above ground level must have the prior approval of the DOE-RL Aviation Safety Officer. (See 14 CFR 77, "Federal Aviation Administration.")

CAUTION: Cranes working near Richland may be within 3.5 miles of the Richland Airport.

14.6.6.7 Seat Belt. If a seat belt is provided with a wheel-mounted, single-control station crane, it shall be used during transit and travel.

14.7 INSPECTION

a. Equipment deficiencies found during operation or inspection that affect safety shall be resolved before continued operation of the crane.

b. Inspection requirements shall be derived from information provided by the crane manufacturer. Unless there is a valid justification to do otherwise, the manufacturer's recommendations shall be followed. Inspection procedures shall be for the applicable make and model of crane.

14.7.1 Initial Inspection

Before initial use, new and altered cranes shall be inspected by a qualified inspector to ensure compliance with requirements contained in the following documents:

a. The purchase order (if applicable)
b. Provisions of this manual
c. ASME B30.5, "Mobile and Locomotive Cranes"
d. 29 CFR 1910.180, "Crawler Locomotive and Truck Cranes"
e. 29 CFR 1926.550, "Cranes and Derricks."

14.7.2 Frequent Inspection

Frequent inspections shall be performed by the operator or an appointed person.

14.7.2.1 Frequent Inspection Procedure. The frequent inspection procedure shall be available to the operator. The frequent inspection procedure, or an attachment thereto, shall state how deficiencies found during frequent inspection shall be reported.

NOTE: Frequent inspection procedures may be supplied by the manufacturer.

14.7.2.2 Frequent Inspection Steps. The following steps should be included in the frequent inspection procedure.

a. Recommended Daily, when used:

(1) Check the control mechanisms for maladjustment that may interfere with proper operation.

(2) Check safety devices and operator aids for proper operation (see para 14.7.4.a.(1).

(3) Inspect hydraulic hoses. Hoses that flex in normal operation of crane functions shall be visually inspected.

(4) Examine crane hooks and latches for deformation, chemical damage, cracks, and wear.

(5) Examine the hydraulic system for proper oil level.

(6) Visually inspect running ropes. A visual inspection shall consist of observation of the rope that can reasonably be expected to be in use during the day's operations. These visual observations should be concerned with discovering gross damage, such as the following, which may be an immediate hazard:

(a) Rope distortion such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion (loss of rope diameter in a short rope length or unevenness of outer strands should provide evidence that the rope or ropes must be replaced)

(b) General corrosion

(c) Broken or cut strands

(d) Number and distribution of visible broken wires (see Chapter 8.0, "Wire Rope," for further guidance).

(7) Perform other inspections as recommended by the manufacturer.

b. Recommended Weekly

(1) Check tires for recommended inflation pressure.

(2) Perform other weekly inspections as recommended by the manufacturer.

c. Recommended Monthly

(1) Examine control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter.

(2) Inspect rope reeving for compliance with crane manufacturer's specifications.

(3) If wire rope clips are used, check the tightness of the clip bolts and tighten if necessary.

(4) Examine electrical apparatus for proper operation, signs of excessive deterioration, dirt, and moisture accumulation.

(5) Check the lubricating systems for proper delivery of lubricant.

(6) Perform other monthly inspections as recommended by the manufacturer. (Specific monthly inspections shall be documented [see para 14.7.3]).

14.7.3 Monthly Documented Inspections

Critical items in use such as brakes, crane hooks, ropes, hydraulic and pneumatic cylinders, and hydraulic and pneumatic relief pressure valves, shall be inspected monthly. See Chapter 5.0 for hook inspection requirements and Chapter 8.0 for wire rope inspection requirements. Inspection records are required.

14.7.4 Operator Aids (Operator Aids are also called Crane Safety Accessories)

Operator aids including Load Indicating, Anti-Two-Block, Two-Block Warning, and Two-Block Damage Prevention Systems shall be checked and inspected as follows:

a. Before daily operation, a check by the operator or other designated person shall be made to ensure that the system is functional in accordance with the system manufacturer's written instructions. This check is not required to be documented, but a checklist to verify inspection completion is recommended.

b. The system shall be inspected and tested by a qualified person every 12 months, or more frequently, if specified by the manufacturer or required by a critical lift procedure. If calibration is required, it shall be done by a qualified person. This inspection and testing shall be documented.

14.7.5 Periodic Inspection

14.7.5.1 Periodic Inspection Frequency. Complete, documented inspections shall be performed monthly to no less than annually, depending upon crane activity, severity of service, and environment. Periodic inspection shall include the requirements of the frequent inspection and, in addition, items such as the following:

a. Deformed, cracked, or corroded members in the crane structure or boom

b. Loose bolts or rivets

c. Cracked or worn sheaves and drums

d. Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, and locking devices

e. Excessive wear on brake and clutch system parts, linings, pawls, and ratchets

f. Load, boom angle, and other indicators over their full range, for any significant inaccuracies

g. Gasoline, diesel, electric, or other power plants for performance and compliance with safety requirements

h. Excessive wear of chain-drive sprockets and excessive chain stretch

i. Crane hooks for deformations or cracks (see Chapter 5.0 for hook inspection requirements)

j. Travel steering, braking, and locking devices, for malfunction

k. Excessively worn or damaged tires

l. Hydraulic and pneumatic hose, fittings, and tubing inspection

m. Evidence of leakage at the surface of the flexible hose or its junction with the metal and couplings

n. Blistering or abnormal deformation of the outer covering of the hydraulic or pneumatic hose

o. Leakage at threaded or clamped joints that cannot be eliminated by normal tightening or recommended procedures

p. Evidence of excessive abrasion or scrubbing on the outer surface of a hose, rigid tube, or fitting. (In this event, means shall be taken to eliminate the interference of elements in contact or otherwise protect the components.)

q. Hydraulic and pneumatic pumps and motors:

(1) Loose bolts or fasteners
(2) Leaks at joints between sections
(3) Shaft seal leaks
(4) Unusual noises or vibration
(5) Loss of operating speed
(6) Excessive heating of the fluid
(7) Loss of pressure

r. Hydraulic and pneumatic valves:

(1) Cracks in valve housing
(2) Improper return of spool to neutral position
(3) Leaks at spools or joints
(4) Sticking spools
(5) Failure of relief valves to attain correct pressure setting
(6) Relief valve pressures checked as specified by the manufacturer

s. Hydraulic and pneumatic cylinders:

(1) Drifting caused by fluid leaking across the piston
(2) Rod seals leakage
(3) Leaks at welded joints
(4) Scored, nicked, or dented cylinder rods
(5) Dented case (barrel)
(6) Loose or deformed rod eyes or connecting joints

t. Hydraulic filters: Evidence of rubber particles on the filter element may indicate hose, O ring, or other rubber component deterioration. Metal chips or pieces on the filter may indicate failure in pumps, motors, or cylinders. Further inspection will be necessary to determine the origin of the problem before corrective action can be taken.

u. Periodic inspections as recommended by the manufacturer.

14.7.6 Inspection of Cranes Not in Regular Use

A crane that has been idle for a period of more than 1 month, but less than 6 months, shall be given a complete frequent inspection and a complete inspection of wire ropes, running ropes, and standing ropes before returning to service. A crane that has been idle for a period of at least 6 months shall be given a complete periodic inspection and a complete documented inspection of wire ropes, load lines, and standing lines.

14.7.7 Standby Cranes

Standby cranes shall be inspected at least semiannually in accordance with the requirements of a frequent inspection. Inspection of running and standing wire ropes shall be completed at least semiannually. Standby cranes that are exposed to adverse environmental conditions should be inspected more frequently.

14.7.8 Before Returning to Lift Service After Excavation or Demolition Work

Cranes used for excavation or demolition work shall be thoroughly inspected by a qualified inspector(s) before returning the crane to lift service. This inspection shall be documented and be at least equal to a periodic inspection with additional emphasis on equipment components susceptible to damage while the crane was in excavation or demolition service. Wire rope shall also be inspected before returning the crane to lift service (see Chapter 8.0, “Wire Rope”).

14.7.9 Inspection Records

Required inspection records shall include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the crane that was inspected. Records (inspection and test reports) shall be retained in the crane maintenance file.

14.7.9.1 Frequent Inspection. Frequent inspection records are not required. It is recommended that a checklist, initialed by the operator, be used to record the completion of frequent inspections.

14.7.9.2 Monthly Inspection of Critical Items. Inspection records are required for monthly critical items inspections.

14.7.9.3 Inspection and Testing of Operator Aids. Except for before use inspections, records documenting inspections and tests of operator aids are required.

14.7.9.4 Periodic Inspection. Periodic inspection records are required.

14.7.9.5 Inspection Before Returning to Lift Service. When a crane returns to lift service, inspection records are required.

14.7.9.6 Standby Crane Inspection Reports. Standby crane inspection records are required.

14.7.9.7 Hook NDE Reports. If hooks receive non-destructive examination (NDE), NDE inspection records are required.

14.8 MAINTENANCE

14.8.1 Preventive Maintenance

a. A preventive maintenance program based on the crane manufacturer's recommendations shall be established. Dated records shall be made available.

b. Replacement parts should be obtained from the original equipment manufacturer.

14.8.2 Maintenance Procedure

a. Before adjustments and repairs are started, the following precautions shall be taken as applicable:

(1) Place the crane where it will cause the least interference with other equipment or operations in the area.

(2) Set the controls in the off or neutral position and secure operating functions from inadvertent motion by brakes, pawls, or other means.

(3) Render the starting means inoperative.

(4) Stop or disconnect the power plant at the power takeoff.

(5) Lower the boom to the ground, if possible, or otherwise secure it against dropping.

(6) Lower the lower load block to the ground, or otherwise secure it against dropping.

(7) Relieve hydraulic oil pressure from hydraulic circuits before loosening or removing hydraulic components.

b. Place "Warning" or "Out of Order" signs on the crane controls. For locomotive cranes, blue flag protection shall be employed. Signs or flags shall be removed only by authorized personnel.

c. After adjustments and repairs have been made, the crane shall not be returned to service until all guards have been reinstalled, trapped air removed from the hydraulic system, safety devices reactivated, and maintenance equipment removed.

14.8.3 Adjustments and Repairs

a. Any hazardous conditions disclosed by inspection or during operation shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.

b. Adjustments shall be maintained to ensure correct functioning of components. The following are examples:

(1) Functional operating mechanisms
(2) Safety devices
(3) Control systems
(4) Power plants
(5) Braking systems.

c. Repairs or replacements shall be provided as needed for operation. The following are examples:

(1) Critical parts or functional operating mechanisms that are cracked, broken, corroded, bent, or excessively worn

(2) Critical parts of the crane structure that are cracked, bent, broken, or excessively corroded

(3) Damaged or worn hooks, as described in Chapter 5.0. "Hooks," Onsite repairs by welding or reshaping are not allowed.

d. Replacement parts or repairs shall have at least the original design factor.

e. Instructions shall be provided by the manufacturer for the removal of air from hydraulic circuits.

14.8.4 Lubrication

a. Moving parts of the crane, for which lubrication is specified, shall be regularly lubricated. Lubricating systems should be checked for proper delivery of lubricant. Care shall be taken to follow the manufacturer's recommendations as to the points and frequency of lubrication, maintenance of lubricant levels, and types of lubricant to be used.

b. Machinery shall be stationary while lubricants are being supplied and protection provided as called for in para 14.8.2(1)(b) through 14.8.2(1)(f), unless equipped with for automatic or remote lubrication.

14.9 TESTING

14.9.1 Operational Tests

a. Each production crane shall be tested by the manufacturer to the extent necessary to ensure compliance with the operational requirements of ASME B30.5, *Mobile and Locomotive Cranes*. (See B30.5-2.2.1, "Operational Tests")

b. Where the complete production crane is not supplied by one manufacturer, such tests shall be conducted at final assembly.

c. Operational crane test results shall be made available by the manufacturer or final assembler.

14.9.2 Rated Load Test

a. Before initial use, cranes in which load-sustaining parts have been altered, replaced, or repaired shall be load tested by, or under the direction of, a qualified person. The replacement of rope (load lines or static lines) is specifically excluded from this requirement. However, a functional test of the crane under a normal operating load shall be made before putting the crane back in service.

(1) Test loads shall not exceed 110 percent of the manufacturer's load rating.

(2) Written reports shall be furnished by an appointed or authorized person, and shall show test procedures and confirm the adequacy of repairs or alterations. Test reports shall be retained in the crane maintenance file.

b. Where rerating is necessary:

(1) Crawler and wheel-mounted cranes shall be tested in accordance with ASME B30.5-1.1.(a) and 5-1.1.1(c) for load ratings where stability governs. Ratings governed by structural competence shall be established by the manufacturer and tested to 110 percent of the rating.

(2) Locomotive cranes shall be tested in accordance with ASME B30.5-1.1.1(a) and 5-1.1.1(b).

(3) The rerating test report shall be retained in the crane maintenance file.

c. No cranes shall be rerated in excess of the original load ratings unless such rating changes are approved by the crane manufacturer or a qualified person.

14.9.3 Test Load Accuracy

The weight of the test loads used on site must be accurately known within a tolerance of (+0 percent to -5 percent), traceable to a recognized standard or verified by engineering calculations.

Note: *The Crane Load Stability Test Code*, SAE J765, describes a test on new cranes done by the crane manufacturer or the manufacturer's testing agency. This code requires a test weight accuracy of ~1%.

14.10 CRANE MAINTENANCE FILES

The crane maintenance file is a compilation of various documents and records relating to operation, maintenance, inspection, testing, evaluating and repair of the equipment. The file may be centrally located or proportioned into satellite holding areas. The method(s) selected for establishing adequate information retention and retrieval shall be determined by the equipment custodian, who is the responsible person for assuring a safe and reliable maintenance program is in place.

14.10.1 Intent of Crane Maintenance Files

The crane maintenance file shall contain, as a minimum, the required current dated periodic inspection records and other documentation to provide the user with evidence of a safe and reliable maintenance program. Inspection records should be retained in a format and location that provides for ease in accessibility. Maintenance file information should provide a source for comparing present conditions with past conditions to determine whether existing conditions show a trending pattern of wear, deterioration, or other comparable factors that may compromise safe, continued use of the equipment. Length of record retention shall be determined by the equipment custodian's established maintenance program.

14.10.2 Maintenance File Contents

Crane maintenance files shall contain the following documentation, as applicable:

a. Periodic inspection records.

b. Load test reports.

c. Documentation of altered, replaced, or repaired load-sustaining parts.

d. Records of special inspections on safety related items such as brakes, crane hooks, ropes, hydraulic and pneumatic cylinders, and hydraulic and pneumatic relief pressure valves.

e. Copies of waivers, exemptions, hostile environment plans, or similar documentation applicable to the crane (to include manufacture's safety bulletins, safety alerts, and product recall information).

f. Documentation for replacement ropes (see Chapter 8.0, "Wire Rope")

g. Wire rope manufacture's certification for replacement ropes.

h. Records of inspection on load indicating devices, anti-two block, two-block warning, and two-block damage prevention systems.

NOTE: Although complete maintenance information for old cranes may not be available, the custodian should acquire as much of the pertinent information as possible.

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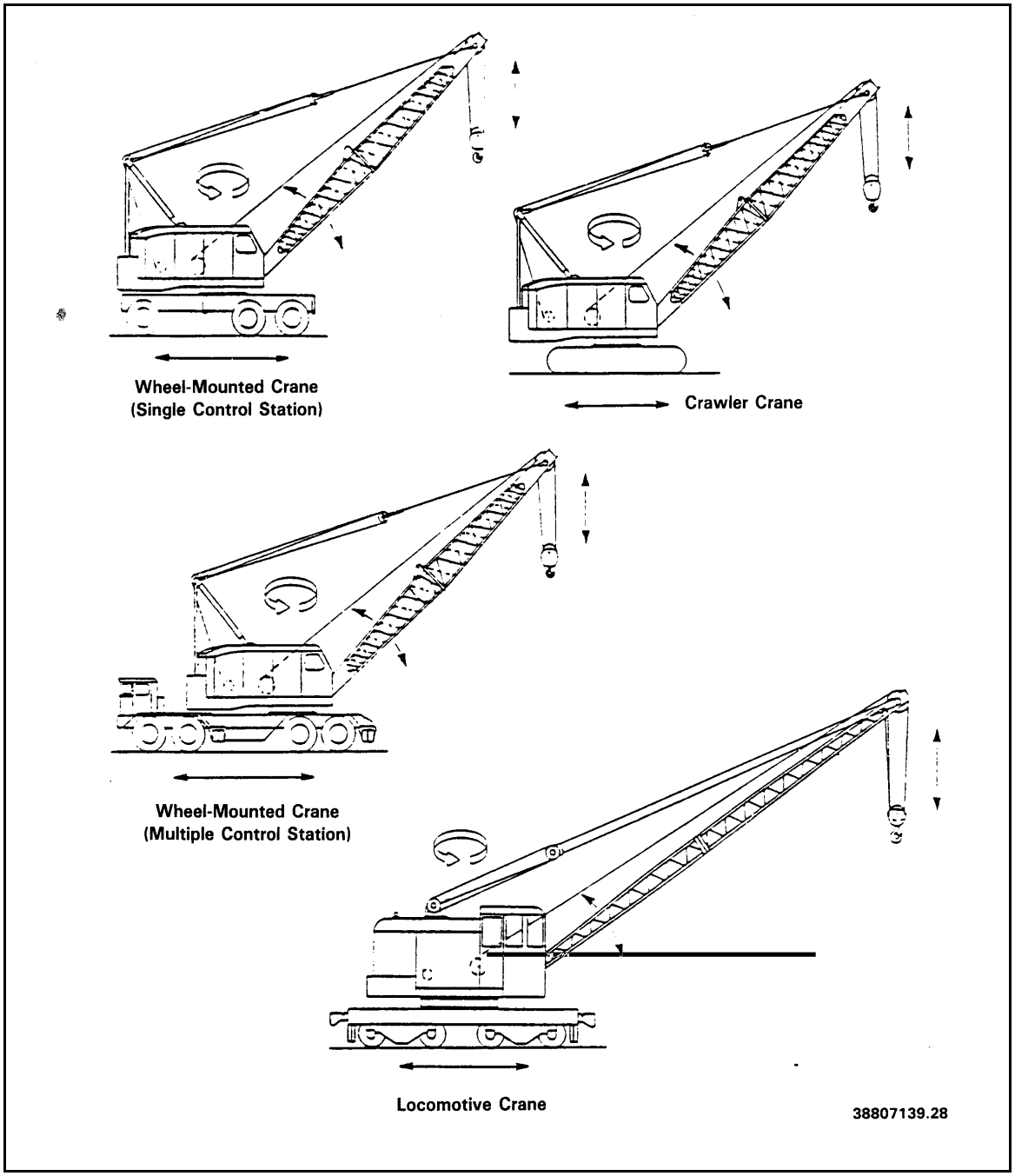
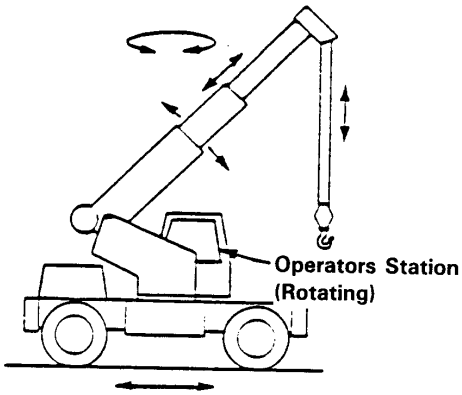
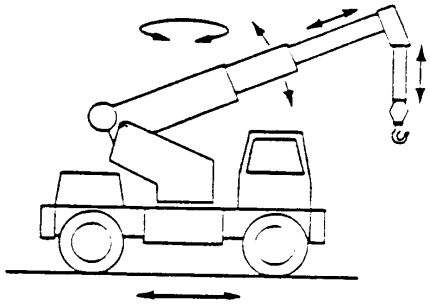
Attachment 14-1. Mobile Crane Types.
(sheet 1 of 3).



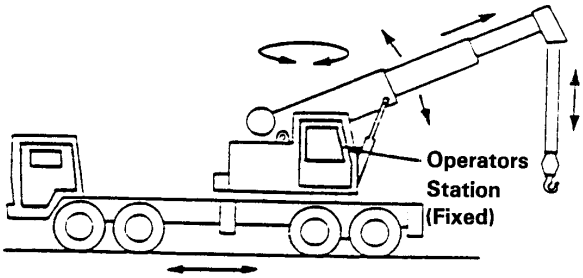
Attachment 14.1. Mobile Crane Types.
(sheet 2 of 3)



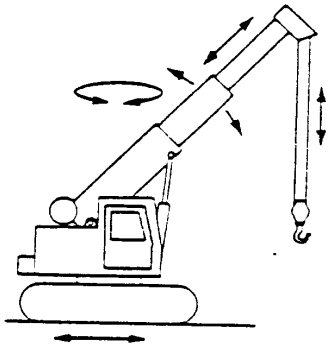
Wheel-Mounted Crane –
Telescoping Boom
(Single Control Station)



Wheel-Mounted Crane –
Telescoping Boom
(Single Control Station)



Wheel-Mounted Crane –
Telescopng Boom
(Multiple Control Station)



Crawler Crane –
Telescoping Boom

General Note:
The boom may have a base boom structure of sections (upper and lower) between or beyond which additional sections may be added to increase its length, or it may consist of a base boom from which one or more boom extensions are telescoped for additional length. These illustrations show some types.

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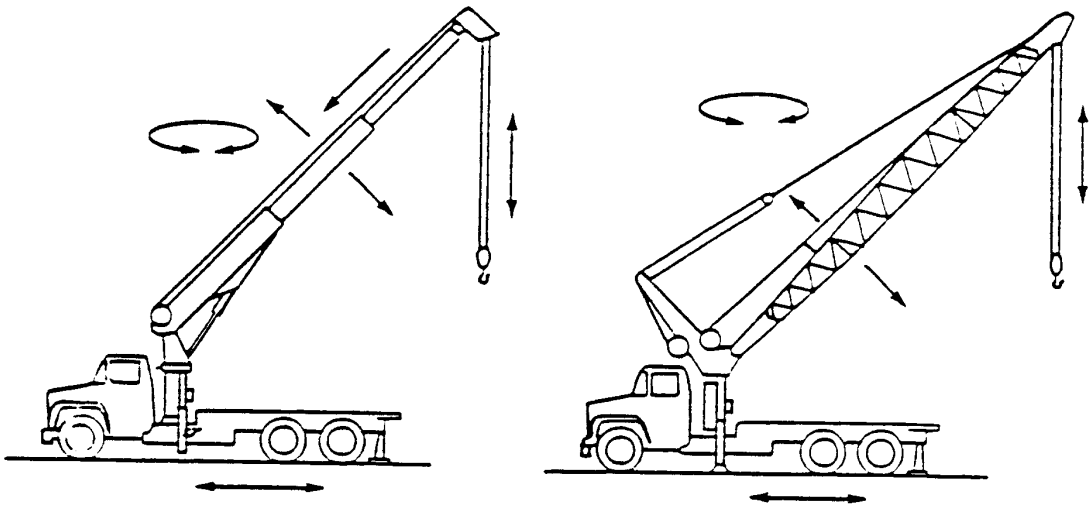
Attachment 14.1. Mobile Crane Types.
(sheet 3 of 3)



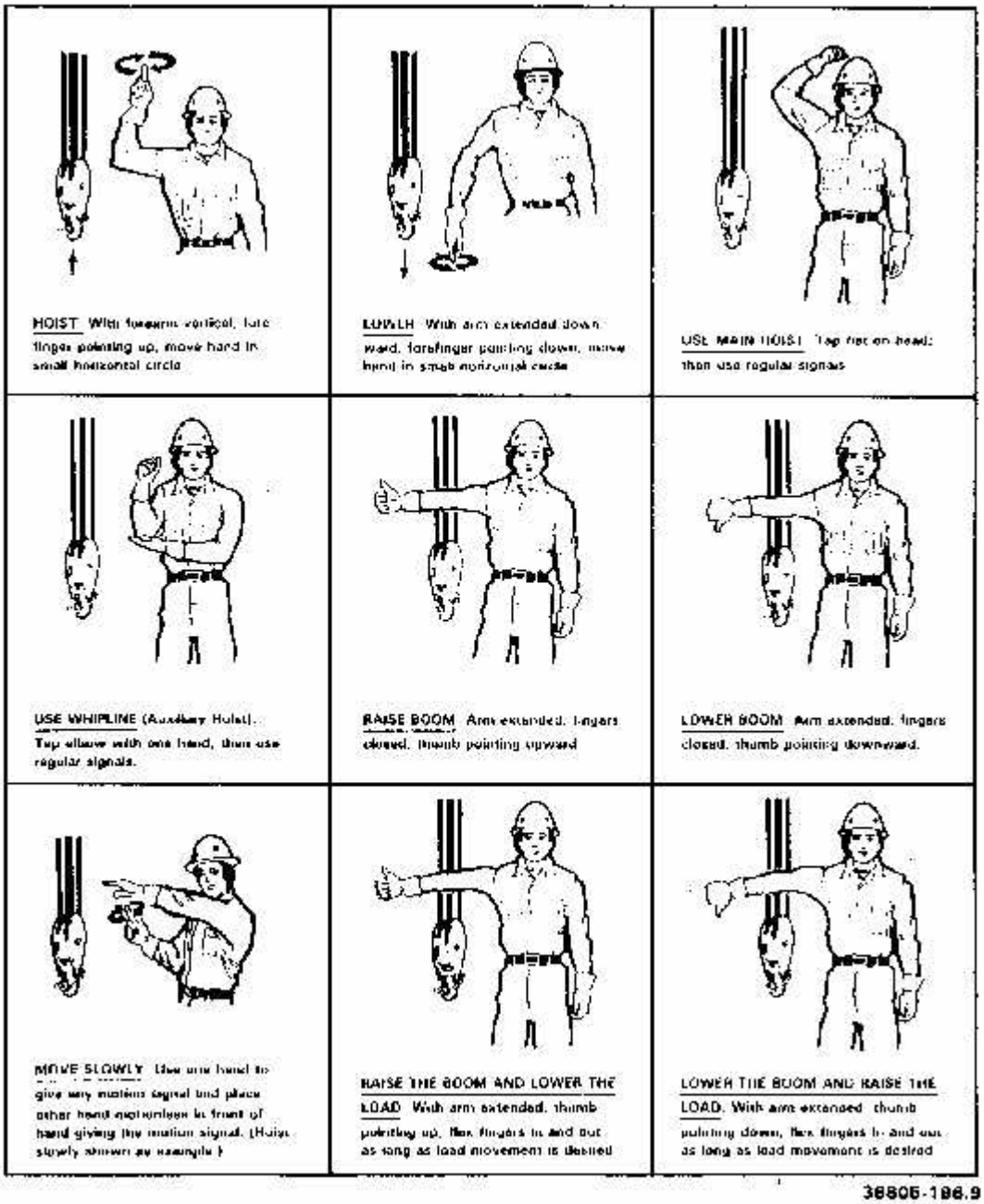
Commercial Truck Mounted Crane — Telescoping Boom

Commercial Truck-Mounted Crane — Nontelescoping Boom

General Note:
The boom may have a base boom structure of sections (upper and lower) between or beyond which additional sections may be added to increase its length, or it may consist of a base boom from which one or more boom extensions are telescoped for additional length. These illustrations show some types.

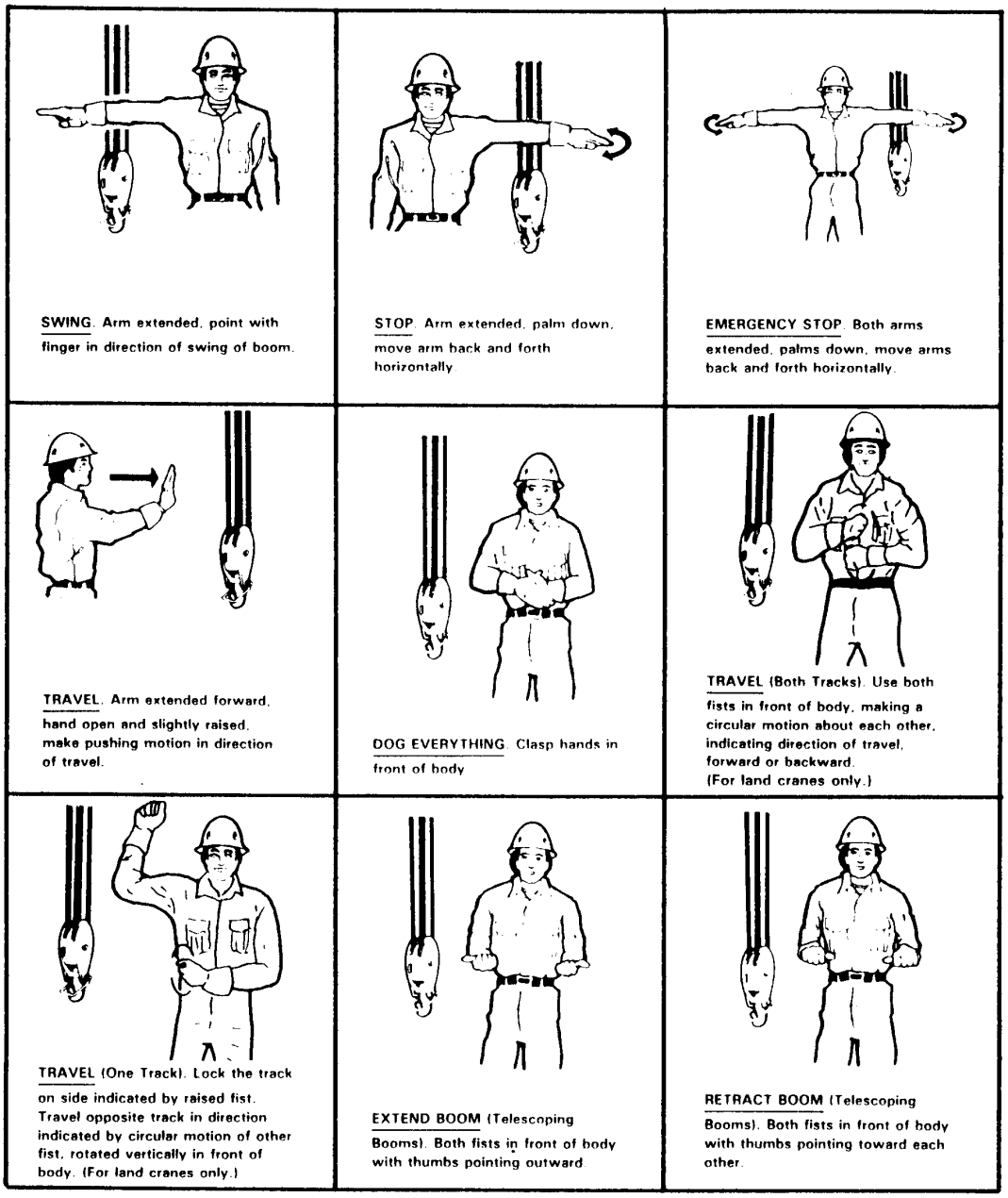
38807139.29

Attachment 14-2. Hand Signals.
(sheet 1 of 3)

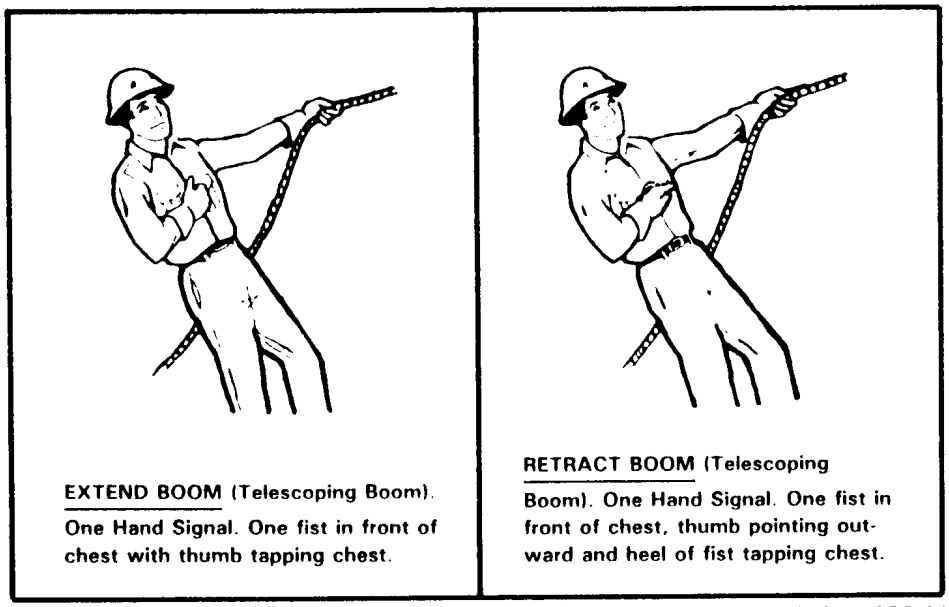


36806-196.9

Attachment 14.2. Hand Signals.
(sheet 2 of 3)



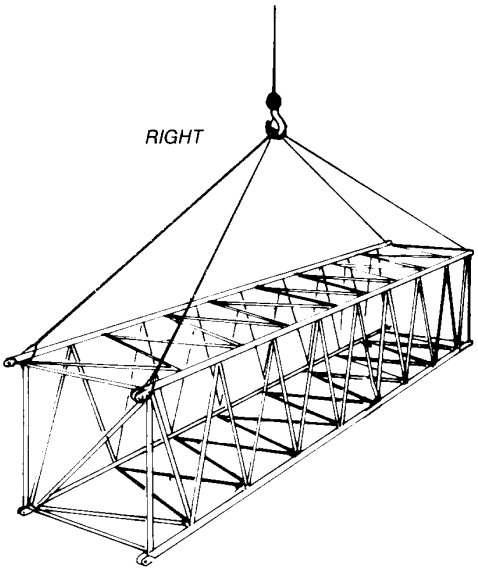
Attachment 14.2. Hand Signals.
(sheet 3 of 3)

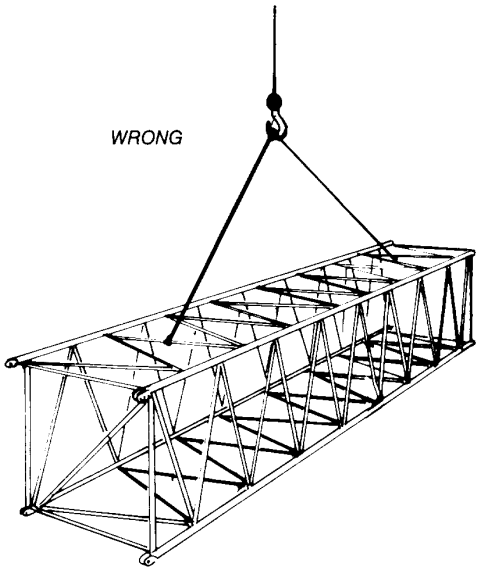


Attachment 14-3. Lattice Boom Dismantling/Assembly (sheet 1 of 16)..
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario).

Most damage to boom sections happens during loading, transportation and unloading.

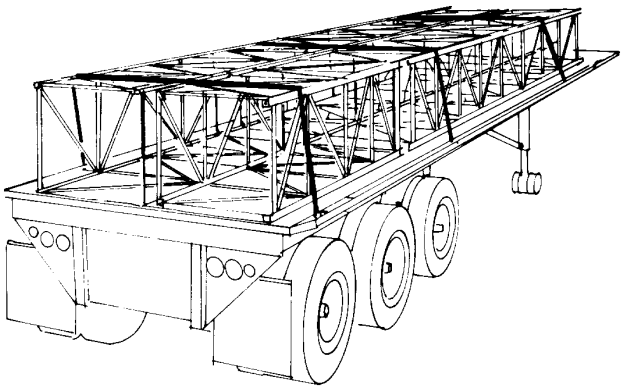
- Never attach slings to lattices – they will bend.
- If possible, avoid attaching slings to the main chords; try to attach them to the fittings at the ends of the main chords (the pin connection points).
- Use synthetic web slings or, if using wire rope slings, pad the boom sections well to prevent damage.





- Block under and between boom sections when loading them on trucks.
- Do not use chain binders as they will damage or bend the boom.

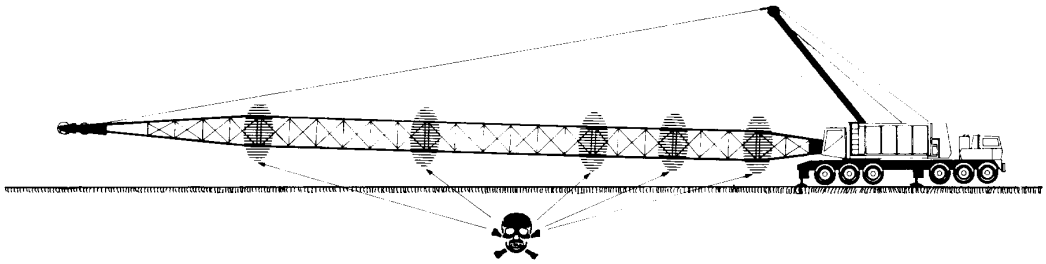
- Synthetic web slings used on all tie-downs are an acceptable alternative.

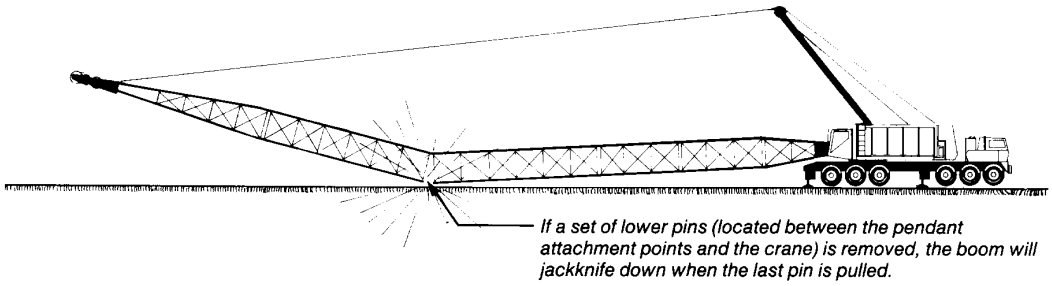


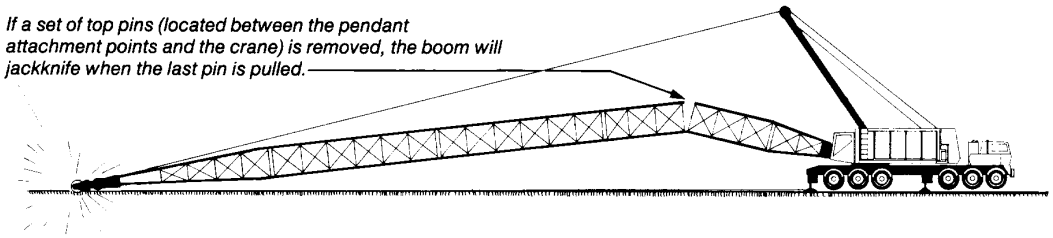
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 2 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

Many operators and riggers have been killed when dismantling or shortening booms and the main cause is usually failure to follow the procedures specified by the manufacturer.
Work on jibs involves the same hazards.

- Never touch *any* (top or bottom) pin on any boom section located between the pendant attachment points and the crane.

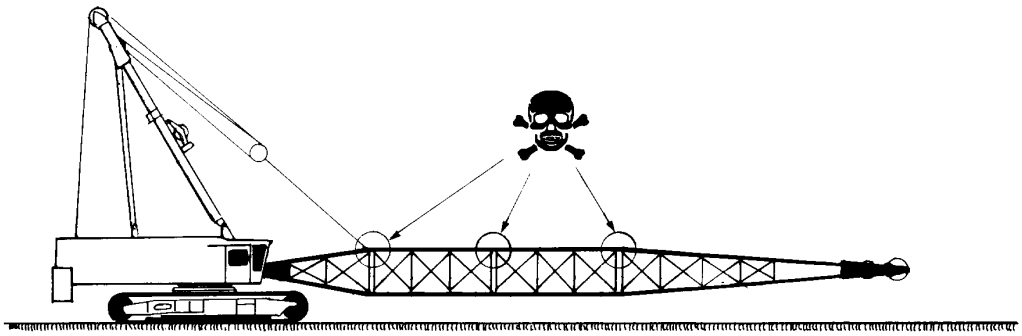


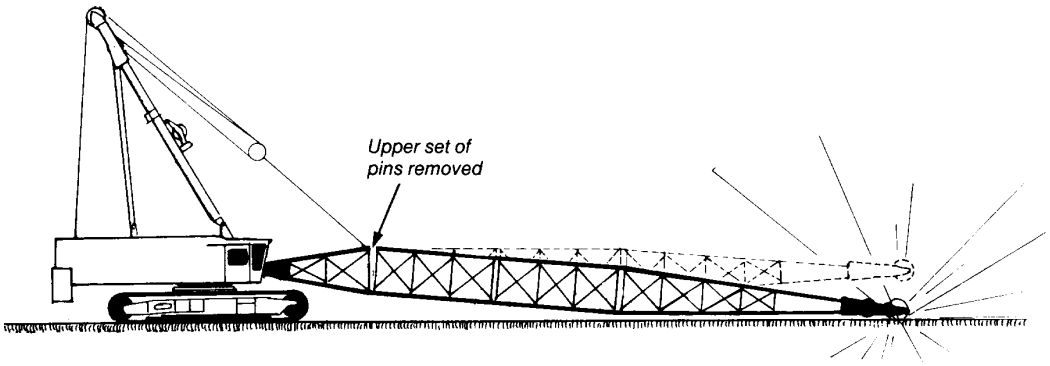




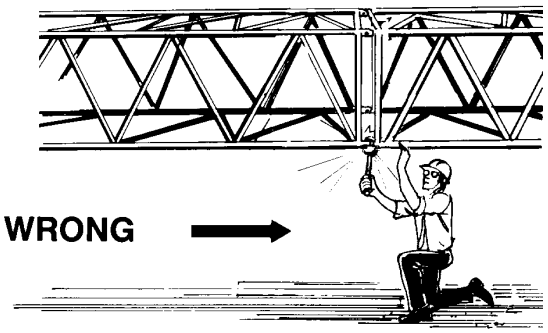
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 3 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

- Until the boom is solidly supported on its blocking never touch the *top* pins ahead of the pendants. The boom will drop.





Caution: Never walk, work, lean or place any part of your body under the boom when it is being assembled, dismantled, shortened or lengthened. If necessary, use a long bar to knock the far side pins out.



Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 4 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

CAUTION:

1. This assembly method applies only when the "maximum cantilever length" specified by the manufacturer is not exceeded. See Section 9.8 for the procedure to follow if the boom is longer than the "maximum cantilever length".
2. Be sure that the boom hoist pawl is always engaged except when lowering the boom. Don't rely on the boom hoist brake alone to hold the boom. Wear, improper adjustment, water or oil on linings, and other factors may reduce the ability of the brake to hold the boom.

Check the manufacturer's procedure and follow the instructions precisely. The following method is common to most manufacturers for pinned boom connections but may not apply to *all*; check the crane's manual before attempting this job.

(1) If so equipped, extend *all* outrigger beams *fully* and extend outrigger cylinders until wheels are clear of ground.

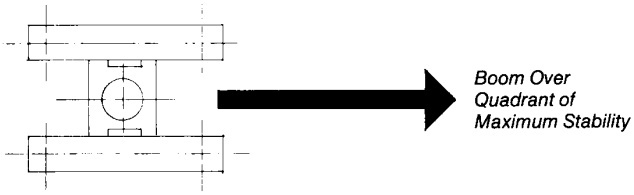
(2) Level the carrier.

(3) Check the amount of counterweight required in the load chart for the lifts to be made and the length of boom being installed. Check also to ensure that enough counterweight is installed to lift the boom off the ground.

(4) Check to see if the front bumper counterweight is required.

(5) If so equipped, the extendible counterweight must be extended.

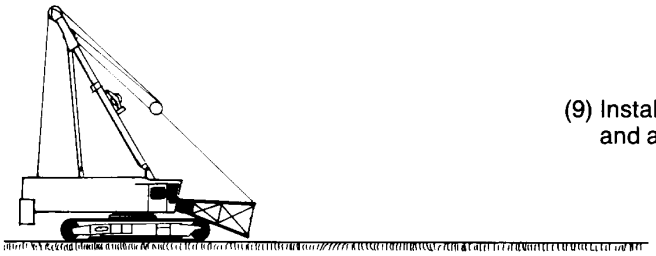
(6) Rotate the upperworks to face "over the rear" or in the direction of maximum stability.



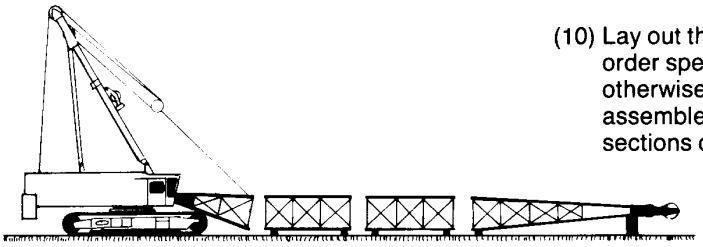
(7) Set the swing lock.

(8) Fully extend the gantry. If the machine has a live mast, check the load chart to see if it must be used.

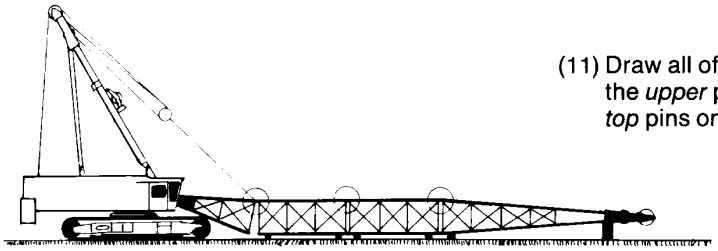
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 5 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)



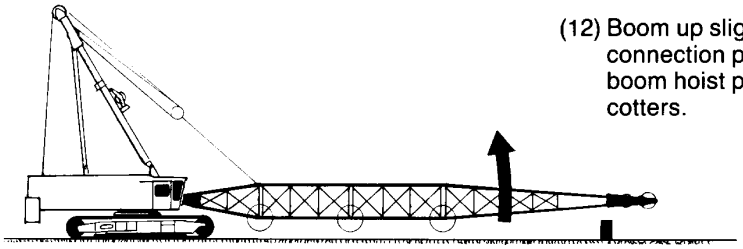
(9) Install the heel or foot section of the boom and attach the pendants to the ends.



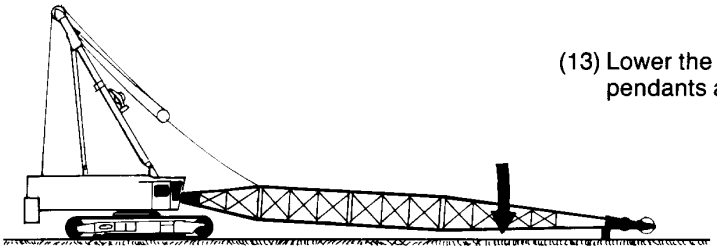
(10) Lay out the boom inserts in the correct order specified by the manual. (Unless otherwise specified by the manufacturer, assemble the boom with the short insert sections close to the boom foot.)



(11) Draw all of the sections together. Line up the *upper* pin connection points. Insert the *top* pins only and install the cotter pins.



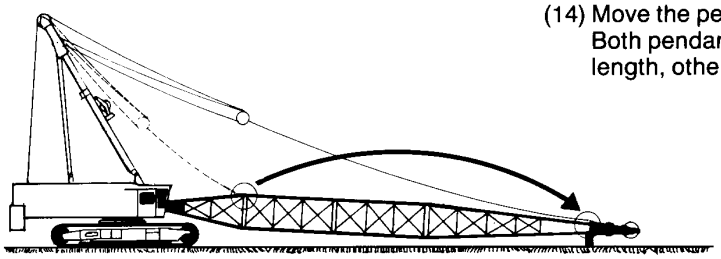
(12) Boom up slightly until the *bottom* pin connection points line up. Engage the boom hoist pawl. Install the pins and cotters.



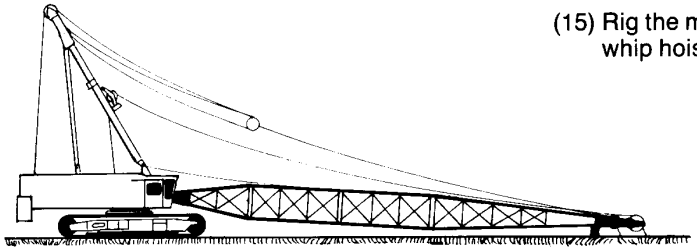
(13) Lower the boom onto blocking until the pendants are slack.

Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 6 of 16).

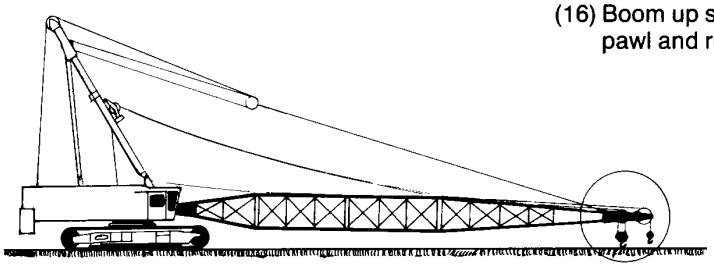
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)



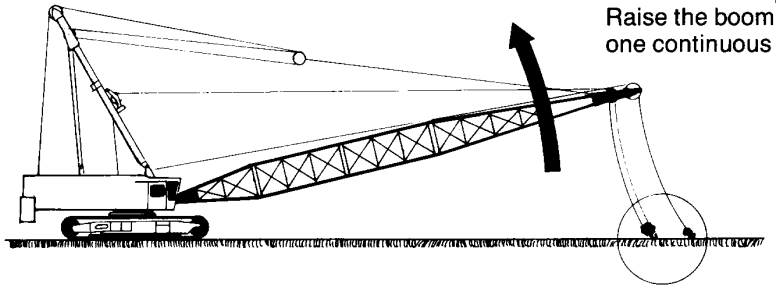
(14) Move the pendants out to end of the boom. Both pendants must be exactly the same length, otherwise the boom will twist.



(15) Rig the main hoist line (and auxiliary or whip hoist line if necessary).



(16) Boom up slightly, engage the boom hoist pawl and reeve the blocks.



(17) To gain extra stability, do not lift the load block when raising the boom. Pay out the hoist line to keep the block on the ground. Raise the boom slowly and smoothly in one continuous lift.

CAUTION:

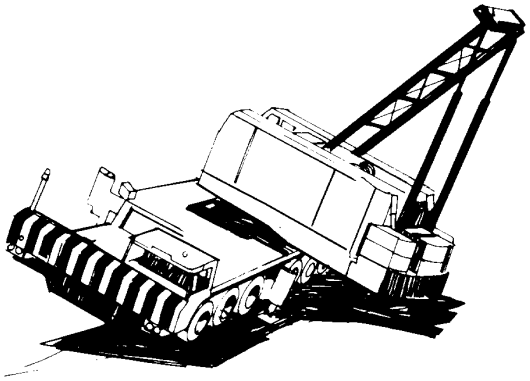
1. Never place any part of your body under the boom during assembly.
2. It is good policy to block beneath each end of each section when assembling it.
3. Never attempt to raise any boom being assembled until all boom insert connection pins are installed.
4. Ensure that suspension ropes and pendants do not catch on the boom connection pins or cotter pins.
5. Check wind velocity limits before lifting the boom off the ground.
6. Once the boom is raised check that the boom hoist limiting device (if provided) is working. It should disengage the boom hoist as the boom nears minimum radius.

Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 7 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

This assembly method applies when the boom length exceeds the manufacturer's "maximum cantilever length".

Check the manufacturer's procedure and follow the instructions precisely. The following method is common to most manufacturers for pinned boom connections but may not apply to *all*; check the crane's manual before attempting this job.

(1) If so equipped, extend *all* outrigger beams *fully* and extend outrigger cylinders until wheels are clear of ground.



Do not swing the upperworks until the outriggers are extended and set.

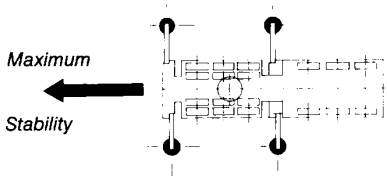
(2) Level the carrier.

(3) Check the amount of counterweight required in the load chart for the lifts to be made and the length of boom being installed. Check also to ensure that enough counterweight is installed to lift the boom off the ground.

(4) Check to see if the front bumper counterweight is required.

(5) If so equipped the extendible counterweight must be extended.

(6) Rotate the upperworks to face "over the rear" or in the direction of maximum stability.



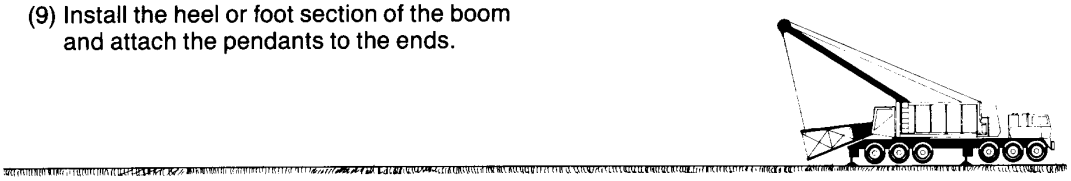
(7) Set the swing lock.

(8) Fully extend the gantry. If machine has a live mast, check the load chart to see if it must be used.

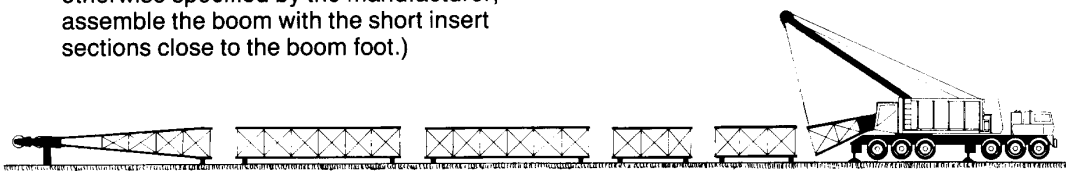
(9) Continued on next page

Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 8 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

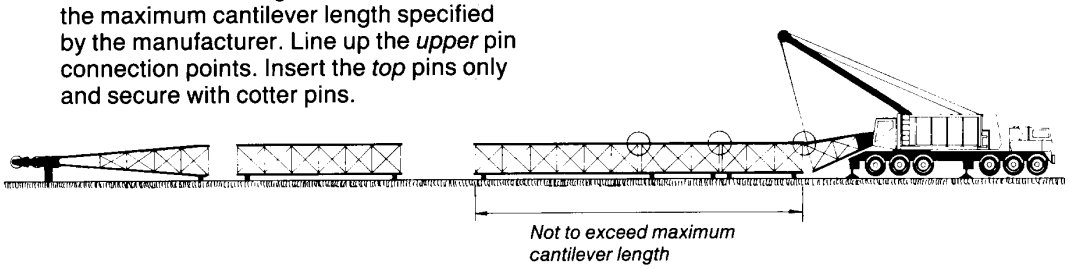
(9) Install the heel or foot section of the boom and attach the pendants to the ends.



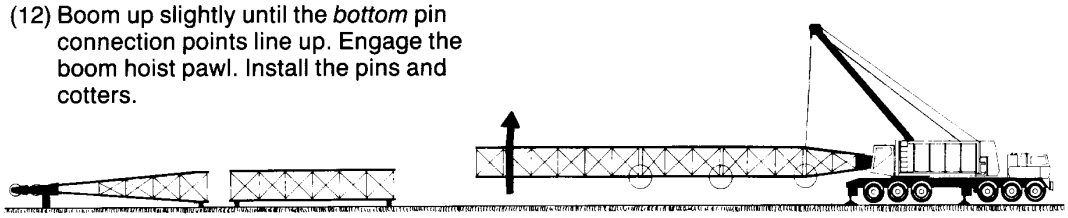
(10) Lay out the boom inserts in the correct order specified by the manual. (Unless otherwise specified by the manufacturer, assemble the boom with the short insert sections close to the boom foot.)



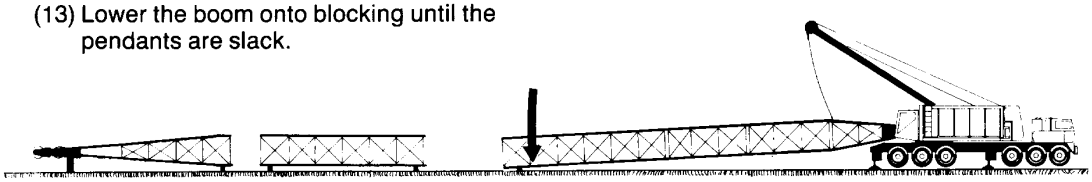
(11) Draw some, but not all, of the sections together. The total length of the inserts to assemble at this stage must not exceed the maximum cantilever length specified by the manufacturer. Line up the *upper* pin connection points. Insert the *top* pins only and secure with cotter pins.



(12) Boom up slightly until the *bottom* pin connection points line up. Engage the boom hoist pawl. Install the pins and cotters.

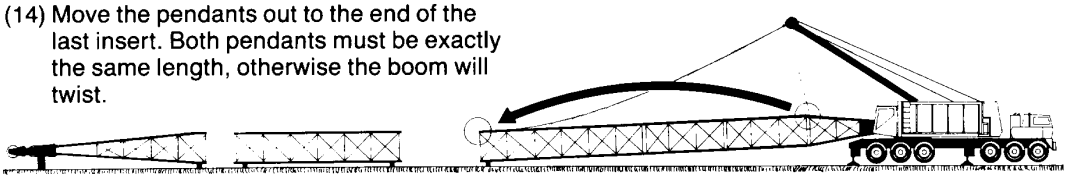


(13) Lower the boom onto blocking until the pendants are slack.



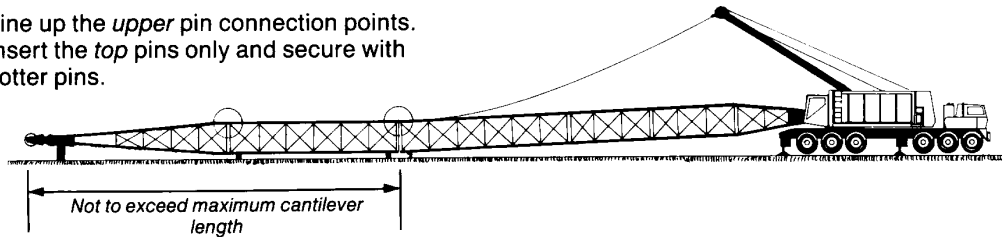
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 9 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

(14) Move the pendants out to the end of the last insert. Both pendants must be exactly the same length, otherwise the boom will twist.

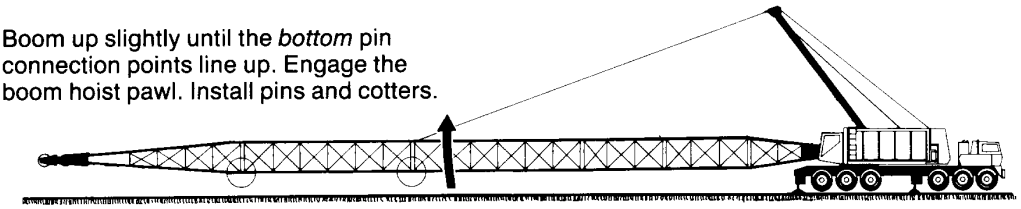


(15) Draw the remaining boom sections together. Ensure that their length does not exceed maximum cantilever length.

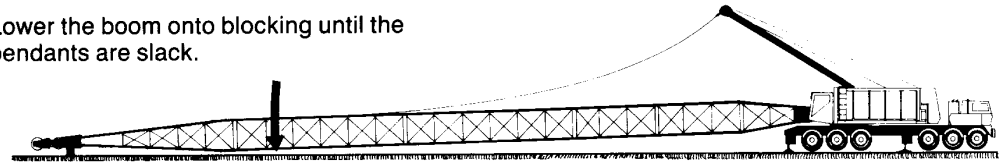
(16) Line up the *upper* pin connection points. Insert the *top* pins only and secure with cotter pins.



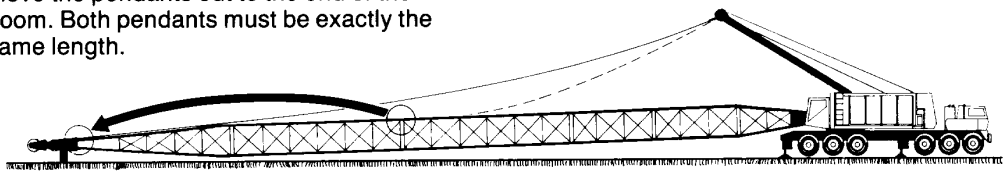
(17) Boom up slightly until the *bottom* pin connection points line up. Engage the boom hoist pawl. Install pins and cotters.



(18) Lower the boom onto blocking until the pendants are slack.

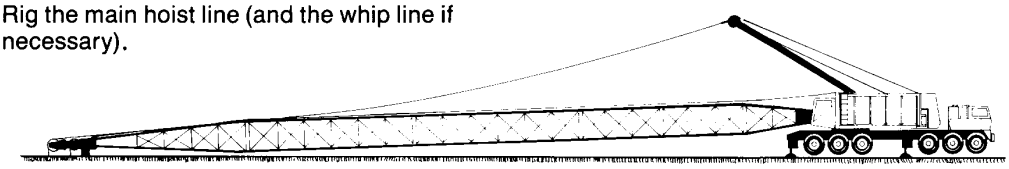


(19) Move the pendants out to the end of the boom. Both pendants must be exactly the same length.

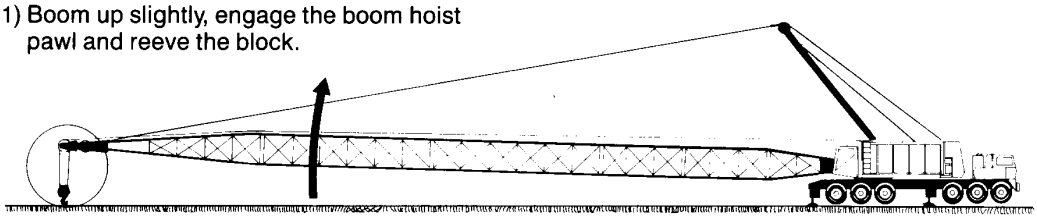


Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 10 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

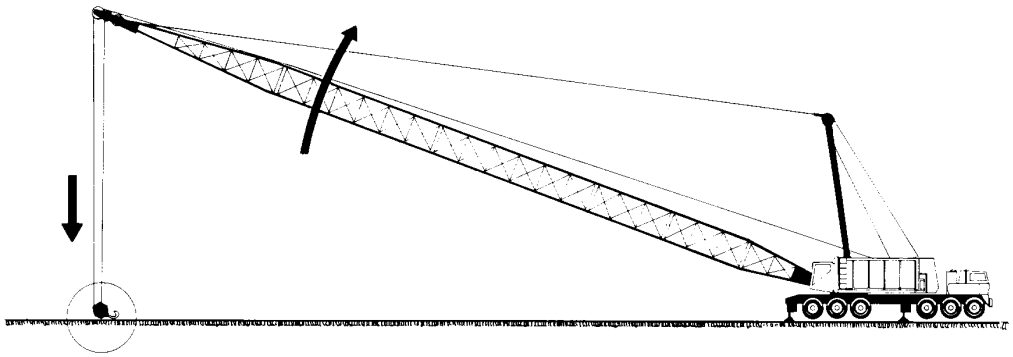
(20) Rig the main hoist line (and the whip line if necessary).



(21) Boom up slightly, engage the boom hoist pawl and reeve the block.



(22) To gain extra stability, do not lift the load block when raising the boom. Pay out the hoist line to keep the block on the ground. Raise the boom in a slow, smooth, continuous lift.



CAUTION:

1. Never place any part of your body under the boom during assembly.
2. It is good policy to block beneath each end of each section when assembling it.
3. Never attempt to raise any boom being assembled until all boom insert connection pins are installed.
4. Ensure that suspension ropes and pendants do not catch on the boom connection pins or cotter pins.
5. Pendant spreader bars may be required on long boom assemblies. Check the manual.
6. Intermediate (mid-point) suspensions may be required as long booms can buckle in the middle from their own weight. Check the manual.
7. Check wind velocity limits before lifting the boom off the ground.
8. Once the boom is raised check that the boom hoist limiting device (if provided) is working. It should disengage the boom hoist as the boom nears minimum radius.

Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 11 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

The following method is common to most manufacturers for pinned boom connections but may not apply to *all*; check the crane's manual before attempting this job.

(1) Move the rig into a clear, level area.

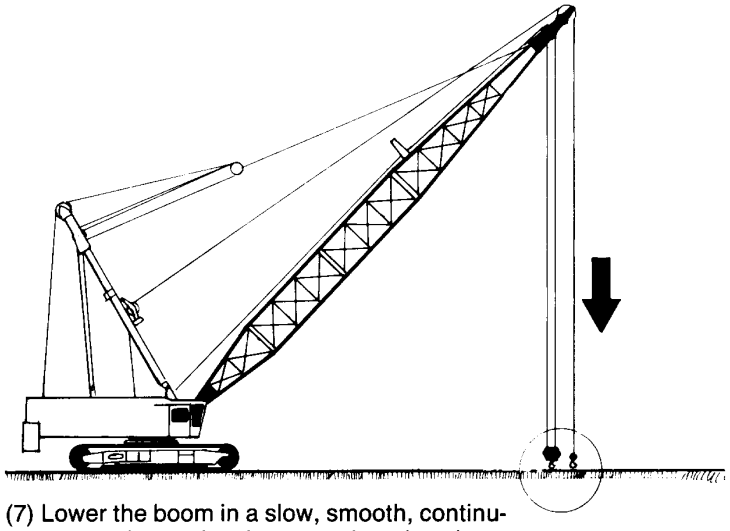
(2) If so equipped, extend *all* outrigger beams *fully* and extend outrigger cylinders until the wheels are clear of the ground.

(3) Level the carrier.

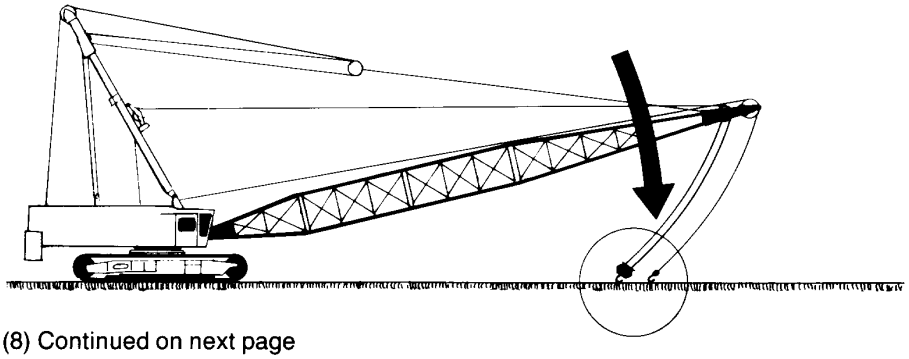
(4) Rotate the upperworks to face "over the rear" or in the direction of maximum stability.

(5) Set the swing lock.

(6) Lower the hook blocks to the ground to gain extra stability when the boom is lowered.

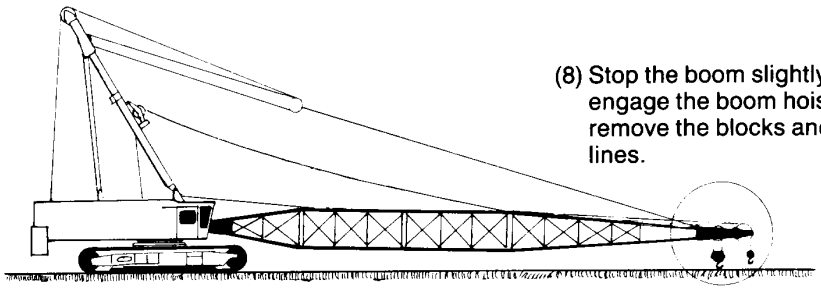


(7) Lower the boom in a slow, smooth, continuous motion and at the same time draw in the hoist lines but leave the blocks on the ground.

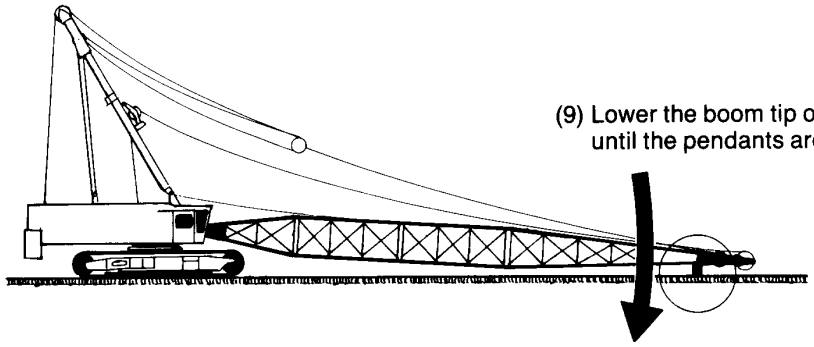


(8) Continued on next page

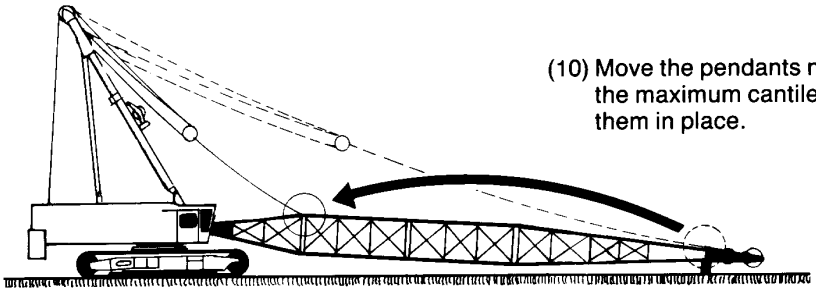
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 12 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)



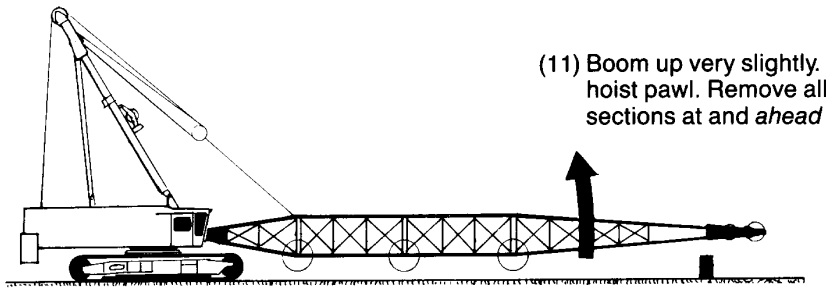
(8) Stop the boom slightly above ground level, engage the boom hoist pawl, unreeve and remove the blocks and draw in the hoist lines.



(9) Lower the boom tip onto solid blocking until the pendants are slack.

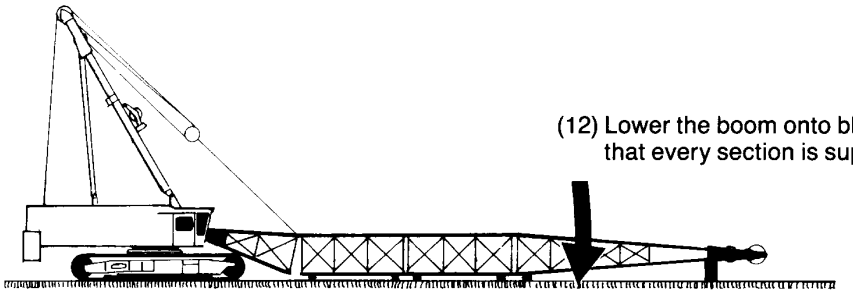


(10) Move the pendants no farther back than the maximum cantilever length and pin them in place.

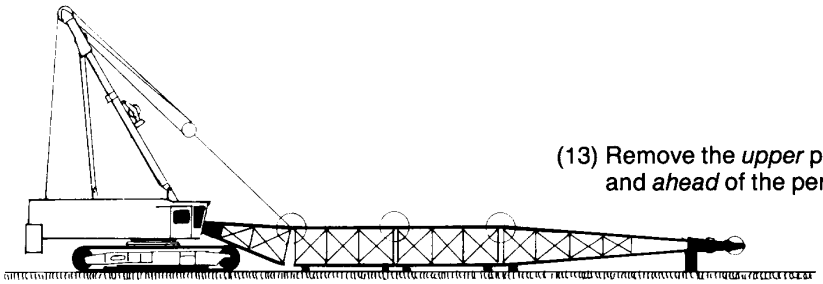


(11) Boom up very slightly. Engage the boom hoist pawl. Remove all *lower* pins on the sections at and *ahead* of the pendants.

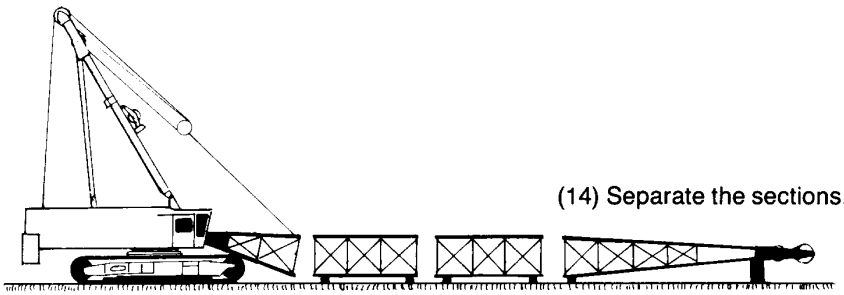
Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 13 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)



(12) Lower the boom onto blocking. Ensure that every section is supported.



(13) Remove the *upper* pins on the sections at and *ahead* of the pendants.



(14) Separate the sections.

Caution: Never walk, work, or lean under the boom at *any* stage of this procedure.

Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 14 of 16).

Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

This procedure applies when the actual boom length is longer than the maximum cantilever length specified by the crane manufacturer and when the boom is pin-connected. Check the crane's handbook for the exact procedure.

(1) Move the rig into a clear, level area.

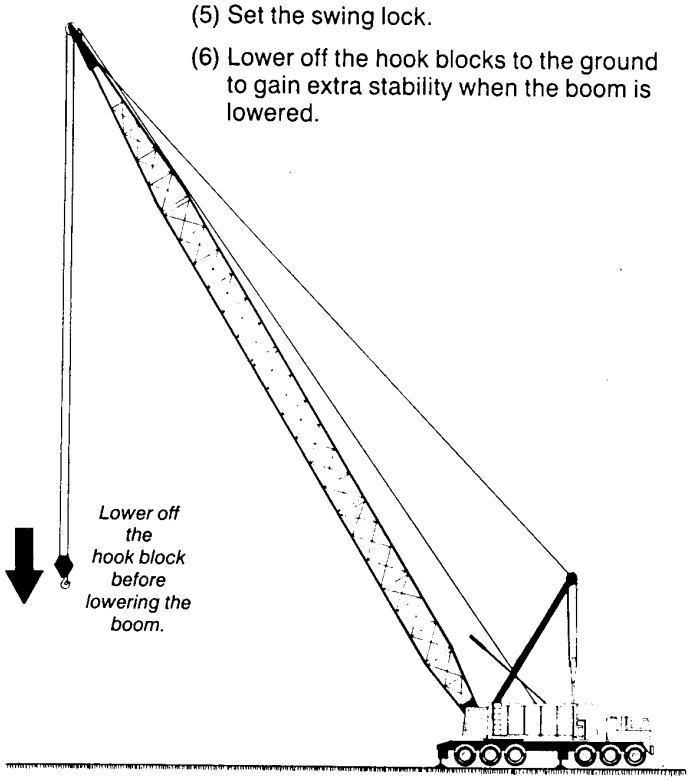
(2) If so equipped, extend *all* outrigger beams *fully* and extend outrigger cylinders until wheels are clear of ground.

(3) Level the carrier.

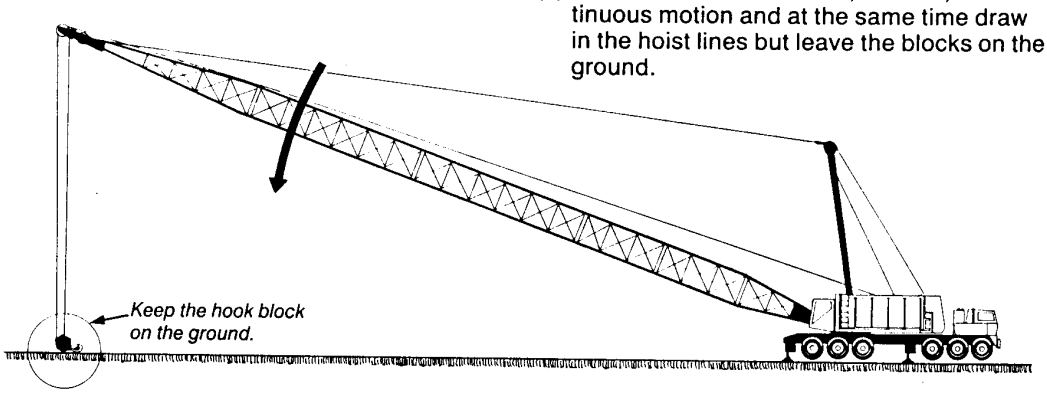
(4) Rotate the upperworks to face "over the rear" or in the direction of maximum stability.

(5) Set the swing lock.

(6) Lower off the hook blocks to the ground to gain extra stability when the boom is lowered.

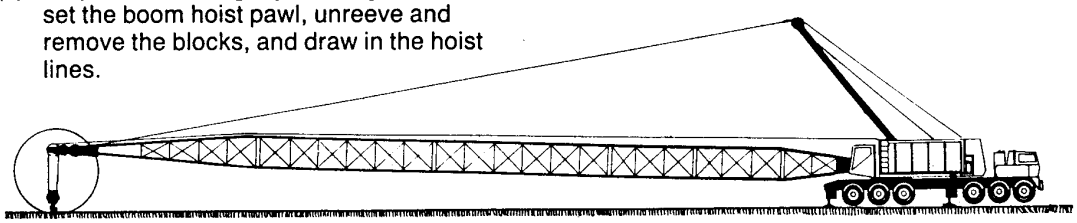


(7) Lower the boom in a slow, smooth, continuous motion and at the same time draw in the hoist lines but leave the blocks on the ground.

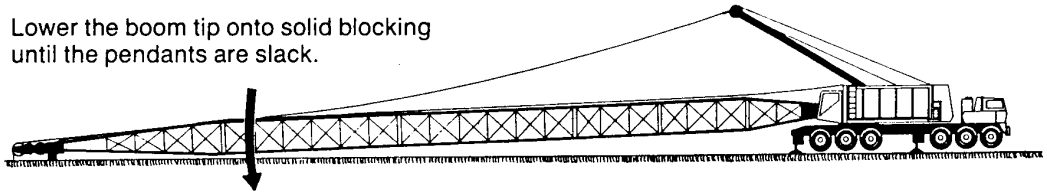


Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 15 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

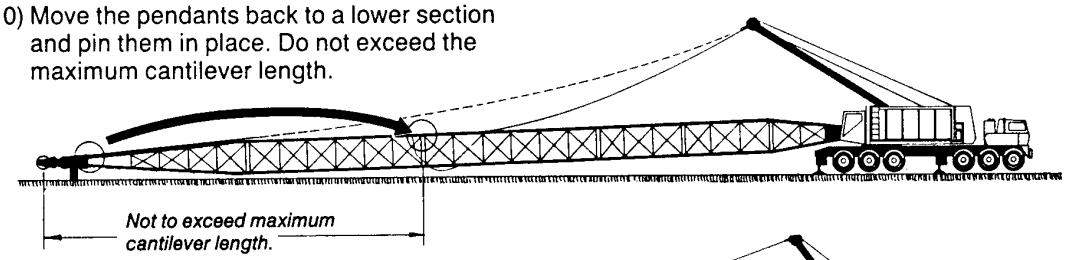
(8) Stop the boom slightly above ground level, set the boom hoist pawl, unreeve and remove the blocks, and draw in the hoist lines.



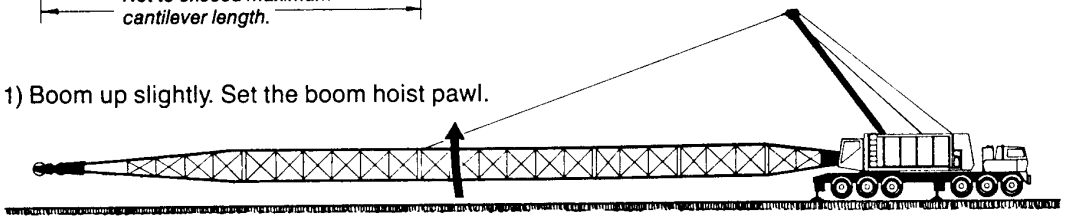
(9) Lower the boom tip onto solid blocking until the pendants are slack.



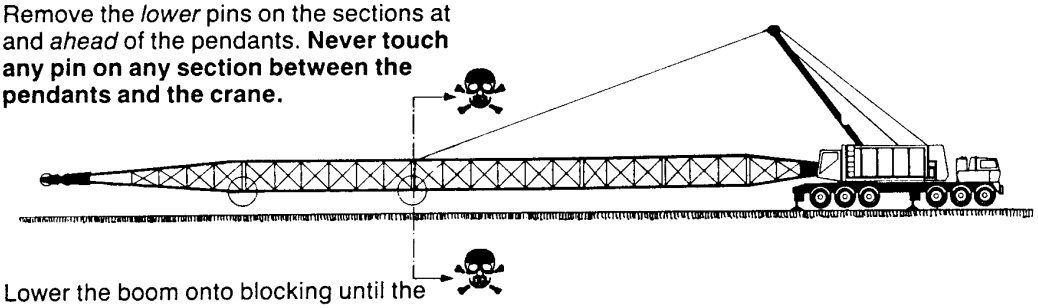
(10) Move the pendants back to a lower section and pin them in place. Do not exceed the maximum cantilever length.



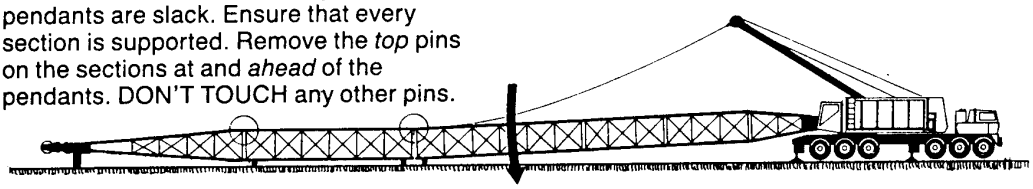
(11) Boom up slightly. Set the boom hoist pawl.



(12) Remove the *lower* pins on the sections at and *ahead* of the pendants. **Never touch any pin on any section between the pendants and the crane.**

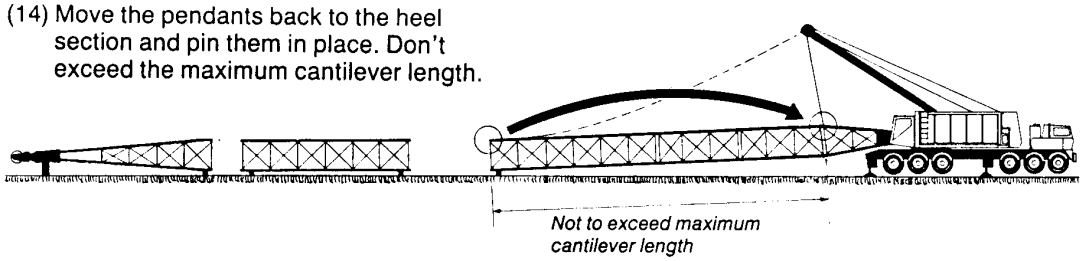


(13) Lower the boom onto blocking until the pendants are slack. Ensure that every section is supported. Remove the *top* pins on the sections at and *ahead* of the pendants. DON'T TOUCH any other pins.

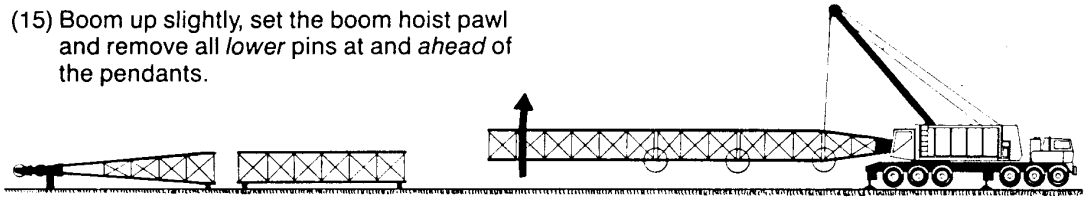


Attachment 14.3 Lattice Boom Dismantling Assembly (sheet 16 of 16).
Excerpts from Mobile Crane Manual (courtesy Construction Safety Association of Ontario)

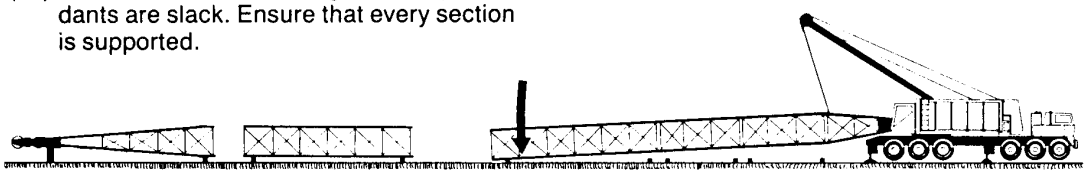
(14) Move the pendants back to the heel section and pin them in place. Don't exceed the maximum cantilever length.



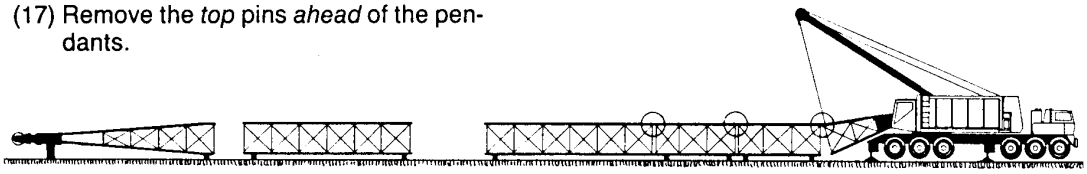
(15) Boom up slightly, set the boom hoist pawl and remove all *lower* pins at and *ahead* of the pendants.



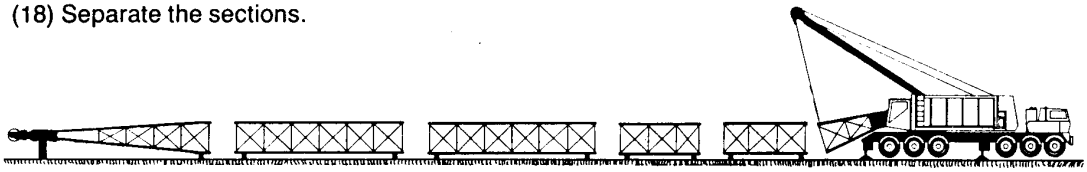
(16) Boom down onto blocking until the pendants are slack. Ensure that every section is supported.



(17) Remove the *top* pins *ahead* of the pendants.



(18) Separate the sections.



Caution: Never walk, work, or lean under the boom at any stage of this procedure.