



# ***Don H. Mahaffey Drilling Co.***

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**CRANE OPERATION SAFETY**

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YOUR OSHA COMPLIANCE SOLUTION

## TABLE OF CONTENTS

Section	Page
<b>1</b>	<b>OBJECTIVE..... 1</b>
<b>2</b>	<b>PROGRAM ADMINISTRATION..... 1</b>
<b>3</b>	<b>GENERAL..... 1</b>
<b>4</b>	<b>EQUIPMENT WITH A RATED HOISTING/LIFTING CAPACITY OF 2,000 POUNDS OR LESS (CRANES AND DERRICKS IN CONSTRUCTION)..... 2</b>
4.1	Equipment Used in Construction with a Maximum Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less..... 2
4.2	Assembly/Disassembly..... 2
4.3	Operation – Procedures..... 3
4.4	Safety Devices and Operational Aids..... 3
4.5	Operator Qualifications..... 4
4.6	Inspections..... 4
4.7	Hoisting Personnel..... 4
4.8	Design..... 4
<b>5</b>	<b>EQUIPMENT MODIFICATIONS – MOBILE AND TOWER CRANES..... 4</b>
<b>6</b>	<b>CRANES (EXCEPT BOOM-TYPE MOBILE CRANES)..... 4</b>
6.1	Access to the Cage, Cab, or Machine House Required..... 4
6.2	Outdoor Cages, Cabs, or Machine Houses..... 5
6.3	Warning Devices..... 6
6.4	Illumination..... 6
6.5	Controllers..... 6
6.6	Hoist Limit Device..... 7
6.7	Brakes for Hoists..... 7
6.8	Foot Brake Pedal..... 8
6.9	Locking Device..... 8
6.10	Brakes for Bridge and Swinging Motion..... 9
6.11	Boom Hoist Mechanisms..... 9
6.12	Runaway Travel Limit Device..... 10
6.13	Trolley Bumpers..... 10
6.14	Bridge or Gantry Buffers..... 10
6.15	Truck Wheel Guards and Railsweeps..... 11
6.16	Capacity Marking and Load Indication..... 11
6.17	Hoisting Ropes..... 12
6.18	Runaway Repair..... 12
6.19	Crane Runways..... 12
6.20	Rails..... 12
6.21	Clearances..... 12
6.22	Wind Indicators and Rail Clamps..... 13
<b>7</b>	<b>BOOM – TYPE MOBILE CRANES..... 13</b>
7.1	Operating Controls..... 13
7.2	Crane Boomstops..... 13

7.3	Load Rating Chart .....	14
7.4	Load Safety Devices.....	16
7.5	Operator's Cab .....	17
7.6	Access to Operator's Position, Machine House and/or Boom Blocks.....	18
7.7	Couplers .....	18
7.8	Boom Hoist Mechanisms .....	18
7.9	Free Fall and Controlled Load Lowering .....	19
7.10	Load Hoist Drums.....	20
7.11	Load Hoist Brakes .....	21
7.12	Power-Controlled Lowering .....	21
7.13	Adjustments.....	21
7.14	Swing Control .....	21
7.15	Swing Brake and Locking Device .....	21
7.16	Travel Brakes and Locks .....	21
7.17	Sheave Guards .....	22
7.18	Warning Device .....	22
7.19	Wheel Guards .....	22
7.20	Truck Wedges or Jacks .....	22
7.21	Lighting.....	23
7.22	Cranes Used in Demolition Work.....	23
7.23	Barge Mounted Cranes .....	23
7.24	Permanently Mounted Floating Cranes and Derricks.....	24
7.25	Life Buoys .....	24
<b>8</b>	<b>HYDRAULIC CRANES AND EXCAVATORS .....</b>	<b>24</b>
8.1	Hoist Mechanisms .....	24
8.2	Load Lowering.....	24
8.3	Boom Hoist and Supporting Mechanism.....	24
8.4	Swing Lock and Swing Brake .....	25
8.5	Controls.....	25
8.6	Brakes.....	25
8.7	General Operating Requirements .....	26
8.8	Hydraulic Relief Valves.....	26
<b>9</b>	<b>DERRICKS .....</b>	<b>26</b>
9.1	Operation Procedures .....	26
9.2	Construction .....	26
9.3	Operational Aid.....	28
9.4	Post-Assembly Approval and Testing—New or Reinstalled Derricks .....	29
9.5	Securing the Boom .....	29
9.6	Inspections .....	30
9.7	Rated Load Marking .....	30
9.8	Use of Winch Heads.....	30
9.9	Hoisting Ropes .....	30
9.10	Access to Sheaves, Bearings, and Blocks .....	31
9.11	Derrick Signals .....	31
<b>10</b>	<b>TOWER CRANES .....</b>	<b>31</b>
10.1	General .....	31
10.2	Inspections .....	32
10.3	Erection, Climbing, Dismantling, and Operation.....	33

10.4	Unattended Booms.....	35
10.5	Safety Devices .....	35
10.6	Safety Devices – Proper Operation Required .....	37
10.7	Operational Aids.....	37
10.8	Electrical Grounding .....	38
<b>11</b>	<b>HOIST, AUXILIARY HOISTING EQUIPMENT AND HOISTING OPERATIONS .....</b>	<b>38</b>
11.1	Limit Device.....	38
11.2	Brakes.....	38
11.3	Hoist Trolley Frame .....	38
11.4	Capacity Marking.....	39
11.5	Stops.....	39
11.6	Control Equipment.....	39
11.7	Warning Devices .....	39
11.8	Sheaves .....	39
11.9	Hoisting Chains and Ropes .....	40
11.10	End Attachments .....	40
11.11	Sheave Nip-Points.....	40
11.12	Hoisting Operations .....	40
11.13	Mobile Towers, Hoists and Similar Equipment.....	41
11.14	Tramways.....	41
<b>12</b>	<b>FLOATING CRANES/DERRICKS AND LAND CRANES/DERRICKS ON BARGES....</b>	<b>42</b>
12.1	Work Area Control.....	42
12.2	Additional Safety Devices .....	42
12.3	Accessibility of Procedures Applicable to Equipment Operation .....	42
12.4	Inspections .....	42
12.5	Manufacturer’s Specifications and Limitations .....	44
12.6	Floating Cranes/Derricks .....	45
12.7	Land Cranes/Derricks.....	46
<b>13</b>	<b>OPERATING RULES .....</b>	<b>48</b>
13.1	Travel .....	48
13.2	Ground Conditions.....	49
13.3	Booms .....	49
13.4	Swing .....	50
13.5	Work Area Control .....	50
13.6	Hoisting .....	51
13.7	Riding Loads on Derricks, Hoists, or Cranes .....	52
13.8	Driver’s Position .....	52
13.9	Fire Extinguisher .....	52
13.10	Refueling .....	52
13.11	Handling Loads .....	53
13.12	Limit Switches .....	54
13.13	Signals .....	55
13.14	Signals – Radio, Telephone or other Electronic Transmission of Signals.....	56
13.15	Signals – Voice Signals – Additional Requirements.....	56
13.16	Signal Person Qualifications – Supplemental Requirements for Cranes and Derricks in Construction .....	57
13.17	Overhead Loads.....	57
13.18	Provisions for Preventing Accidents in the Area of High-Voltage Lines.....	58



13.19	Power Line Safety (Up to and Including 350kV) – Equipment Operations.....	59
13.20	Power Line Safety (Over 350kV) .....	62
13.21	Power Line Safety (All Voltages) – Equipment Operations Closer Than the Table A Zone.....	62
13.22	Power Line Safety - While Traveling Under or Near Power Lines with No Load. 63	
13.23	Crane or Derrick Suspended Personnel Platforms .....	64
13.24	Work Near Transmitter Towers.....	72
13.25	Crane and Hoisting Equipment Operators – Qualifications .....	72
13.26	Mobile Crane and Tower Crane-Operator Qualifications and Certification (Applicable to Cranes in General Industry Only) .....	72
13.27	Operator Training, Certification, and Evaluation for Cranes and Derricks in Construction .....	75
13.28	Operating Practices .....	80
13.29	Operation .....	80
13.30	Floor-Operated Cranes.....	82
13.31	Assembly/Disassembly – Selection of Manufacturer or Don H. Mahaffey Drilling Co.'s Procedures .....	82
13.32	Assembly/Disassembly - General Requirements (Applies to All Assembly and Disassembly Operations) .....	82
13.33	Disassembly – Additional Requirements for Dismantling of Booms and Jibs (Applies to Both the Use of Manufacturer Procedures and Don H. Mahaffey Drilling Co.'s Procedures) .....	86
13.34	Assembly/Disassembly – Don H. Mahaffey Drilling Co.'s Procedures – General Requirements .....	86
13.35	Power Line Safety (Up to and Including 350kV) – Assembly and Disassembly.....	87
13.36	Fall Protection – Supplemental/Specific Requirements for Cranes .....	89
13.37	Training – Supplemental Requirements for Cranes in Construction.....	90
<b>14</b>	<b>SAFETY DEVICES AND OPERATIONAL AIDS .....</b>	<b>91</b>
14.1	Safety Devices .....	91
14.2	Operational Aids.....	92
14.3	Operational Aids and Alternative Measures.....	92
<b>15</b>	<b>TESTING.....</b>	<b>93</b>
15.1	Operational Testing .....	93
15.2	Equipment Over Three Tons Rated Capacity .....	93
15.3	Proof Load Test and Examination of Cranes and Their Accessory Gear .....	93
15.4	Test Weights .....	95
15.5	Proof Load Test and Examination of Derricks and Their Accessory Gear .....	96
15.6	Examination of Bulk Cargo Handling Devices.....	96
15.7	Certificates .....	96
15.8	Determination of Crane or Derrick Safe Working Loads and Limitations in Absence of Manufacturer's Data.....	97
15.9	Safe Working Load Reduction .....	97
15.10	Safe Working Load Increase .....	97
<b>16</b>	<b>INSPECTION AND MAINTENANCE.....</b>	<b>97</b>
16.1	Inspection .....	97
16.2	Inspection – Post-Assembly .....	100
16.3	Inspection – Modifications or Additions.....	100

16.4	Repaired/Adjusted Equipment .....	101
16.5	Maintenance.....	101
16.6	Qualifications of Maintenance and Repair Employees .....	101
16.7	Adjustments and Repairs.....	102
16.8	Damaged Booms.....	103
16.9	Inspection – Wire Rope (Additional Requirements for Cranes and Derricks in Construction) .....	103
16.10	Wire Rope – Selection and Installation Criteria.....	105
<b>17</b>	<b>SLINGS.....</b>	<b>106</b>
17.1	Safe Operating Practices.....	106
17.2	Inspections .....	106
17.3	Alloy Steel Chain Slings .....	107
17.4	Wire Rope Slings.....	108
17.5	Metal Mesh Slings .....	110
17.6	Natural and Synthetic Fiber Rope Slings .....	111
17.7	Synthetic Web Slings.....	113
17.8	Defective Hoist or Sling Hooks and Rings .....	114
	<b>APPENDIX 1 – DEFINITIONS .....</b>	<b>116</b>
	<b>APPENDIX 2 – EQUIPMENT CHECKLIST .....</b>	<b>132</b>
	<b>APPENDIX 3 – PLATE I.....</b>	<b>133</b>
	<b>APPENDIX 4 – PLATES.....</b>	<b>136</b>

## 1 OBJECTIVE

Don H. Mahaffey Drilling Co. is committed to ensuring that a safe work environment is provided for all employees. This program has been created to direct safe work operations and is compliant with California Code of Regulations, Title 8, Subchapter 7, Group 13 (Cranes and Other Hoisting Equipment).

## 2 PROGRAM ADMINISTRATION

Ashley Mahaffey Tullius has been designated for the administration of this safety and certification program. Ashley Mahaffey Tullius will be responsible for ensuring that:

- a. All crane operators are current in their certifications;
- b. Safe work practices are being utilized; and
- c. Providing for regular safety training regarding cranes and crane safety is conducted for all personnel who work within close proximity to cranes.

## 3 GENERAL

3.1 Posted warnings as required by this program, as well as those supplied with the equipment manufacturer, will be maintained in legible condition.

3.2 All exhaust pipes, turbochargers, and charge air coolers will be insulated or guarded where inadvertent contact by employees (except for maintenance and repair employees) is possible in the performance of normal duties.

3.3 Load hooks, ball assemblies and load blocks will be of sufficient weight to overhaul the line from the highest hook position for boom or boom and jib lengths and the number of parts of the line in use.

3.4 Hook and ball assemblies, load blocks.

- a. Hook and ball assemblies and load blocks on mobile cranes will be marked with their rated capacity and weight.
- b. Hook and ball assemblies and load blocks will be equipped with latches.

*Exception: Hooks without latches, or with latches removed or disabled, will not be used unless a qualified person has determined that it is safer to hoist and place the load without latches (or with the latches removed/tied-back).*

3.5 Cabs (Supplemental requirements for cranes in construction)

Equipment with cabs will meet the following requirements:

- a. Cabs will be designed with a form adjustable ventilation and method for clearing the windshield (when provided) for maintain visibility and air circulation. Examples of means for adjustable ventilation may include an air conditioner or window that can be opened (for ventilation and air circulation); examples of means for maintaining visibility may include heater (for preventing windshield icing), defroster, fan, or windshield wiper.
- b. Cab doors (swinging, sliding) will be designed to prevent inadvertent opening or closing while traveling or operating the machine. Swinging doors adjacent to the operator will open outward. Sliding operator doors will open rearward.

- c. Windows (if provided or other openings)
  - 1. Windows or other openings will be provided in front and on both sides of the operator with visibility forward and to either side. Forward vertical visibility will be sufficient to give the operator a view of the boom point at all times.
  - 2. Windows may have sections designed to be opened or readily removed. Windows with sections designed to be opened will be designed so that they can be secured to prevent inadvertent closure.
  - 3. Windows will be of safety glass or material with similar optical and safety properties, which introduce no visible distortion or otherwise obscure visibility that interferes with the safe operation of the equipment.
- d. A clear passageway will be provided from the operator's station to an exit door on the operator's side.
- e. Areas of the cab roof that serves as a workstation for rigging, maintenance or other equipment-related tasks will be capable of supporting 250 pounds.

#### **4 EQUIPMENT WITH A RATED HOISTING/LIFTING CAPACITY OF 2,000 POUNDS OR LESS (CRANES AND DERRICKS IN CONSTRUCTION)**

##### **4.1 Equipment Used in Construction with a Maximum Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less**

If applicable, where Don H. Mahaffey Drilling Co. is using this equipment, the following provisions of this program will be complied with:

- a. Section 5
- b. Appendix 1
- c. Subsection 7.9
- d. Subsection 13.2
- e. Subsection 13.6.6
- f. Subsections 13.13 and 13.14
- g. Subsection 13.17 (except for subsection 13.17.3)
- h. Subsections 13.19, 13.20, 13.21, 13.22, and 13.35
- i. Subsection 13.28.3
- j. Subsection 13.31
- k. Subsection 13.34
- l. Subsection 13.36
- m. Subsection 16.2
- n. Subsections 16.1, 16.9, and 16.10
- o. Section 9
- p. Section 10
- q. Section 12 and the California Code of Regulations, Title 8, Section 6060
- r. Section 6

##### **4.2 Assembly/Disassembly**

- 4.2.1 In addition, with compliance with subsection 13.31 and 13.34, employees will comply with subsection 4.2.2 and 4.2.3.



#### 4.2.2 Components and configuration

It will be ensured that:

- a. The selection of components, and the configuration of the equipment, that affect the capacity or safe operation of the equipment complies with either the:
  1. Manufacturer instructions, recommendations, limitations, and specifications. When these documents and information are unavailable, a certified agent familiar with the type of equipment involved will approve, in writing, the selection and configuration of components; or
  2. Modifications that meet the requirements of section 5.

#### 4.2.3 Manufacturer Prohibitions

Employees will comply with applicable manufacturer prohibitions

### 4.3 Operation – Procedures

4.3.1 All manufacturer procedures applicable to the operational functions of the equipment, including its use with attachments, will be complied with.

#### 4.3.2 Unavailable Operation Procedures

Don H. Mahaffey Drilling Co. will:

- a. When the manufacturer's procedures are unavailable, develop, and ensure compliance with, all procedures necessary for the safe operation of the equipment and attachments.
- b. Ensure that procedures for the operational controls are developed by a qualified person.
- c. Ensure that procedures related to the capacity of the equipment are developed and signed by a certified agent familiar with the equipment.

#### 4.3.3 Accessibility

It will be ensured that:

- a. The load chart is available to the operator at the control station;
- b. Procedures applicable to the operation of the equipment, recommended operating speeds, special hazard warnings, instructions, and operator's manual are readily available for use by the operator;
- c. When rated capacities are available at the control station only in electronic form and a failure occurs that makes the rated capacities inaccessible, the operator immediately ceases operations or follows safe shut-down procedures until the rated capacities (in electronic or other form) are available.

### 4.4 Safety Devices and Operational Aids

4.4.1 Safety and operational aids that are part of the original equipment will be maintained in accordance with the manufacturer procedures.

#### 4.4.2 Anti-two Blocking

Boom-type cranes covered by this section will have either an anti-two-block device that meet the requirements of subsection 7.4.4 or be designed so that, in event of a two-block situation, no damage, or load failure will occur.

#### **4.5 Operator Qualifications**

Subsection 13.25 will apply to operation of boom-type cranes with a rated hoisting/lifting capacity of 2,000 pounds or less.

#### **4.6 Inspections**

Boom-type cranes will be inspected in accordance with the manufacturer procedures.

#### **4.7 Hoisting Personnel**

Equipment covered by this section will not be used to hoist personnel.

#### **4.8 Design**

All non-original equipment manufacturer (OEM) lifting equipment will be approved by a registered professional engineer.

### **5 EQUIPMENT MODIFICATIONS – MOBILE AND TOWER CRANES**

Modifications or additions which affect the capacity or safe operation of the equipment are prohibited except where the requirements of subsections (a) or (b) are met.

a. Manufacturer review and approval:

1. The manufacturer approves the modifications/additions in writing.
2. The load charts, procedures, instruction manuals and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.
3. The original safety factors of the equipment are not reduced.

b. Unavailable manufacturer

The manufacturer is unavailable and the following requirements are met:

1. A certified agent who is a qualified person with respect to the equipment involved:
  - I. Approves the modification/addition and specifies the equipment configurations to which that approval applies, and
  - II. Modifies load charts, procedures, instruction manuals and instruction plates/tags/decals as necessary to accord with the modification/addition.
2. The original safety factor of the equipment is not reduced.

### **6 CRANES (EXCEPT BOOM-TYPE MOBILE CRANES)**

#### **6.1 Access to the Cage, Cab, or Machine House Required**

- 6.1.1 Access to the cage, cab or machine house will be afforded by a fixed ladder, stairs or platform requiring a step-over of not more than 12 inches, except in installations prior to January 1, 1973, the gap may exceed 12 inches but will not exceed 20 inches, and so located that a person approaching or leaving the crane will not be exposed to dangerous shear hazards. If the top of a ladder or stairway or any position thereof is located where a moving part of a crane, such as a revolving house, could strike an

employee ascending or descending the ladder or stairway, a prominent warning sign will be posted at the foot of the ladder or stairway. A system of communication (such as a buzzer or bell) will be established and maintained between the foot of the ladder or stairway and the operator's cab.

- 6.1.2 For bridge and gantry cranes, there will be a ladder, stairs or other safe means which provides access to the bridge walkway. Where cage is attached to and below bridge girders, no portion of the cage or cage platform will be in the projected area between the girders unless there are bridge stops or bumpers to prevent the trolley from passing over the projected area opposite the cage.
- 6.1.3 On all cranes having revolving cabs or machine houses, means will be provided to permit the operator to enter or leave the crane cab or machine house irrespective of position of the cab and to safely reach the ground.
- 6.1.4 When necessary to go out on booms or bridges to service the blocks or other parts of the machinery, each boom or bridge will be equipped with a substantial walkway or platform handholds, or grab irons giving access to the blocks and machinery. Permanent elevated platforms attached to the building at the end of the bridge crane runways and at the same level of the bridge, which give safe access to the bridge, or mobile work platforms, will be acceptable in lieu of the platform on the bridge. Single girder or monorail bridges with underhung trolleys and hoists are exempted, provided the hoists and trolleys are serviced or repaired from a safe, portable ladder or other safe temporary means. Booms which can be and are safely lowered to a safe location for such servicing operation will be exempted from this program, provided all grease and oil fittings and receptacles are piped or otherwise located so that they can be conveniently serviced from such walkways or safe locations without climbing over or upon the boom, bridge, or trolley structure. Footwalks will be of rigid construction and designed to sustain a distributed load of at least 50 pounds per square foot.
- 6.1.5 Where practicable, every overhead traveling crane walkway will have a headroom of at least 78 inches. Where not practicable to provide this clearance, the crane walkway will have at least 60 inches clearance or the walkway will be omitted from the crane and a permanent elevated platform shall be attached to the building at the end of the crane runway.

## **6.2 Outdoor Cages, Cabs, or Machine Houses**

- 6.2.1 The cages, cabs, or machine houses on cranes used in inclement weather will be enclosed to protect the operator.
- 6.2.2 The general arrangement of the cab and the location of control and protective equipment will be such that all operating handles are within convenient reach of the operator when facing the area to be served by the load hook, or while facing the direction of travel of the cab. The arrangement will allow the operator a full view of the load hook in all positions except as provided under subsection 12.13.

- 6.2.3 The cab will be located to afford a minimum of 3 inches clearance from all fixed structures within its area of possible movement.

### **6.3 Warning Devices**

- 6.3.1 An audible warning device will be mounted on each overhead traveling or bridge crane equipped with a power traveling mechanism, to warn persons in or near the path of crane travel.

*Exception: Floor operated cranes whose movements are controlled by an operator through the use of controllers contained in a pendant station suspended from the crane.*

- 6.3.2 When starting the bridge and when the load or hook approaches personnel, the warning signal will be sounded.

*Exception: When an employee whose specific duties are to spot and direct crane operations who is in contact with the operator by signals, telephone, radio, etc.*

- 6.3.3 Cranes traveling on rails or rubber tires at ground level and operating in work areas will be equipped with automatic warning devices to warn employees whenever the crane is traveling.

- 6.3.4 Overhead traveling or bridge cranes equipped with a power traveling mechanism whose warning device has become inoperative will not be operated until the warning device is repaired or replaced.

*Exception: Temporary crane operation will be permitted if a spotter having a clear view of the crane load and operator is present whose specific duty is to warn those in the path of the crane or its load.*

### **6.4 Illumination**

Sufficient light will be provided in the cab to enable the operator to see clearly enough to perform the work.

### **6.5 Controllers**

- 6.5.1 Cranes not equipped with spring-return controllers or momentary contact pushbuttons will be provided with a device which will disconnect all motors from the line on failure of line power and will not permit any motor to be restarted on line power until the controller handle is brought to the "off" position, or a reset switch or button is operated.

- 6.5.2 For cranes operated from the floor, the controller or controllers, if the controller is rope or line actuated, will automatically return to the "off" position when released by the operator.

- 6.5.3 Lever-operated controllers will be provided with a mechanical device which will hold the handle in the "off" position, requiring voluntary effort to move it from the "off" position to the "on" position.
- 6.5.4 All electrically operated cranes will have their controllers plainly marked to indicate their function and the equipment they control. As far as is practicable, the movement of each controller handle shall be in the same general direction as the resultant movement of the load.
- 6.5.5 The controller operating handles will be located within convenient reach of the operator.
- 6.5.6 The controls for the bridge and trolley will be so located that the operator can readily see the direction of travel while operating the controls.
- 6.5.7 All electric cranes of similar design operating in a given plant will be so wired that like motion of controller handles will produce like effect in similarly controlled mechanisms.
- 6.5.8 Remote-operated cranes will function so that if the control signal for any crane motion becomes ineffective, crane motion shall stop.
- 6.5.9 Automatic cranes will be so designed that all motions will failsafe if any malfunction of controls occurs.
- 6.5.10 Pendant controller controls will return to the "off" position when released by the operator.

## **6.6 Hoist Limit Device**

The hoisting motion of all electric overhead traveling cranes will be provided with a suitable and effective enclosed-type limit switch so placed and arranged as to stop the hoist before the hook passes the highest point of safe travel.

## **6.7 Brakes for Hoists**

- 6.7.1 Each independent hoisting unit of a crane will be equipped with at least one self-setting brake, hereafter referred to as a holding brake, applied directly to the motor shaft or some part of the gear train.
- 6.7.2 Each independent hoisting unit of a crane, except worm-gear hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction, will, in addition to a holding brake, be equipped with control braking means to prevent over-speeding.
- 6.7.3 Holding brakes for hoist motors will have not less than the following percentage of the full load hoisting torque at the point where the brake is applied:
  - a. 125 percent when used with a control braking means other than mechanical.



- b. 100 percent when used in conjunction with a mechanical control braking means.
- c. 100 percent each if two holding brakes are provided.

6.7.4 Holding brakes on hoists will have ample thermal capacity for the frequency of operation required by the device.

6.7.5 Holding brakes on hoists will be applied automatically when power is removed from the brake holding mechanism.

*Note: Dynamic braking controls of d-c motors may maintain power at the brake holding mechanism (coil) if the power supply to the crane is interrupted while a load is being lowered. The holding brakes need not be applied automatically in this situation, since the operator can stop or control the lowering speed of the load in a normal manner.*

6.7.6 Holding brakes will be provided with adjustment means to compensate for wear.

6.7.7 The wearing surface of all holding-brake drums or discs will be smooth.

6.7.8 Each independent hoisting unit of a crane handling hot metal and having power control braking means will be equipped with at least two holding brakes.

6.7.9 A power control braking means such as regenerative, dynamic or counter-torque braking, or a mechanically controlled braking means will be capable of maintaining safe lowering speeds of rated loads.

6.7.10 The control braking means will have ample thermal capacity for the frequency of operation required by service.

## **6.8 Foot Brake Pedal**

Foot-operated brake pedals will be maintained so that the operator's foot will not easily slip off.

## **6.9 Locking Device**

A locking device capable of holding the brake applied at 50 percent more than the maximum rated load will be provided on each hand or foot operated hoisting motion brake unless a ratchet and pawl are provided on the drum. Such locking device will either, require a separate motion of the hand or foot from that motion which applies the brake or other arrangement for application and release which will not distract the operator from his other activities of controlling the crane and load.

## **6.10 Brakes for Bridge and Swinging Motion**

- 6.10.1 On cage-operated cranes with the cage mounted directly on the bridge girders, a foot brake to properly retard and stop the motion of the bridge will be installed unless the bridge stops automatically when the power is cut off. This does not apply to underslung cab monorail cranes.
- 6.10.2 Brakes for retarding the motion of the bridge will be capable of retarding it at the rate of 1 foot per second per second while full load is being carried.
- 6.10.3 The swinging or slewing mechanism on boom-type cranes will be provided with a brake or lock having holding power in either direction. The lever operating this brake or lock will have a device by which it can be secured in the holding position.
- 6.10.4 On cab-operated cranes with the cab on the trolley, a trolley brake will be required of sufficient size to stop the trolley within a distance in feet equal to 10 percent of full load speed in feet per minute when traveling at full speed with a full load.
- 6.10.5 On cab-operated cranes with cab on trolley, a bridge brake of the holding type will be required.
- 6.10.6 If holding brakes are provided on bridge or trolley(s), they will not prohibit the use of a drift point in the control circuit.
- 6.10.7 On all floor, remote and pulpit operated crane bridge drives, a brake or noncoasting mechanical drive will be provided.

## **6.11 Boom Hoist Mechanisms**

- 6.11.1 When using recommended boom hoist reeving and with rated loads suspended, the boom hoist will be capable of raising the boom, holding it stationary without attention from the operator, and lowering it only when coupled to its prime mover.
- 6.11.2 The boom hoisting mechanism will be provided with a suitable clutching or power engaging device permitting immediate starting or stopping of the boom drum motion. The boom hoisting mechanism also will be provided with a self-setting safety brake, capable of supporting all rated loads, with recommended reeving.
- 6.11.3 Brakes and clutches will be provided with adjustments where necessary to compensate for wear and to maintain required force in springs where used.
- 6.11.4 The boom hoisting mechanism will be provided with an auxiliary ratchet and pawl or other positive locking device.
- 6.11.5 The boom hoist drum will have sufficient rope capacity to operate the boom at all positions from horizontal to the highest angle recommended when using the manufacturer's recommended reeving and rope size.

- a. No less than two full wraps of rope will remain on the drum with boom point lowered to the level of the crane and supporting surface.
  - b. The drum end of the rope will be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane or rope manufacturer.
- 6.11.6 The drum diameter will be sufficient to provide a first layer rope pitch diameter of not less than 15 times the nominal diameter of the rope used.
- 6.11.7 Automatic means will be provided to stop boom drum motion when the maximum permissible boom angle is reached.
- 6.11.8 The wearing surface of all brake drums or discs will be smooth.

## **6.12 Runaway Travel Limit Device**

- 6.12.1 At the limits of travel of the bridges or gantry structures, bumpers or other positive travel limiting device will be provided which will prevent bridge or gantry structures from leaving the ends of the rails. If bumpers are provided and they engage the tread of the wheel, they will be of a height not less than the radius of the wheel.
- 6.12.2 Bumpers, if used, will have energy absorbing capacity to stop the crane when traveling at a speed of at least 40 percent of rated load speed, but the average deceleration rate will not exceed 3 feet per second per second when traveling in either direction at 20 percent of the rated load speed and will be so mounted that there is no direct shear on bolts.

## **6.13 Trolley Bumpers**

- 6.13.1 Bumpers will be provided at each end of the trolley travel to prevent trolleys leaving the rails. If the bumpers engage the tread of the wheels, they will be of a height at least equal to the radius of the wheel. Trolley bumpers will be capable of stopping the trolley at an average rate of deceleration not exceeding 4.7 feet per second per second when traveling in either direction at 1/3 of the rated load speed. Bumpers will be designed and installed to minimize parts falling from the trolley in case of breakage.
- 6.13.2 If there is more than one trolley on the same bridge girder, buffers or other cushioning devices will be placed between the trolleys. Buffers will be designed and installed to minimize parts falling from the trolley in case of breakage.

## **6.14 Bridge or Gantry Buffers**

- 6.14.1 If there is more than one crane on the same runway, buffers or other cushioning devices will be placed between the cranes at both ends of the bridges or gantries.
- 6.14.2 Buffers will have energy absorbing capacity to stop the crane when traveling at a speed of at least 40 percent of rated load speed, but the

average deceleration rate will not exceed 3 feet per second per second when traveling in either direction at 20 percent of the rated load speed.

#### **6.15 Truck Wheel Guards and Railsweeps**

- 6.15.1 Bridge truck wheels, except on underhung cranes, or those isolated by location, will be equipped with wheel guards. They will also be equipped with railsweeps which extend below the top of the rail and project in front of the truck wheels.
- 6.15.2 Gantry, tower, hammerhead, or portal crane trucks and wheels will be equipped with wheel guards or be otherwise similarly guarded at both ends of each truck to prevent a person being crushed beneath the wheels. The clearance between the guard and the rail or running surface will be such as will afford maximum protection against crushing injuries. Wherever practicable, one half of an inch clearance will be maintained.
- 6.15.3 Container-handling, rubber-tired, gantry cranes will be guarded with wheel fenders, bumpers or skirt guards which shield each wheel to the front and rear extended to the lowest practicable level above ground.

#### **6.16 Capacity Marking and Load Indication**

- 6.16.1 The maximum rated load of all bridge or fixed radius cranes will be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist will have marked on it or its load block its rated capacity, and this will be clearly legible from the ground or floor.
- 6.16.2 Each variable radius boom-type crane will be equipped with a boom angle or a boom radius indicator and a clearly legible load rating chart in clear view from the operator's position.
  - a. Cranes having a boom exceeding 60 feet in length or a maximum rated capacity exceeding 15 tons will be provided with an approved boom angle indicator which clearly shows the boom angle in degrees to the operator at all times. The indicator will give a clear visual warning signal before high or low unsafe boom angles are reached. The indicator will be mounted in the cab, adjustable and under control of the operator at all times, and a visual inspection of the indicator will be made each day by the operator to see that it is properly functioning.
  - b. Cranes having either a maximum rated boom exceeding 200 feet or a maximum rated capacity exceeding 50 tons will be equipped with a load indicating device, a load moment device, or a device that prevents an overload condition. Only approved devices as defined in the General Industry Safety Orders, Section 3206 shall be used.
  - c. When a load indicating device or alternative system is so arranged in the supporting system (crane structure) that its failure could cause the load to be dropped, its strength will not be the limiting factor of the supporting system (crane structure).
  - d. All load indicating devices will be operative over the full operating radius. Overall accuracy will be based on actual applied load and not on full scale (full capacity) load.

- e. When the device uses the radius as a factor in its use or in its operating indications, the indicated radius (which may be in feet and/or meters, or degrees of boom angle, depending on the system used) will be a figure which is within the range of a figure no greater than 110 percent of the actual radius to a figure which is no less than 97 percent of the actual (true) radius. A conversion chart will be provided whenever it is necessary to convert between degrees of radius and feet or meters.

- 6.16.3 If change-speed gear is used on the lifting motion, the rated load for each speed will be similarly indicated.

## **6.17 Hoisting Ropes**

- 6.17.1 The hoisting ropes will be of a type as recommended by the certified agent. The rated load divided by the number of parts of rope shall not exceed 20 percent of the nominal breaking strength of the rope.
- 6.17.2 If hoisting ropes run near enough to other parts to make fouling or chafing possible, guards will be installed to prevent this condition.
- 6.17.3 A guard will be provided to prevent contact between bridge conductors and hoisting ropes if they could come into contact.

## **6.18 Runaway Repair**

No repairs will be made on crane runways, supporting structures, or equipment within reach of the runway unless a wheel stop capable of preventing crane movement within the work area is secured to each rail and a warning sign is placed on each rail a reasonable distance from the workers.

## **6.19 Crane Runways**

Runway columns will be securely anchored to the foundation, the structure will be free from excessive vibration under operating conditions, and the runway girders shall be level and parallel within accepted engineering tolerances.

## **6.20 Rails**

Rails will be securely attached to the girders or to the foundation, will be level in elevation with each other, parallel and in correct span within accepted engineering tolerances.

## **6.21 Clearances**

- 6.21.1 All travelling cranes, the supporting truck or wheels of which travel on rails on the ground, will have at least 24 inches clearance between the crane and stationary structures or stacks or piles of materials. Where impracticable to obtain this clearance, such areas will be guarded by guardrails or barricades to prevent access.



6.21.2 If the runways of two cranes are parallel, and there are no intervening walls or structure, there will be adequate clearance provided and maintained between the two bridges.

6.21.3 Minimum clearance of 3 inches overhead and 2 inches laterally will be provided and maintained between crane and obstructions.

*Note: These clearances are only concerned with passage of the crane machinery past building structure.*

6.21.4 Where passageways or walkways are provided obstructions will not be placed so that safety of personnel will be jeopardized by movements of the crane.

## **6.22 Wind Indicators and Rail Clamps**

Outdoor storage bridges will be provided with automatic rail clamps. A wind-indicating device will be provided which will give a visible or audible alarm to the bridge operator at a predetermined wind velocity. If the clamps act on the rail heads, any beads or weld flash on the rail heads will be ground off.

# **7 BOOM – TYPE MOBILE CRANES**

## **7.1 Operating Controls**

7.1.1 Lever-operated controllers will be provided with a device which will hold the handle in the "off" position, requiring voluntary effort to remove it from the "off" to the "on" position.

7.1.2 The operating controls will be located within convenient reach of the operator and shall be identified by marking or a legible chart to indicate the motion controlled and the direction.

7.1.3 Controls will include means:

- To start and stop.
- To control speed of internal combustion engines.
- To stop engines under emergency conditions.
- For shifting selective transmission.

## **7.2 Crane Boomstops**

7.2.1 Cranes of such design that the boom could fall over backward will be equipped with boomstops whenever the main boom is rope supported and the crane used for hook, clamshell, magnet, grapple, concrete bucket, or service presenting similar risk. The boomstop will provide emergency protection against destructive damage and related hazard by opposing any unexpected upward and rearward boom movement beyond the working range. It will not be used purposely as a substitute for normal procedures in stopping a boom being raised.

- 7.2.2 In the case of new cranes over 10 tons in capacity purchased after January 1, 1971, the required boomstops will satisfy the following standards and each Don H. Mahaffey Drilling Co. will have substantial assurance of this in the form of crane manufacturers' warranties, test reports, charts, engineering calculations, etc.
- a. The boomstops will be strong enough to develop the ultimate strength of the boom in bending at the point of attachment or contact between boomstop and boom, which point should be located near the outer end of the basic inner section of the boom; however, the point must be at least 5 feet above the operator's normal seat level when the crane is level and the boom vertical.
  - b. The ultimate bending strength of the boom referred to in 5.2.2(a) will not be reduced by the nature of contact between the boomstop and boom; such points of contact to be so located and designed that forces developed by boomstop action on the boom will not cause prior local failure of any boom members.
  - c. The boomstop will prevent that portion of the boom below the point of boomstop contact from upward and rearward movement beyond 90 degrees, or some lesser angle, in reference to the horizontal machinery deck.
  - d. The boomstop will provide energy absorbing resistance to the upward and rearward movement of the boom throughout an angular range of the last 5 degrees of such movement as limited in 7.2.2(c).
- 7.2.3 Jibs will have positive stops to prevent their movement of more than 5 degrees beyond the straight line of the jib and boom on conventional-type crane booms.
- 7.2.4 No boomstop will remain in use unless it is in good operating condition and maintained in accordance with the certified agent's guidelines for maintenance and service.

### **7.3 Load Rating Chart**

- 7.3.1 A durable load chart with clearly legible letters and figures provided by the certified agent will be securely fixed to the crane in a location clearly visible to the operator or within reach of the operator while at the control station. The chart will contain a full and complete range of crane load ratings, consistent with the manufacturers' recommendations, at all stated operating radii or boom angles and for all permissible boom lengths, jib lengths and angles, also alternate ratings for use and non-use of optional equipment on the mobile crane, such as outriggers and counterweights which affect ratings. The chart will also contain essential precautionary or warning notes relative to limitations on equipment and operating procedures, including indication of the least stable position. In addition, no crane shall be rerated unless such rating changes are approved by the certified agent. Load ratings will be expressed in terms related to method of measuring boom angle and length or lifting radius.
- 7.3.2 Where boom or jib ratings are limited by structural competence, such ratings will be clearly shown and emphasized on the rating charts.

7.3.3 Load ratings where stability governs lifting performance.

- a. The margin of stability for determination of load ratings, with booms of stipulated lengths at stipulated working radii for the various types of crane mountings is established by taking a percentage of the loads which will produce a condition of tipping or balance with the boom in the least stable direction, relative to the mounting. The load ratings will not exceed the following percentages for cranes, with the indicated types of mounting under conditions stipulated in subsections 5.3.4 and 5.3.5.

Maximum Load Ratings	Type of Crane Mounting (% of Tipping Loads)
Locomotive, without outrigger (stabilizer) support <sup>1</sup> Booms 60 feet or less	85
Booms over 60 feet	85 <sup>2</sup>
Locomotive, using outriggers (stabilizers) fully extended and set	80
Crawler, without outrigger support	75
Crawler, using outrigger fully extended and set	85
Wheel mounted using outriggers fully extended and set, with wheels off supporting surface	85
Commercial truck vehicle mounted crane with stabilizer extended and set	85
Wheel mounted without outrigger support	75

*Note<sup>1</sup>: As a precaution while testing for free ratings, outriggers should be loosely applied; rail clamps should not be used.*

*Note<sup>2</sup>: The difference between the backward stability moment and the forward moment resulting from the load should not be less than 30,000 lb-ft with the backward stability moment being the greater.*

7.3.4 The following stipulations will govern the application of the values in 5.3.3 for locomotive cranes:

- a. Tipping with or without the use of outriggers occurs when half of the wheels farthest from the load leave the rail.
- b. The crane will be standing on track which is level within one-percent grade.
- c. Radius of the load is the horizontal distance from a projection of the axis of rotation to the rail support surface, before loading, to the center of vertical hoist line or tackle with load applied.
- d. Tipping loads from which ratings are determined will be applied under static conditions only, i.e. without dynamic effect of hoisting, lowering, or swing.
- e. The weight of all auxiliary handling devices such as hoist blocks, hooks, and slings will be considered a part of the load rating.

- 7.3.5 Stipulations governing the application of the values in subsection 7.3.3 for crawler, truck and wheel-mounted cranes will be in accordance with the Crane Load-Stability Test Code, SAEJ765, 1969 or 1980 as applicable.

*Note: The effectiveness of these preceding stability factors will be influenced by such additional factors as freely suspended loads, track, wind, or ground conditions, condition and inflation of rubber tires, boom lengths, proper operating speeds for existing conditions, and in general, careful and competent operation. All of these will be taken into account by the user.*

## **7.4 Load Safety Devices**

- 7.4.1 All cranes having a maximum rated capacity exceeding one ton will be equipped with safety devices as provided in this section.

*Exceptions:*

1. *Boom-type excavators used in excavation work and all equipment when configured for pile driving or log handling.*
2. *Articulating boom cranes are exempt from the provisions of subsection 7.4.3.*
3. *Digger derrick trucks designed, built and maintained in accordance with ANSI/ASSE A10.31 standards for "Construction and Demolition Operations - Safety Requirements, Definitions and Specifications for Digger Derricks".*

- 7.4.2 All mobile cranes including truck-mounted tower cranes having either a maximum rated boom length exceeding 200 feet or a maximum rated capacity exceeding 50 tons will be equipped with a load indicating device or a load moment device, or a device that prevents an overload condition. Only approved devices as defined in the General Industry Safety Orders, Section 3206 will be used.

- a. All other mobile cranes manufactured after September 27, 2005, with a maximum rated capacity exceeding 3 tons will be equipped with a load indicating device, load moment device, or a device that prevents an overload condition.

*Exception: When installed load indicating devices are not functional, a qualified person shall determine load weights until the device is restored to operation. When installed load indicating devices are not functional, a qualified person will determine load weights until the device is restored to operation.*

- b. Load indicating devices will be repaired in accordance with the manufacturer's recommendations.

- 7.4.3 Mobile cranes will be provided with a boom angle or radius indicator which clearly shows the boom angle or radius distance to the operator at all times.
- a. Boom angle or radius indicators will be repaired in accordance with the manufacturer's recommendations.

*Exception: When a boom angle or radius indicator is inoperative or malfunctioning, a qualified person will determine the radius or boom angle by measurement until the indicator is restored to operation. When a boom angle or radius indicator is inoperative or malfunctioning, a qualified person will determine the radius or boom angle by measurement until the indicator is restored to operation.*

**7.4.4 Anti-two-block prevention and warning features.**

- a. Telescopic boom cranes manufactured after February 28, 1992, will be equipped with an anti-two-block device or two-block damage prevention feature for all points of two-blocking.
- b. Lattice boom cranes manufactured after February 28, 1992, will be equipped with a device which automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) shall prevent such damage/failure at all points where two-blocking could occur.
- c. Lattice boom derricks manufactured after November 8, 2011, will be equipped with a device which automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) will prevent such damage/failure at all points where two-blocking could occur.  
*Exception: The requirements of subsections 7.4.4(b) and 7.4.4(c), do not apply to lattice boom cranes when used for dragline, clamshell (grapple), magnet, and drop ball work.*
- d. Articulating boom cranes manufactured after August 30, 2001, equipped with a load hoisting device (winch) will be equipped with a two-block damage prevention feature.

**7.4.5 Spirit levels, or equivalent, will be provided to indicate the level of the crane fore and aft and across the width.**

**7.5 Operator's Cab**

- 7.5.1 Operators exposed to the hazard of falling material or objects will be protected by a canopy-type guard or cab over their usual operating position on the equipment except when such enclosure would interfere with the safe operation of the crane or create an additional hazard by excessively restricting the operator's vision.
- 7.5.2 All windows on such equipment will be safety glass, or equivalent, without optical distortion and possess optical qualities meeting standards of the California Department of Motor Vehicles. Wire glass, or equivalent, will only be used for those windows through which the operator is not required to view the operations. Visibility forward will include a vertical range adequate to cover the boom point at all times. The front window may have a section which may be readily removed or held open if desired. If the section is of the type held in the open position, it will be secured to prevent closure.



- 7.5.3 Exhaust gas discharge will be away from the normal position of the operator. All exhaust pipes will be guarded or insulated in areas where contact by employees is possible in the performance of normal duties.

## **7.6 Access to Operator's Position, Machine House and/or Boom Blocks**

- 7.6.1 Boom-type mobile cranes and boom-type excavators will be provided with steps and hand-holds or other safe means so located as to give convenient and safe access to the operator's position or machine house.
- 7.6.2 When necessary to go out on booms to oil the blocks or other parts of machinery, each boom will be equipped with a catwalk, guardrails and grab-irons or hand-holds. Booms which are lowered to the ground or floor level for service, are exempted from this requirement.

## **7.7 Couplers**

- 7.7.1 If locomotive cranes are equipped with couplers, they will be extended to clear the revolving superstructure of the crane.
- 7.7.2 Automatic couplers will be provided on cranes that switch or couple to railroad cars.

## **7.8 Boom Hoist Mechanisms**

- 7.8.1 When using recommended boom hoist reeving and with rated loads suspended, the boom hoist will be capable of raising the boom, holding it stationary without attention from the operator, and lowering it only when coupled to its prime mover.
- 7.8.2 The boom hoisting mechanism will be provided with a clutching or power engaging device permitting immediate starting or stopping of the boom drum motion. The boom hoisting mechanism also will be provided with a self-setting safety brake, capable of supporting all rated loads, with recommended reeving.
- 7.8.3 Brakes and clutches will be provided with adjustments where necessary to compensate for wear and to maintain adequate force in springs.
- 7.8.4 The boom hoisting mechanism will be provided with an auxiliary ratchet and pawl or other positive locking device as an added safety feature.
- 7.8.5 The boom hoist drum will have sufficient rope capacity to operate the boom at all positions from horizontal to the highest angle recommended when using the certified agent's recommended reeving and rope size.
- No less than 2 full wraps of rope will remain on the drum with boom point lowered to the level of the crane supporting surface.
  - The drum end of the rope will be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane or rope manufacturer.

- 7.8.6 The drum diameter will be sufficient to provide a first layer rope pitch diameter of not less than 15 times the nominal diameter of the rope used.
- 7.8.7 Automatic means will be provided to stop drum motion when highest permissible boom angle is reached.

## **7.9 Free Fall and Controlled Load Lowering**

- 7.9.1 Boom hoist and load hoist free fall prohibitions
  - a. The use of equipment in which the boom, or hoist line in use, is configured to free fall (live boom/live hoist line) is prohibited in each of the following circumstances:
    - 1. An employee is in the fall zone of the boom or load.
    - 2. An employee is being hoisted.
    - 3. The load or boom is directly over a power line, or over any part of the area extending the Table A of subsection 13.19 clearance distance to each side of the power line; or any part of the area extending the Table A clearance distance to each side of the power line is within the radius of vertical travel of the boom or the load.  
*Note: Operations in proximity to overhead lines are also subject to Section 2946 of California Code of Regulations, Title 8.*
    - 4. The load is over a shaft, except where there are no employees in the shaft.
    - 5. The load is over a cofferdam, except where there are no employees in the fall zone of the boom or the load.
    - 6. Lifting operations are taking place in a refinery or tank farm.
  - b. The use of equipment in which the boom is configured to free fall (live boom) is permitted only where none of the circumstances listed in subsection 7.9.1(a) are present and:
    - 1. The equipment was manufactured prior to October 31, 1984; or
    - 2. The equipment is a floating crane/derrick or a land crane/derrick on a vessel/flotation device.
- 7.9.2 Preventing boom free fall (Controlled Load Lowering). Where the use of equipment with a boom that is configured to free fall (live boom) is prohibited, the boom will have a secondary mechanism or device designed to prevent the boom free fall in the event the primary system used to hold or regulate the boom hoist fails, as follows:
  - a. Friction drums will have:
    - 1. A friction clutch and a braking device to allow for controlled boom lowering.
    - 2. A secondary braking or locking device, which is manually or automatically engaged, to back-up the primary brake while the boom is held (such as a secondary friction brake or a ratchet and pawl device).
  - b. Hydraulic drums will have an integrally mounted holding device or internal static brake to prevent hoist movement in the event of hydraulic failure.
  - c. Neither clutches nor hydraulic motors will be considered as a brake or locking device for purposes of this section.

- d. Hydraulic boom hoist cylinders will have an integrally mounted holding device.

#### 7.9.3 Load Line Free Fall Prohibitions

In each of the following circumstances, controlled load lowering is required and free fall of the load line hoist is prohibited:

- a. An employee is in the fall zone of the load.
- b. An employee is being hoisted.
- c. The load or boom is directly over a power line, or over any part of the area extending the Table A of subsection 13.19 clearance distance to each side of the power line; or any part of the area extending the Table A clearance distance to each side of the power line is within the radius of vertical travel of the boom or the load.  
*Note: Operations in proximity to overhead lines are also subject to Section 2946, California Code of Regulations, Title 8.*
- d. The load is over a shaft.
- e. The load is over a cofferdam, except where there are no employees in the fall zone of the load.
- f. Lifting operations are taking place in a refinery or tank farm.

### 7.10 Load Hoist Drums

- 7.10.1 The load hoist drum assemblies will have power and operational characteristics to perform all load hoisting and lowering functions required in crane service when operated under recommended conditions.

- 7.10.2 Where brakes and clutches are used to control the motion of the load hoist drums, they will be of such size and thermal capacity to control all rated crane loads with minimum recommended reeving.

*Note: Where maximum rated loads are being lowered with near maximum boom length or operations involving long lowering distances, power controlled lowering usually is necessary to reduce demand on the load brake.*

- 7.10.3 Load hoist drums will have rope capacity with recommended rope size and reeving to perform crane service within the range of boom lengths, operating radii and vertical lifts specified by the certified agent.
  - a. No less than 2 full wraps of rope will remain on the drum when the hook is in its extreme low position.
  - b. The drum end of the rope will be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane or rope manufacturer.
  - c. Drums will be provided with a means to prevent rope from jumping off the drum.
  - d. Fiber rope fastenings are prohibited.
- 7.10.4 Diameter of the load hoist drums will be sufficient to provide a first layer rope pitch diameter of not less than 18 times the nominal diameter of the rope used.

*Exception: On small cranes of less than 10,000 pounds capacity a smaller drum may be used, provided that when lifting loads the actual pitch diameter is not less than 15 times the rope diameter and the rope safety factor is not less than 5.*

- 7.10.5 Means, controllable from the operator's station, will be provided to hold the drum from rotating in the lowering direction and be capable of holding the rated load indefinitely without further attention from the operator.

## **7.11 Load Hoist Brakes**

- 7.11.1 When power-operated brakes having no continuous mechanical linkage between the actuating and braking means are used for controlling loads, an automatic means will be provided to prevent the load from falling in the event of loss of brake actuating power.
- 7.11.2 Foot-operated brake pedals will be maintained so that the operator's foot will not easily slip off.
- 7.11.3 Means will be provided for holding the brakes in the applied position without further action by the operator.

## **7.12 Power-Controlled Lowering**

When provided, a power-controlled lowering system will be capable of handling rated loads and speeds as specified by the certified agent to provide precision lowering and to reduce demand on the load brake.

## **7.13 Adjustments**

Brakes and clutches will be provided with adjustments where necessary to compensate for wear and to maintain adequate force in springs where used.

## **7.14 Swing Control**

The swing mechanism will be capable of smooth starts and stops with varying degree of acceleration and deceleration required in normal crane operation.

## **7.15 Swing Brake and Locking Device**

A braking means with holding power in both directions will be provided to prevent movement of the rotating superstructure, when desired under normal operation. The braking means will be capable of being set in the holding position and remaining so without attention on the part of the operator.

## **7.16 Travel Brakes and Locks**

- 7.16.1 On crawler cranes, brakes or other locking means will be maintained to hold the machine stationary during working cycles on level grade or while the machine is standing on maximum grade recommended for travel. Such

brakes or locks will be arranged to remain in engagement in event of loss of operating pressure or power.

- 7.16.2 On locomotive cranes, brakes will be maintained to bring the crane to a stop while descending the maximum grade recommended for travel. In addition, manual brake engagement means will be maintained to hold the machine stationary on maximum grade recommended for travel. Such means will be arranged to remain in engagement in event of loss of operating pressure or power.
- 7.16.3 On a crawler crane, the travel and steering mechanism will be arranged so that it is not possible for both crawlers to become disconnected simultaneously from the power train and to "freewheel."

#### **7.17 Sheave Guards**

Sheaves carrying ropes which can momentarily be unloaded will be provided with close fitting guards, or other devices, to guide the rope back into the groove when the load is again applied.

#### **7.18 Warning Device**

An effective, audible warning and operating signal device will be provided on the outside of the crane. The controls for the device will be within easy reach of the operator.

#### **7.19 Wheel Guards**

- 7.19.1 Locomotive cranes will be provided with a running board which will extend the full width of the truck bed with a grab-iron extending across and near the outer end of the truck bed, or with a pilot or fender which will prevent a person being crushed beneath the truck wheels.
- 7.19.2 Outrigger wheels when used on mobile cranes will be properly guarded to prevent a person being run over by a wheel.

#### **7.20 Truck Wedges or Jacks**

- 7.20.1 Locomotive crane cars will be provided with suitable removable wedges or jacks for transmitting loads from the crane body directly to the wheels without permitting the truck springs to function when handling heavy loads. These wedges will be removed, or jacks released in a positive manner for traveling.
- 7.20.2 Rail clamps, if used, will have some slack between the point of attachment to the rail and the end fastened to the crane. Rail clamps will not be used as a means of restraining tipping of a locomotive crane.



## **7.21 Lighting**

Boom-type mobile cranes which operate at night will have their load hooks and working areas adequately illuminated.

## **7.22 Cranes Used in Demolition Work**

7.22.1 The weight of the demolition ball will not exceed 50 percent of the crane's rated load, based on the length of the boom and the angle of operation at which the demolition ball will be used, or its weight shall not exceed 25 percent of the nominal breaking strength of the line by which it is suspended, whichever results in a lesser value.

7.22.2 The ball will be attached to the load line with a swivel-type connection to prevent twisting of the load line and shall be attached by positive means in such a manner that the weight cannot become accidentally disconnected.

*Note: The swing of the boom should not exceed 30 degrees from the centerline, front to back of the crane mounting.*

7.22.3 The load line and attachment of the demolition ball to the load line will be checked at least twice each shift.

7.22.4 Truck cranes without outriggers extended will not be used to swing a demolition ball.

7.22.5 No employees, which can be adversely affected by demolition operations, will be permitted in any area when balling or clamming is being performed. Only those employees necessary for the performance of the operations will be permitted in this area at any time.

7.22.6 Cranes used on demolition job-sites to perform balling, clamming and related lifting operations will not be required to comply with the annual certification requirement of subsection 12.4.4.

7.22.7 Cranes used exclusively for demolition operations as stated in subsection 6.22.6 and that are moved from demolition job-site to demolition job-site will not be required to comply with the annual certification requirement in subsection 12.4.

7.22.8 Cranes with or without a current annual certification as required in Section 5021 and used for balling or clamming operations will be recertified or certified when used for lifting operations (lifting service) not associated with demolition operations. This requirement will apply even if the crane's annual certification is current.

## **7.23 Barge Mounted Cranes**

7.23.1 When a mobile crane is mounted on a barge, the rated load of the crane will not exceed the capacity specified by the certified agent.

- 7.23.2 Load ratings will be reduced to stay within the limits for list of the barge with a crane mounted on it and a revised load rating chart will be provided.
- 7.23.3 Mobile cranes on barges will be secured to the barge. When stability of barge is not a factor, and control barriers are provided, limited travel may be authorized.
- 7.23.4 The width of barge hulls supporting mobile cranes equipped with pile driver or extractor leads will be not less than 45 percent of the height of the lead above water.

#### **7.24 Permanently Mounted Floating Cranes and Derricks**

- 7.24.1 When cranes and derricks are permanently installed on a barge, the capacity and limitations of use will be as specified by the certified agent.
- 7.24.2 Floating cranes and floating derricks in use will meet the applicable requirements for design, construction, installation, testing, maintenance and operation as prescribed by the certified agent.

#### **7.25 Life Buoys**

Where applicable, life buoys, life rings and/or life vests will be provided and used as required in Section 3389, California Code of Regulations, Title 8.

### **8 HYDRAULIC CRANES AND EXCAVATORS**

#### **8.1 Hoist Mechanisms**

The hoist mechanism when properly adjusted will be capable of developing 110% of permissible line pull and maintaining the load in suspended position.

#### **8.2 Load Lowering**

Load lowering may be controlled by brakes acting on drums, other means, or by "Power Controlled Lowering" or other means. The lowering mechanism will be capable of controlling 110% of permissible line pull as defined in Appendix 1.

#### **8.3 Boom Hoist and Supporting Mechanism**

- 8.3.1 The boom hoist will be capable of elevating and supporting the boom and 110% of rated load without attention from the operator and allow lowering to rated radius only when under operator's control.
- 8.3.2 A holding device will be provided.
  - a. On rope boom support machines a ratchet and pawl or other positive locking device will be provided to prevent unintentional lowering of the boom.

- b. For hydraulic cylinder boom support machines, a holding device (such as load checks) will be provided to prevent unintentional lowering of the boom.
- 8.3.3 Minimum ratio of boom hoist drum and sheave pitch diameters to nominal rope diameters will not be less than 15 to 1.
- 8.3.4 On a telescoping boom, the retract function will be capable of controlling 110% of rated load. A holding device (such as load check) shall be provided.
- 8.3.5 Where friction mechanisms (such as brakes and clutches) are used to control the boom hoist or load line hoist, they will be:
  - a. Of a size and thermal capacity sufficient to control all rated loads with the minimum recommended reeving.
  - b. Adjustable to permit compensation for lining wear to maintain proper operation.
- 8.3.6 Hydraulic drums will have an integrally mounted holding device or internal static brake to prevent load hoist movement in the event of hydraulic failure.

#### **8.4 Swing Lock and Swing Brake**

Unless swing drive mechanism is of a self-locking type, a swing lock or swing brake capable of preventing rotation under normal working conditions will be provided.

#### **8.5 Controls**

- 8.5.1 The operating controls will be located within convenient reach of the operator and shall be identified by marking or suitable chart to indicate the motion controlled and direction.
- 8.5.2 Controls for load hoist, boom hoist, swing and boom telescope will be provided with means for holding in neutral position without use of positive locks.
- 8.5.3 Controls and corresponding controlled elements will be maintained and adjusted such that the machine is operated within the certified agent's rating.

#### **8.6 Brakes**

- 8.6.1 A travel lock or brake will be provided on crawler machines capable of holding the machine stationary on any grade the machine is capable of negotiating.
- 8.6.2 Service brakes will be provided and maintained on truck or wheel mounted machines as specified by the certified agent and this programs. Means will be provided to hold the machine stationary during working cycles and on any grade which it can negotiate.

## **8.7 General Operating Requirements**

- 8.7.1 When required by certified agent's instructions, outriggers will be set so that wheels or crawler tracks within the boundary of the outriggers will be relieved of all weight by the outrigger jacks or blocking.
- 8.7.2 Telescopic booms that have an indicator will show the boom length from minimum to maximum and be visible to the operator from the operator's position at the controls.
- 8.7.3 A boom hoist disconnect shut-off or hydraulic relief will be provided to automatically stop the boom hoist when the boom reaches a predetermined high angle.
- 8.7.4 At least one of the following stops will be provided to resist the boom falling backwards:
  - a. A fixed or telescoping bumper.
  - b. A shock absorbing bumper.
  - c. Hydraulic boom elevation cylinder(s).
- 8.7.5 A load rating chart and/or label(s) will be located on the crane to be available to the operator from the operator's position at the control stand. It will include the applicable portions of subsection 5.3 and the maximum loads permitted during actual boom telescoping operation.

## **8.8 Hydraulic Relief Valves**

Hydraulic relief valves will have pressure settings of sufficient magnitude to provide the capabilities of operations under 110% of rated loading conditions. Relief valve settings will be specified and no change in relief valve setting will be made without the consent of the certified agent. Gauge ports will be provided in each hydraulic circuit for checking certified agent's specified pressure settings.

# **9 DERRICKS**

## **9.1 Operation Procedures**

Derrick operations will be supervised by a qualified person.

## **9.2 Construction**

- 9.2.1 Guy derricks
  - a. The minimum number of guys will be 6, with equal spacing, except where a certified agent or derrick manufacturer approves variations from these requirements and revises the rated capacity to compensate for such variations.
  - b. Guy derricks will not be used unless the employer has the following guy information from the manufacturer or a certified agent, when not available from the manufacturer:
    - 1. The number of guys.

2. The spacing around the mast.
3. The size, grade, and construction of rope to be used for each guy.
- c. For guy derricks manufactured after December 18, 1970, in addition to the information required in subsection 9.2.1(b), Don H. Mahaffey Drilling Co. will have the following guy information from the manufacturer or a certified agent, when not available from the manufacturer:
  1. The amount of initial sag or tension.
  2. The amount of tension in guy line rope at anchor.
- d. The mast base will permit the mast to rotate freely with allowance for slight tilting of the mast caused by guy slack.
- e. The mast cap will:
  1. Permit the mast to rotate freely.
  2. Withstand tilting and cramping caused by the guy loads.
  3. Be secured to the mast to prevent disengagement during erection.
  4. Be provided with means for attaching guy ropes.

#### 9.2.2 Stiffleg Derricks

- a. The mast will be supported in the vertical position by at least two stifflegs; one end of each will be connected to the top of the mast and the other end securely anchored.
- b. The stifflegs will be capable of withstanding the loads imposed at any point of operation within the load chart range.
- c. The mast base will:
  1. Permit the mast to rotate freely (when necessary).
  2. Permit deflection of the mast without binding.
- d. The mast will be prevented from lifting out of its socket when the mast is in tension.
- e. The stiffleg connecting member at the top of the mast will:
  1. Permit the mast to rotate freely (when necessary).
  2. Withstand the loads imposed by the action of the stifflegs.
  3. Be secured so as to oppose separating forces.

#### 9.2.3 Gin Pole Derricks

- a. Guy lines will be sized and spaced so as to make the gin pole stable in both boomed and vertical positions.  
*Exception: Where the size and/or spacing of guy lines do not result in the gin pole being stable in both boomed and vertical positions, Don H. Mahaffey Drilling Co. will ensure that the derrick is not used in an unstable position.*
- b. The base of the gin pole will permit movement of the pole (when necessary).
- c. The gin pole will be anchored at the base against horizontal forces (when such forces are present).

#### 9.2.4 Chicago Boom Derricks

The fittings for stepping the boom and for attaching the topping lift will be arranged to:

- a. Permit the derrick to swing at all permitted operating radii and mounting heights between fittings.
- b. Accommodate attachment to the upright member of the host structure.

- c. Withstand the forces applied when configured and operated in accordance with the manufacturer's/builder's procedures and within its rated capacity.
- d. Prevent the boom or topping lift from lifting out under tensile forces.

#### 9.2.5 Anchoring and Guying

- a. General Requirements
  - 1. Derricks will be guyed and anchored so as to prevent tipping or collapsing.
  - 2. Reinforcing steel will not be used for guy line anchors.
  - 3. Load anchoring data developed by the manufacturer or a certified agent will be used.
- b. Guy Derricks
  - 1. The mast base will be anchored.
  - 2. The guys will be secured to the ground or other firm anchorage.
  - 3. The anchorage and guying will be designed to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular guy slope and spacing specified for the application.
- c. Stiffleg Derricks
  - 1. The mast base and stifflegs will be anchored.
  - 2. The mast base and stifflegs will be designed to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular stiffleg spacing and slope specified for the application.

#### 9.2.6 Swingers and Hoists

- a. The boom, swinger mechanisms and hoists will be suitable for the derrick work intended and will be anchored to prevent displacement from the imposed loads.
- b. Hoists
  - 1. Base mounted drum hoists will meet the requirements of ASME B30.7–2011 which is incorporated by reference.
  - 2. Load tests for new, repaired and modified hoists. See Section 10 for testing requirements.
  - 3. Load tests required by subsection 9.2.6(b)(2) of this section will include the following:
    - I. The test load will be hoisted a vertical distance to assure that the load is supported by the hoist and held by the hoist brake(s).
    - II. The test load will be lowered, stopped and held with the brake(s).

### 9.3 Operational Aid

#### 9.3.1 Boom Angle Aid

A boom angle indicator is not required but if the derrick is not equipped with a functioning one, Don H. Mahaffey Drilling Co. will ensure that either:

- a. The boom hoist cable will be marked with caution and stop marks. The stop marks will correspond to maximum and minimum allowable boom angles. The caution and stop marks will be in view of the operator, or a spotter who is in direct communication with the operator; or



- b. An electronic or other device that signals the operator in time to prevent the boom from moving past its maximum and minimum angles, or automatically prevents such movement, is used.

#### 9.3.2 Load Weight/Capacity Devices

- a. Derricks manufactured more than one year after July 7, 2011, with a maximum rated capacity over 6,000 pounds will have at least one of the following: load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter.

**Temporary alternative measures:** The weight of the load shall be determined from a source recognized by the industry (such as the load's manufacturer), or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information will be provided to the operator prior to the lift.

- b. A load weight/capacity device that is not working properly will be repaired no later than 7 calendar days after the deficiency occurs.

### 9.4 Post-Assembly Approval and Testing—New or Reinstalled Derricks

- 9.4.1 Anchorages, including the structure to which the derrick is attached (if applicable), will be approved by a certified agent.
- 9.4.2 Prior to initial use, new or reinstalled derricks will be tested in accordance subsection 15.1 of this program.
- 9.4.3 Prior to initial use, new or reinstalled derricks will be load tested by a certificating agency. The testing will be done in accordance with the provisions of subsection 15.5 of this program.
  - a. The test will consist of:
    - 1. Hoisting the test load a few inches and holding to verify that the load is supported by the derrick and held by the hoist brake(s).
    - 2. Swinging the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load.
    - 3. Booming the derrick up and down within the allowable working radius for the test load.
    - 4. Lowering, stopping and holding the load with the brake(s).
  - b. The derrick will not be used unless the certificating agency determines that the test has been passed.
- 9.4.4 Tests conducted under this subsection will be documented. The document will contain the date, test results and the name of the tester. The document will be retained until the derrick is re-tested or dismantled, whichever occurs first. All such documents will be available, during the applicable document retention period, to all persons who conduct inspections in accordance with Section 15.

### 9.5 Securing the Boom

- 9.5.1 When the boom is being held in a fixed position, dogs, pawls, or other positive holding mechanism on the hoist will be engaged.

- 9.5.2 When taken out of service for 30 days or more, the derrick boom will be secured by one of the following methods:
- Be laid down.
  - Be secured to a stationary member, as nearly under the head as possible, by attachment of a sling to the load block.
  - For guy derricks, be hoisted to a vertical position and secured to the mast.
  - For stiffleg derricks, secured against the stiffleg.

## **9.6 Inspections**

In addition to Sections 14 and 15, the following additional items will be included in the inspections:

- Daily: Guys for proper tension.
- Annual:
  - Gudgeon pin for cracks, wear, and distortion.
  - Foundation supports for continued ability to sustain the imposed loads.

## **9.7 Rated Load Marking**

- 9.7.1 For permanently installed derricks with fixed lengths of boom, guy and mast, a substantial durable and clearly legible rating chart will be provided with each derrick and securely affixed where it is visible to personnel responsible for the safe operation of the equipment. The chart shall include but not necessarily be limited to the following data:
- Certified agent's approved load ratings at corresponding ranges of boom angle or operating radii.
  - Specific length of components on which the load ratings are based.
  - Required parts for hoisting reeving. Size and construction of the rope will be shown either on the rating chart or in the operating manual.
- 9.7.2 For non-permanent installations, capacity charts will be prepared for the particular installation based on information provided by the certified agent. The capacity charts will be located at the derrick.

## **9.8 Use of Winch Heads**

- 9.8.1 Ropes will not be handled on a winch head without the knowledge of the operator.
- 9.8.2 While a winch head is being used, the operator will be within reach of the power unit control lever.

## **9.9 Hoisting Ropes**

Hoisting ropes and similar moving ropes in exposed locations within 7 feet of the ground or floor, except for free end section, will be guarded, enclosed, or fenced with standard railings.

### **9.10 Access to Sheaves, Bearings, and Blocks**

If necessary to go out on derrick booms to service sheaves, bearings or blocks, the boom will be equipped with catwalks, guardrails, and handholds and/or grab irons to give safe access to the equipment to be serviced. Booms which are lowered to the ground or floor level for service are exempted from this requirement.

### **9.11 Derrick Signals**

Whenever derricks are used for hoisting, two-way radios, telephones, or other acceptable signals will be used unless manual signals are appropriate.

## **10 TOWER CRANES**

### **10.1 General**

This section applies to cranes of the general type such as those having a revolving boom with counterweight on a single vertical mast, and mobile tower cranes.

- 10.1.1 Each crane will be provided with a descriptive booklet, written in English, containing a comprehensive summary of design characteristics, erection procedures, operation techniques, repair recommendations, and safety precautions. This booklet will be available on every job site where such cranes are in use.
- 10.1.2 A durable, clearly legible load rating chart will be provided with each crane and securely affixed in the cab or operator's station easily visible to the operator while at the controls. The chart will include load ratings and restrictions as specified by the certified agent for specific lengths of components, counterweights, swing, and radii. Where load ratings for cranes are governed by structural competence, the limitation on loading will be such that no structural member is overstressed, and load rating charts will be subject to this limitation.
- 10.1.3 Each crane will be equipped with a device which will effectively prevent overloading beyond the certified agent's recommendations at any load, boom radius, and counterweight position.
- 10.1.4 Each crane will contain a means which will cause the boom swing to be started and stopped gradually to prevent damaging effects of torsion in the mast section.
- 10.1.5 Each crane will be equipped with a brake system, or equivalent, which will prevent any movement when the power is lost, or at any time desired by the operator.
- 10.1.6 Parts of the crane requiring adjustment or maintenance will be provided with access walkways, handholds, footholds, safety lines, or other safeguards as necessary to eliminate the hazard of falling from the crane.

*Exception: Mobile tower crane adjustment or maintenance that can be achieved from the ground.*

- 10.1.7 The size and location of signs installed on tower cranes will be in accordance with manufacturer specifications. Where these are unavailable, a certified agent familiar with the type of equipment involved will approve in writing the size and location of any signs.
- 10.1.8 Cranes will be tested, maintained, inspected, and operated as specified by the certified agent and this program. Luffing boom tower cranes used in the construction industry will comply with the requirements of ASME B30.3-1990, Hammerhead Tower Cranes.
- 10.1.9 If a tower crane remains on a project over twelve months, tests required by subsection 10.1.8 will be performed following dismantling and prior to its next use.
- 10.1.10 Records of the most recent nondestructive tests and test procedures will be maintained in accordance with Don H. Mahaffey Drilling Co.'s recordkeeping policies and procedures, and will be provided to the Division upon request.

## **10.2 Inspections**

- 10.2.1 Before each crane component is erected, it will be inspected by a qualified person for damage or excessive wear.
  - a. The qualified person will pay particular attention to components that will be difficult to inspect thoroughly during shift inspections.
  - b. If the qualified person determines that a component is damaged or worn to the extent that it would create a safety hazard if used on the crane, that component will not be erected on the crane unless it is repaired and, upon re-inspection by the qualified person, found to no longer create a safety hazard.
  - c. If the qualified person determines that, though not presently a safety hazard, the component needs to be monitored, the component will be checked in periodic inspections. Any such determinations will be documented, and the documentation will be available to any individual who conducts a periodic inspection.
- 10.2.2 In addition to the requirements in subsection 15.1, the following requirements will be met:
  - a. A load test using certified weights, or scaled weights using a certified scale with a current certificate of calibration, will be conducted after each erection.
  - b. The load test will be conducted in accordance with Article 13 (Certification Requirements) of the California Code of Regulations, subsection 15.3, and the manufacturer's instructions.

- 10.2.3 The following additional items will be included:
- a. Tower (mast) bolts and other structural bolts (for loose or dislodged condition) from the base of the tower crane up or, if the crane is tied to or braced by the structure, those above the upper-most brace support.
  - b. The upper-most tie-in, braces, floor supports and floor wedges where the tower crane is supported by the structure, for loose or dislodged components.
- 10.2.4 In addition to the items that will be inspected under subsections 15.3.4, 16.1.4, and 17.1, all turntable and tower bolts will be inspected for proper condition and torque.

### **10.3 Erection, Climbing, Dismantling, and Operation**

- 10.3.1 The erection, climbing (up and down), and dismantling of a fixed tower will comply with the requirements of the California Code of Regulations, Title 8, Section 34.1.2(b)(2).
- 10.3.2 Employees engaged in the erection and/or dismantling of tower cranes and the inspection, maintenance or repair related to such erection and/or dismantling, when working at elevations 15 feet or greater over ground or other surfaces shall be required to use fall protection as specified in Don H. Mahaffey Drilling Co.'s fall protection program.
- 10.3.3 Guys, braces and other supports will be employed as necessary to prevent damage or collapse of the equipment during the erection and dismantling procedures.
- 10.3.4 The unbraced, free standing portion of the mast between the boom and the top support position will be limited in height to the distance recommended by the certified agent.
- 10.3.5 When the certified agent requires the mast to be secured in the shaftway of a structure, the structural members to which it is secured will be adequate to safely sustain all anticipated loads including vibration.
- 10.3.6 Tower crane foundations and structural supports (including both the portions of the structure used for support and the means of attachment) will be designed by a certified agent to prevent structural damage of such support.
- a. The controlling entity will ensure the tower crane foundations and structural supports are installed in accordance with the manufacturer's or certified agent's instructions.
  - b. The controlling entity will provide a written statement of compliance with subsection 10.3.6(a) to the erecting entity prior to erection or jump of the tower crane.
  - c. The top of the support/foundation will be accessible and free of debris, materials and standing water. No materials shall be stored on the support unless approved by a qualified person. The foundation and fasteners will remain accessible and visible for inspection at all times.

- 10.3.7 When the mast sections are raised to a new position, measures will be taken to prevent damage or collapse of the crane assembly including vertical slippage of the mast unit.
- a. Prior to, and during, all climbing procedures (including inside climbing and top climbing), employees will:
    1. Comply with all manufacturer prohibitions.
    2. Have a certified agent verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages and supporting floors.
- 10.3.8 Load Limit Device
- a. The load limit device will be in effective operation and will not be readjusted to handle loads greater than those specified by the certified agent.
  - b. In addition to the requirements of subsection (5000), whenever a load limit device is unsealed, repaired, or readjusted, a qualified person will perform any testing necessary to ensure the continuing effective operation of the device. A test load or device capable of measuring 110 percent of the certified agent's load capacity will be available at the job site.
- 10.3.9 The load line will be directly over the load to be lifted.
- 10.3.10 The operator will be stationed in a safe position where good visibility and control can be maintained.
- 10.3.11 Dangerous areas
- a. Only employees directly involved in the erection, climbing, and dismantling operations of tower cranes are allowed to work in the area under the tower, jib, or rotating portion of the crane during these operations.
  - b. Self-Erecting Tower Cranes  
Employees will not be in or under the tower, jib, or rotating portion of the crane during erecting, climbing and dismantling operations until the crane is secured in a locked position and the competent person in charge indicates it is safe to enter this area, unless the manufacturer's instructions direct otherwise and only the necessary personnel are permitted in this area.
- 10.3.12 In addition to the requirements in subsection 13.32.8, the A/D director will confirm the following:
- a. Prior to erection/installation of tie-ins, Don H. Mahaffey Drilling Co. will provide documentation to the A/D director that the tower crane foundations and structural supports are installed in accordance with the design.
  - b. All cranes will be ballasted or counterweighted in accordance with the manufacturer's recommendations to ensure stability.
  - c. Operations will not be conducted when wind speed exceeds the speed tolerance recommended by the manufacturer or, where the manufacturer does not specify this information, the speed tolerance will be determined by a qualified person.



- 10.3.13 Towers will be erected plumb in accordance with the manufacturer's specifications and verified by a qualified person. Where the manufacturer does not specify plumb tolerance, the crane tower will be plumb to a tolerance within 1:500 (approximately 1 inch in 40 feet).
- 10.3.14 Where more than one fixed jib (hammerhead) tower crane is installed, the cranes will be located such that the structural members of the cranes cannot come in contact with one another. Cranes are permitted to pass over one another.
- 10.3.15 Counterweight/ballast
  - a. Equipment will not be erected, dismantled or operated without the amount and position of counterweight and/or ballast in place as specified by the manufacturer or a certified agent familiar with the equipment.
  - b. The maximum counterweight and/or ballast specified by the manufacturer or certified agent familiar with the equipment will not be exceeded.

#### **10.4 Unattended Booms**

When necessary to lash crane booms, they will be lashed only in accordance with the certified agent's recommendations.

#### **10.5 Safety Devices**

*Note: Subsection 15.1 does not apply to tower cranes.*

- 10.5.1 All tower cranes will have the following safety devices:
  - a. Visual warning devices:
    - 1. A warning light which will be activated at a percentage of the rated load, not to exceed 95 percent of the rated load, or
    - 2. Electronic instrumentation provided by the certified agent that gives a continuous direct reading of the load weight and the trolley radius.
  - b. An audible signal that operates at a percentage of the rated load, not to exceed 100 percent of the rated load.
  - c. The visual warning light, and audible signal required by subsection 10.5.1(a) and (b) will be set to avoid simultaneous activation, and operate with a difference of at least 5 percent of the rated load to ensure independent warnings.
- 10.5.2 The tower crane will have:
  - a. An automatic stop that operates at a percentage of the rated load, not to exceed 105 percent of the rated load.
  - b. A load moment limiting device to prevent moment overloading.
- 10.5.3 When the crane manufacturer specifies lower activation points for safety devices than subsections 10.5.1(a),(b) and 10.5.2, the manufacturer's specifications will be followed.

- 10.5.4 Limit devices to:
  - a. Provide deceleration before the top position of the hook is reached.
  - b. Prevent trolley contact with the end stops by use of a trolley travel stop limit switch.
  - c. Limit the range of the boom hoist at the minimum and maximum radius.
  - d. Limit the capacity of the hoist to prevent overloading, including each individual gear ratio if equipped with a multiple speed hoist transmission by means of a hoist line pull.
- 10.5.5 Constant pressure control devices which automatically return to neutral or the "off" position when released by the operator.
- 10.5.6 Boom stops on luffing boom type tower cranes.
- 10.5.7 Jib stops on luffing boom type tower cranes if equipped with a jib attachment.
- 10.5.8 Trolley end stops shall be provided at both ends of travel of the trolley.
- 10.5.9 Cranes mounted on rail tracks will be equipped with:
  - a. Limit switches limiting the travel of the crane on the track, and end stops or buffers at each end of the tracks.
  - b. Travel rail clamps on all travel bogies.
  - c. Limit switches that limit travel bogies travel distance in each direction to prevent running into the end stops or buffers.
- 10.5.10 Integrally mounted check valves on all load supporting hydraulic cylinders.
- 10.5.11 Hydraulic system pressure limiting device.
- 10.5.12 The following brakes, which will automatically set in the event of pressure loss or power failure, are required:
  - a. A hoist brake on all hoists.
  - b. Swing brake.
  - c. Trolley brake.
  - d. Rail travel brake.
- 10.5.13 Emergency stop switch at the operator's station.
- 10.5.14 Anti-two-blocking device.
- 10.5.15 Boom angle or hook radius indicator
  - a. Luffing boom tower cranes will have a boom angle or radius indicator readable from the operator's station.
  - b. Hammerhead tower cranes manufactured after July 7, 2012, will have a hook radius indicator readable from the operator's station.
- 10.5.16 The boom hoist drum will be equipped with a control that will enable the operator to positively lock the boom hoist drum from the cab.

- 10.5.17 The following deceleration devices:
- a. The trolley speed will be automatically reduced prior to the trolley reaching the end limit in both directions to prevent trolley contact with end stops.
  - b. The boom speed will be automatically reduced prior to the boom reaching the minimum or maximum radius limit.
  - c. The load speed will be automatically reduced prior to the hoist reaching the upper limit.
- 10.5.18 Any other safety devices as may be required by the applicable edition of ASME B30.3.

## 10.6 Safety Devices – Proper Operation Required

Operations will not begin unless the devices listed in subsection 10.5 are in proper working order. If a device stops working properly during operations, the operator will safely stop operations. The equipment will be taken out of service, and operations will not resume until the device is again working properly. Alternative measures are not permitted to be used.

## 10.7 Operational Aids

- 10.7.1 Subsection 15.2 does not apply to tower cranes.
- 10.7.2 The devices listed in this section are required on all tower cranes covered by this program, unless otherwise specified.
- 10.7.3 Operations will not begin unless the operational aids are in proper working order. If a listed operational aid stops working properly during operations, the operator will safely stop operations until the device is repaired, or the device is again working properly.
- a. Any replacement part or device utilized will perform the same type function as permitted subject to the provisions of Section 3 (Equipment Modifications) of the California Code of Regulations.
  - b. See subsection 13.28.7 for additional requirements.
  - c. Temporary operations are permitted where Don H. Mahaffey Drilling Co. meets the specified alternative measures; however, more protective alternative measures specified by the tower crane manufacturer, if any, will be followed.
- 10.7.4 Operational aids listed in this section that are not working properly will be repaired no later than 7 calendar days after the deficiency occurs subject to the provisions of subsection 7.7.3.
- a. Tower cranes manufactured after July 7, 2012, will be equipped with a device that prevents the last 2 wraps of hoist cable from being spooled off the drum.  
**Temporary alternative measure:** mark the cable (so it can be seen by the operator) at a point that will give the operator sufficient time to stop the hoist prior to the last 2 wraps of hoist cable being spooled off the drum.

- b. A device will be provided to display the wind speed and will be mounted above the upper rotating structure on tower cranes. On self-erecting cranes, it will be mounted at or above the jib level.  
**Temporary alternative measure:** Use of wind speed information from a properly functioning indicating device on another tower crane on the same site, or a qualified person estimates the wind speed.

## 10.8 Electrical Grounding

All electrically-operated cranes will be effectively grounded.

# 11 HOIST, AUXILIARY HOISTING EQUIPMENT AND HOISTING OPERATIONS

## 11.1 Limit Device

Each overhead electric hoist will be equipped with an effective enclosed-type limit device which will stop the travel before the hook/load block passes the highest and, where applicable, lowest point of safe travel.

## 11.2 Brakes

- 11.2.1 The braking system will perform the following functions:
  - a. Arrest and hold the load promptly when controls are released with loads up to 125 percent of rated capacity.
  - b. Limit the speed of load during lowering to a maximum of 120 percent of rated lowering speed.
- 11.2.2 Holding brakes on hoists will have ample thermal capacity for the frequency of operation required by the service.
- 11.2.3 The braking system will have provision for adjustments where necessary to compensate for wear.
- 11.2.4 Where the prime mover is an electric motor, a self-setting electric motor brake, or other self-setting brake, will be provided to prevent drum rotation in the event of power failure.
- 11.2.5 The hoist will be so designed that, when the actuating force is removed, it will automatically stop and hold any load up to 125 percent of the rated load.

## 11.3 Hoist Trolley Frame

Trolley frames will be constructed to avoid excessive spreading under load. Trolley frames which show signs of excessive spreading under load will not be used until repaired or replaced.

## **11.4 Capacity Marking**

Each hoist designed to lift its load vertically will have its rated load legibly marked on the hoist or load block or some equally visible space.

## **11.5 Stops**

- 11.5.1 Stops will be provided at the limits of travel of the trolley. A stop engaging the tread of the wheel will be of a height at least equal to the radius of the wheel. Stops engaging other parts of the trolley are preferable.
- 11.5.2 An automatic stop will be provided at each switch, dead-end rail or turntable to prevent the trolley running off when the switch is open.
- 11.5.3 Every overhead monorail system of tracks, which employs the use of traveling transfer bridges between stationary rails, will be equipped with automatic locking devices which positively lock the traveling bridge rail to the stationary rails when the bridge is positioned for trolley travel from stationary rails to movable bridge or vice versa.

## **11.6 Control Equipment**

Operating controls will be plainly marked to indicate the function or direction of travel or motion.

## **11.7 Warning Devices**

Each cage-controlled hoist will be equipped with an effective warning device.

## **11.8 Sheaves**

- 11.8.1 Sheaves carrying ropes which can be momentarily unloaded will be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.
- 11.8.2 Sheave grooves will be smooth and free from surface defects which could cause rope damage.
- 11.8.3 The sheaves in the bottom block will be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with ropes loose.
- 11.8.4 Pockets and flanges of sheaves used with hoist chains will be of such dimensions that the chain does not catch or bind during operation.
- 11.8.5 All running sheaves will be equipped with means for lubrication.

## **11.9 Hoisting Chains and Ropes**

- 11.9.1 All chains, ropes, and fiber ropes used for hoisting purposes will be of sufficient strength to safely lift or otherwise handle the loads. The maximum allowable working loads will be based on manufacturer's tables.
- 11.9.2 Every hoist chain, rope, and fiber rope on hoisting drums will be of sufficient length for the entire range of movement for the application, with no less than two full wraps of rope on the drum at all times. Where this is not practicable, lower-limit switches will be used to restrict the downward limit of travel.

*Exception: Chain hoists employing pocket sheaves instead of drums.*

- 11.9.3 Rope end will be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer.
- 11.9.4 Wherever exposed to temperatures, at which fiber cores would be damaged, rope having an independent wire-rope or wire-strand core, or other temperature-damage resistant core will be used.

## **11.10 End Attachments**

- 11.10.1 Socketing will be done in a manner specified by the manufacturer of the rope.
- 11.10.2 Eye splices will develop maximum splice efficiencies as set forth in manufacturer's tables.
- 11.10.3 Rope clip attachments will be made with U-bolts on the dead or short end of the rope and the saddle on the live end. The number of clips for end attachments shall be in accordance with the manufacturer's tables. Clips will be drop forged steel and spaced at a distance equal to at least six times the diameter of the rope. All clip or clamp bolts will be kept tight while rope is under tension.
- 11.10.4 No "contractor's standby" (knot and clip) attachment will be used as an end connection on any permanent hoisting sling or rope.
- 11.10.5 Swaged, compressed, or wedge socket fittings will be applied in a manner specified by the manufacturer.

## **11.11 Sheave Nip-Points**

All nip or contact points between ropes and sheaves which are permanently located within 7 feet of the floor or working platform will be guarded.

## **11.12 Hoisting Operations**

- 11.12.1 Only those employees whose duties requires them to be present will be in the hoist room or station.



11.12.2 The hoist operator will be informed of changes which effect safe hoisting operations.

11.12.3 No one will be permitted to oil the hoist while it is in operation.

*Exception: Oiling of wire hoist rope when not under load.*

11.12.4 Appropriate operating rules will be established and posted at the operator's station of the hoist.

### **11.13 Mobile Towers, Hoists and Similar Equipment**

11.13.1 The platform of a mobile hoist unit used to transport any rolling equipment, such as wheelbarrows, concrete buggies, etc., will be provided with an adequate means to hold such equipment and its load securely in place.

11.13.2 All mobile towers, hoists, and similar equipment must comply with applicable provisions of this program.

### **11.14 Tramways**

11.14.1 All hoists will be equipped with at least two means of stopping and holding the maximum expected load on the maximum slope. (Friction brake plus stopping engine.)

11.14.2 The locking dog or ratchet or suitable, positive, tell-tale device will be in plain view of operator's position.

11.14.3 There will be a positive means of communication between the hoist operator and signaler at all times.

11.14.4 No person will ride the tramway unless all rigging provides a safety factor of at least six.

11.14.5 All workers below will be cleared from the danger area while material is being moved.

11.14.6 Every machine used to hoist workers will be equipped with a control that will return to the "stop" position when the hand of the hoist operator is removed from the control lever. The brakes will be automatically applied and the power from the machine cut off whenever the control lever is in the "stop" position. There will be no friction gearing or clutch mechanism by which the motor or other power source can be disconnected from the hoisting drum.

## 12 FLOATING CRANES/DERRICKS AND LAND CRANES/DERRICKS ON BARGES

### 12.1 Work Area Control

Employees will either:

- a. Erect and maintain control lines, warning lines, railings or similar barriers to mark the boundaries of the hazard areas; or
- b. Clearly mark the hazard areas by a combination of warning signs (such as, “Danger — Swing/Crush Zone”) and high visibility markings on the equipment that identify the hazard areas. In addition, each employee will be trained to understand what these markings signify.

### 12.2 Additional Safety Devices

In addition to the safety devices list in subsection 12.1, the following devices are required:

- a. Barge, pontoon, vessel or other means of flotation list and trim device. The safety device will be located in the cab or, when there is no cab, at the operator’s station.
- b. Positive equipment house lock.
- c. Wind speed and direction indicator. A competent person will determine if wind is a factor that needs to be considered; if wind needs to be considered, a wind speed and direction indicator will be used.

*Exceptions:*

1. *The requirements of subsection 14.1.1(l) do not to dragline, clamshell (grapple), magnet, drop ball, container handling, concrete bucket, and pile driving work performed under this program.*
2. *An anti-two-block device (as mentioned in subsection 14.1.1(h)) is required only when hoisting personnel or hoisting over an occupied cofferdam or shaft.*

### 12.3 Accessibility of Procedures Applicable to Equipment Operation

If the crane/derrick has a cab, the requirements of subsection 13.28.2 apply. If the crane/derrick does not have a cab, Don H. Mahaffey Drilling Co. will ensure that:

- a. Rated capacities (load charts) are posted at the operator’s station. If the operator’s station is moveable (such as with pendant-controlled equipment), the load charts will be posted on the equipment.
- b. Procedures applicable to the operation of the equipment (other than load charts), recommended operating speeds, special hazard warnings, instructions and operators manual, will be readily available on board the vessel/flotation device.

### 12.4 Inspections

- 12.4.1 In addition to meeting the requirements of section 16, the barge, pontoons, vessel or other means of floatation used to support a floating crane/derrick or land crane/derrick will be inspected, and it will be ensured that the following inspections have taken place.

#### 12.4.2 Shift Inspection

For each shift inspection, the means used to secure/attach the equipment to the vessel/flotation device is in proper condition, including wear, corrosion, loose or missing fasteners, defective welds, and (when applicable) insufficient tension.

#### 12.4.3 Periodic Inspection

For each periodic inspection:

- a. The means used to secure/attach the equipment to the vessel/flotation device is in proper condition, including inspection for wear, corrosion, and, when applicable, insufficient tension.
- b. The vessel/flotation device is not taking on water.
- c. The deck load is properly secured.
- d. The vessel/flotation device is watertight based on the condition of the chain lockers, storage, fuel compartments, and hatches.
- e. The firefighting and lifesaving equipment is in place and functional.

#### 12.4.4 The shift and periodic inspections will be conducted by a qualified person, and:

- a. If any deficiency is identified, an immediate determination will be made by a qualified person whether the deficiency constitutes a hazard.
- b. If the deficiency is determined to constitute a hazard, the vessel/flotation device will be removed from service until the deficiency has been corrected.

#### 12.4.5 Annual

For each annual inspection:

- a. The external portion of the barge, pontoons, vessel or other means of flotation used will be inspected annually by a qualified person who has expertise with respect to vessels/flotation devices and the inspection includes the following items:
  1. The items identified in subsections 12.4.2 and 12.4.3 of this section.
  2. Cleats, bitts, chocks, fenders, capstans, ladders, and stanchions, for significant corrosion, wear, deterioration, or deformation that could impair the function of these items.
  3. External evidence of leaks and structural damage; evidence of leaks and damage below the waterline may be determined through internal inspection of the vessel/flotation device.
  4. Four-corner draft readings.
  5. Firefighting equipment for serviceability.
- b. Rescue skiffs, lifelines, work vests, life preservers and ring buoys are inspected for proper condition.
- c. If any deficiency is identified, an immediate determination will be made by the qualified person whether the deficiency constitutes a hazard or, though not yet a hazard, needs to be monitored in the periodic inspections.
  1. If the qualified person determines that the deficiency constitutes a hazard, the vessel/flotation device will be removed from service until it has been corrected.

2. If the qualified person determines that, though not presently a hazard, the deficiency needs to be monitored, the deficiency will be checked in the periodic inspections.

#### 12.4.6 Four-year Internal Vessel/Flotation Device Inspection

For each four-year inspection:

- a. A licensed marine engineer or other qualified person who has expertise with respect to vessels/flotation devices surveys the internal portion of the barge, pontoons, vessel, or other means of flotation.
- b. If the surveyor identifies a deficiency, an immediate determination will be made by the surveyor as to whether the deficiency constitutes a hazard or, though not yet a hazard, needs to be monitored in the periodic or annual inspections, as appropriate.
  1. If the surveyor determines that the deficiency constitutes a hazard, the vessel/flotation device will be removed from service until it has been corrected.
  2. If the surveyor determines that, though not presently a hazard, the deficiency needs to be monitored, the deficiency will be checked in the periodic or annual inspections, as appropriate.

#### 12.4.7 Documentation

The periodic and annual inspections required in subsections 12.4.3 and 12.4.5 will be documented in accordance with subsections 16.1.3 and 16.1.4 respectively, and the four-year inspection required by subsection 12.4.6 will be documented in accordance with subsection 16.1.4(b)(5), except that the documentation for the inspection will be retained for a minimum of 4 years. All such documents will be made available, during the applicable document retention period, to all persons conducting inspections in accordance with section 16.

### 12.5 Manufacturer's Specifications and Limitations

- 12.5.1 The barge, pontoons, vessel, or other means of floatation will be capable of withstanding imposed environmental, operational and in-transit loads when used in accordance with the manufacturer's specifications and limitations.
- 12.5.2 The manufacturer's specifications and limitations with respect to environmental, operational, and in-transit loads for a barge, pontoon, vessel, or other means of flotation will not be exceeded or violated.
- 12.5.3 When the manufacturer's specifications and limitations are unavailable, specifications and limitations will be established by a certified agent qualified with respect to environmental, operational and in-transit loads for the barge, pontoons, vessel, or other means of flotation and will not be exceeded or violated.

## 12.6 Floating Cranes/Derricks

For equipment designed by the manufacturer or Don H. Mahaffey Drilling Co. for marine use by permanent attachment to barges, pontoons, vessels or other means of flotation:

### 12.6.1 Load Charts

- a. The manufacturer load charts applicable to operations on the water will not be exceeded. When using these charts, employees will comply with all parameters and limitations (such as dynamic and environmental parameters) applicable to the use of the charts.
- b. Load charts will take into consideration a minimum wind speed of 40 miles per hour.

### 12.6.2 The requirement for maximum allowable list and maximum allowable trim as specified in Table M1 of this section will be met.

Table M1		
Rated Capacity	Maximum Allowable List (degrees)	Maximum Allowable Trim (degrees)
Equipment designed for marine use by permanent attachment (other than derricks):		
25 tons or less	5	5
Over 25 tons	7	7
Derricks designed for marine use by permanent attachment:		
Any rated capacity	10	10

### 12.6.3 The equipment will be stable under the conditions specified in Tables M2 and M3 of this section.

*Note: "Freeboard" is the vertical distance between the water line and the main deck of the vessel.)*

Table M2		
Operated at	Wind Speed (mph)	Minimum freeboard (ft)
Rated capacity	60	2
Rated capacity plus 25%	60	1
High boom, no load	60	2

Table M3	
Operated at	Wind Speed (mph)
For backward stability of the boom	90
High boom, no load, full back list (least stable condition)	

- 12.6.4 If Don H. Mahaffey Drilling Co. made the equipment, it will not be used unless there are documents demonstrating that the load charts and applicable parameters for use meet the requirements of subsections 12.6.1 and 12.6.2. Such documents will be signed by a certified agent knowledgeable with respect to the design of this type of equipment (including the means of flotation).
- 12.6.5 The barge, pontoons, vessel, or other means of flotation that are used will be:
- a. Structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derrick's maximum rated capacity with all planned and actual deck loads and ballasted compartments.
  - b. Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free-surface effect.
  - c. Have access to void compartments to allow for inspection and pumping.

## **12.7 Land Cranes/Derricks**

- 12.7.1 The rated capacity of the equipment (including but not limited to modification of load charts) applicable for use on land will be reduced to:
- a. Account for increased loading from list, trim, wave action, and wind.
  - b. Be applicable to a specified location(s) on the specific barge, pontoons, vessel or other means of flotation that will be used, under the environmental conditions expected and encountered.
  - c. The conditions required in subsections 12.7.3 and 12.7.4 are met.
- 12.7.2 The rated capacity modification required in subsection 12.7.1(a) will be performed by the equipment manufacturer, or a certified agent who has expertise with respect to both land crane/derrick capacity and the stability of vessels/flotation devices.
- 12.7.3 For List and Trim
- a. The maximum allowable list and the maximum allowable trim for the barge, pontoon, vessel or other means of flotation will not exceed the amount necessary to ensure that the conditions in subsection 12.7.4 are met. In addition, the maximum allowable list and the maximum allowable trim will not exceed the least of the following: 5 degrees, the amount specified by the crane/derrick manufacturer, or, when, an amount is not so specified, the amount specified by the certified agent.
  - b. The maximum allowable list and the maximum allowable trim for the land crane/derrick will not exceed the amount specified by the crane/derrick manufacturer, or, when, an amount is not so specified, the amount specified by the certified agent.
- 12.7.4 For the following conditions:
- a. All deck surfaces of the barge, pontoons, vessel or other means of flotation used are above water.
  - b. The entire bottom area of the barge, pontoons, vessel or other means of flotation used is submerged.



- 12.7.5 Physical attachment, corraling, rails system and centerline cable system will meet the requirements in Option (1), Option (2), Option (3), or Option (4) of this section, and that whichever option is used will also meet the requirements of subsection 12.7.5(d).
- a. **Option 1 Physical Attachment:** The crane/derrick is physically attached to the barge, pontoons, vessel or other means of flotation. Methods of physical attachment include crossed-cable systems attached to the crane/derrick and vessel/flotation device, bolting or welding the crane/derrick to the vessel/flotation device, strapping the crane/derrick to the vessel/flotation device with chains, or other methods of physical attachment.
  - b. **Option 2 Corraling:** The crane/derrick is prevented from shifting by installing barricade restraints (i.e., a corraling system). Corraling systems will not allow the equipment to shift by any amount of shifting in any direction.
  - c. **Option 3 Rails:** The crane/derrick will be prevented from shifting by being mounted on a rail system. Rail clamps and rail stops will be used unless the system is designed to prevent movement during operation by other means.
  - d. **Option 4 Centerline Cable System:** The crane/derrick is prevented from shifting by being mounted to a wire rope system. The wire rope system will meet the following requirements:
    - 1. The wire rope and attachments are of sufficient size and strength to support the side load of the crane/derrick.
    - 2. The wire rope is attached physically to the vessel/flotation device.
    - 3. The wire rope is attached to the crane/derrick by appropriate attachment methods (such as shackles or sheaves) on the undercarriage, and that the method used will allow the crew to secure the crane/derrick from movement during operation and to move the crane/derrick longitudinally along the vessel/flotation device for repositioning.
    - 4. Means are installed to prevent the crane/derrick from passing the forward or aft end of the wire rope attachments.
    - 5. The crane/derrick is secured from movement during operation.
- d. The systems/means used to comply with Option (1), Option (2), Option (3), or Option (4) of this section will be designed by a licensed marine engineer, or registered professional engineer familiar with floating crane/derrick design.

*Exception for 12.7.5:*

*For mobile auxiliary cranes used on the deck of a floating crane/derrick, the requirement specified by subsection 10.7.5 to use Option (1), Option (2), Option (3), or Option (4) does not apply when it can be demonstrated that implementation of a plan and procedures that meet the following requirements:*

- a. *A marine engineer or registered professional engineer familiar with floating crane/derrick design develops and signs a written plan for the use of the mobile auxiliary crane.*
- b. *The plan is designed so that the applicable requirements of this section are met despite the position, travel, operation, and lack of physical*

*attachment (or corraling, use of rails or cable system) of the mobile auxiliary crane.*

- c. The plan specifies the areas of the deck where the mobile auxiliary crane is permitted to be positioned, travel, and operate, and the parameters and limitations of such movements and operation.*
- d. The deck is marked to identify the permitted areas for positioning, travel, and operation.*
- e. The plan specifies the dynamic and environmental conditions that will be present for use of the plan.*
- f. If the dynamic and environmental conditions in exception (e) are exceeded, the mobile auxiliary crane will be attached physically or corralled in accordance with Option (1), Option (2) or Option (4) of subsection 10.7.5.*

12.7.6 The barge, pontoons, vessel, or other means of flotation used:

- a. Will be structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derrick's maximum rated capacity with all anticipated deck loads and ballasted compartments.
- b. Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free surface effect.
- c. Have access to void compartments to allow for inspection and pumping.

## 13 OPERATING RULES

### 13.1 Travel

- 13.1.1 The travel of boom-type equipment and cranes will be controlled so as to avoid collision with persons, material, and equipment. The cabs of units (of the revolving type) traveling under their own power will be turned so as to provide the least obstruction to the operator's vision in the direction of travel, unless receiving signals from someone with an unobstructed view.
- 13.1.2 In transit, the following additional precautions for mobile cranes will be exercised:
  - a. The boom will be carried in line with the direction of motion and the superstructure will be secured against rotation, except when negotiating turns when there is an operator in the cab, or when the boom is supported on a dolly.
  - b. The empty hook, headache ball, or block will be lashed or otherwise restrained so that it cannot swing freely.
- 13.1.3 Traveling with a load will be prohibited if the practice is prohibited by the equipment manufacturer.
- 13.1.4 Where traveling with a load, the following will be implemented:
  - a. A competent person will supervise the operation, determine if it is necessary to reduce rated capacity, and will make determinations regarding load position, boom location, ground support travel route,

- overhead obstructions, and speed of movement necessary to ensure safety.
- b. For equipment with tires, tire pressure specified by the equipment manufacturer for traveling with a load will be maintained.

## **13.2 Ground Conditions**

- 13.2.1 Equipment will not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.
- 13.2.2 Where there is a controlling entity:
  - a. The ground preparations necessary to meet the requirements in subsection 13.2.1. will be provided by the controlling entity.
  - b. Users of equipment and the operator will be informed of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) that are in the possession of the controlling entity (whether at the site or off-site) or the hazards are otherwise known to the controlling entity.
- 13.2.3 If there is no controlling entity for the project, the requirement in subsection 13.2.2(a) will be met by Don H. Mahaffey Drilling Co. or another employer that has authority at the site to make or arrange for ground preparations need to meet subsection 13.2.1.
- 13.2.4 If the A/D director or the operator determines that ground conditions do not meet the requirements in subsection 13.2.1, that person's employer or, if applicable, Don H. Mahaffey Drilling Co. will have a discussion with the controlling entity regarding the ground preparations that are needed so that, with the use of suitable supporting materials/devices (if necessary), the requirements in subsection 13.2.1 can be met.

*Exception: This section does not apply to cranes designed for use on railroad tracks when used on railroad tracks that are part of the general railroad system of transportation that is regulated pursuant to the Federal Railroad Administration under 49 CFR part 213 and that comply with applicable Federal Railroad Administration requirements.*

## **13.3 Booms**

Booms which are being assembled or disassembled on the ground will be securely blocked or secured to prevent dropping of the boom and boom sections.

## 13.4 Swing

- 13.4.1 When rotating the crane, sudden stops will be avoided. Rotational speed will be such that the load does not swing out beyond the radius at which it can be safely controlled.
- 13.4.2 Tag or restraint lines will be used where rotation of the load is hazardous.
- 13.4.3 Cranes or boom-type excavators will not be mounted by personnel, unless the unit is stopped or an exchange of signals with the operator indicates that it is safe to mount.
- 13.4.4 A locomotive crane will not be swung into a position where railway cars on an adjacent track might strike it, until it has been ascertained that cars are not being moved on the adjacent track and proper flag protection has been established.

## 13.5 Work Area Control

- 13.5.1 **Swing Radius Hazard**  
The requirements of this subsection will apply where there are accessible areas in which the equipment's rotating superstructure poses a hazard of:
  - a. Striking and injuring an employee; or
  - b. Pinching/crushing an employee against another part of the equipment or another object.
- 13.5.2 To prevent employee from entering these hazardous areas, the following will be implemented:
  - a. Each employee assigned to work on or near the equipment ("authorized personnel") will be trained in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure.
  - b. The erection and maintenance of control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas.

*Exception: Where it can be demonstrated that it is not feasible to erect such barriers on the ground or on the equipment, the hazard areas will be clearly marked by a combination of warning signs (such as "Danger - Swing/Crush Zone") and high visibility markings on the equipment that identify the hazard areas. The markings will be visible to employees from outside the hazard area. In addition, each employee will be trained to understand what these markings signify.*

- 13.5.3 **Protecting Employees in the Hazard Area**
  - a. Before an employee goes to a location in the hazard area that is out of view of the operator, the employee will inform the operator that he/she is going to that location.
  - b. When the operator has been informed of employee entry to a location covered by subsection 10.5.3(a), the operator will not rotate the superstructure until the operator is informed by the employee or visually confirms that the employee has exited the location and is in a safe position.

- 13.5.4 Where any part of a crane/derrick is within the load radius of another crane/derrick, the controlling entity will institute a system to coordinate operations. If there is no controlling entity, Don H. Mahaffey Drilling Co. (if there is only one employer operating the multiple pieces of equipment) will institute such a system.

## **13.6 Hoisting**

- 13.6.1 Cranes will not be operated with wheels or tracks off the ground or working surface at any time unless properly bearing on outriggers or stabilizers. Power actuated jacks (outriggers or stabilizers), where used, will be provided with means to prevent loss of support under load.
- 13.6.2 Outriggers or stabilizers will be used when the load to be handled at that particular radius exceeds the rated load without outriggers or stabilizers as given by the certified agent for that crane.
- a. Where floats are used they will be securely attached to the outriggers or stabilizers.
  - b. Outrigger or stabilizer supports will:
    - 1. Be strong enough to prevent crushing.
    - 2. Be free from defects.
  - c. Outriggers or stabilizers will be set in accordance with the crane manufacturer's specified configuration requirements for the capacity chart being used. If the crane manufacturer is no longer in business or if the crane manufacturer's specifications regarding the deployment of outriggers or stabilizers is no longer available, the outriggers or stabilizers will be deployed as specified by a qualified person.
  - d. If needed to support the load of an outrigger or stabilizer so as not to exceed the allowable bearing capacity of the underlying material or to establish a level condition for the crane, timbers, cribbing or other structural members will be used. When used, timbers, cribbing or other structural members will be strong enough to prevent crushing and be of such thickness, width, and length as to completely support the outrigger or stabilizer float.
  - e. When a crane is equipped with stabilizers, the stabilizers will be used in accordance with American Society of Mechanical Engineers (ASME) B30.22-2010, Section 22-3.2.4, and/or B30.5-2011, Section 5-1.2.
- 13.6.3 The brakes will be tested each time a load is 90% or more of the rated load as configured by raising the load a few inches and applying the brakes. In duty cycle and repetitive lifts where each lift is 90% or more of the rated load, this requirement applies to the first lift but not to successive lifts.
- 13.6.4 The load or the boom will not be lowered below the point where less than two full wraps of rope remain on grooved drums and three full wraps on ungrooved drums.
- 13.6.5 When two or more cranes are used to lift one load, a qualified person, other than the operators, will direct the operation. This person will analyze the operation and instruct all personnel involved in the proper positioning,

rigging of the load, and the movements to be made. A qualified person will be in direct audible communication with both crane operators at all times to direct the lifting operation. Where two cranes or more are used to lift one load, the rating chart will be reduced on each crane by not less than 25 percent, unless equalizer or other acceptable provisions assure safe distribution of both vertical and horizontal load to the cranes involved, in which case a lesser reduction may be applied.

**13.6.6 Multiple Crane/Derrick Lifts – Supplemental Requirements**

- a. Before beginning a crane/derrick operation in which more than one crane/derrick will be supporting the load, the operation will be planned. The planning will meet the following requirements:
  - 1. The plan will be developed by a qualified person.
  - 2. The plan will be designed to ensure that the requirements of this program are met.
  - 3. Where the qualified person determines that engineering expertise is needed for the planning, it will be provided.
- b. Plan Implementation
  - 1. The multiple-crane/derrick lift will be directed by a person (lift director) who meets the criteria for both a competent person and a qualified person.
  - 2. The lift director will review the plan in a meeting with all workers who will be involved with the operation.

**13.7 Riding Loads on Derricks, Hoists, or Cranes**

No employee will be permitted to ride on loads, hooks, or slings of any derrick, hoist, or crane.

**13.8 Driver's Position**

Where practicable, haulage vehicles will be loaded in such a way that the bucket or boom does not pass over the vehicle driver's position; no loading will be done until it is determined that the driver is in a safe location.

**13.9 Fire Extinguisher**

A fire extinguisher of not less than 10-B:C rating will be kept in serviceable condition and readily accessible to the operator's station, and affected personnel will be familiarized with its use.

**13.10 Refueling**

- 13.10.1 Open lights, flames or spark-producing devices will be kept at a safe distance while refueling an internal combustion engine, and no person shall smoke or carry lighted smoking material in the immediate vicinity of the refueling area. The engine will be stopped during refueling, unless the fueling system provides adequate safe refueling features.



- 13.10.2 Fuel tank filler pipe will be located in such a position, or protected in such manner, as to prevent fuel spillage or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.

### **13.11 Handling Loads**

- 13.11.1 The qualified person (rigger) will be trained and capable of safely performing the rigging operation. All loads will be rigged by a qualified person (rigger) or by a trainee under the direct visual supervision of a qualified person (rigger).
- 13.11.2 A crane, derrick, or hoist will not be loaded beyond the rated capacity, except for test purposes. In all operations where the weight of the load being handled is unknown and may approach the rated capacity, there will be a qualified person (rigger) assigned to determine the weight of the load, unless the crane or derrick is equipped with a load weighing device. The operator will not make any lift under these conditions until informed of such weight by the qualified person (rigger) assigned to that operation.
- a. In all operations where the weight of the load being handled is unknown and may approach the rated capacity, the operator will verify that the load is within the rated capacity of the equipment by at least one of the following methods:
1. The weight of the load will be determined from a source recognized by the industry (such as the load's manufacturer), or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information will be provided to the operator prior to the lift; or
  2. The operator may begin hoisting the load to determine, using a load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter, if it exceeds 75 percent of the maximum rated capacity at the longest radius that will be used during the lift operation. If it does, the operator will not proceed with the lift until the operator verifies the weight of the load in accordance with subsection 13.11.2(a).
- 13.11.3 Attaching the Load
- a. The load will be attached to the hook by means of slings or other suitable and effective means which will be rigged to insure the safe handling of the load.
  - b. Slings will be freed of kinks or twists before use. Slings will comply with the requirements of section 15 of this program.
  - c. Baskets, tubs, skips, or similar containers used for hoisting bulk materials will be loaded so as not to exceed their safe carrying capacity.
  - d. The hoist rope will not be wrapped around the load.
- 13.11.4 The individual directing the lift will see that:
- a. The crane is properly leveled for the work being performed and blocked, where necessary;



- b. The load is well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches;
- c. Ropes shall not be handled on a winch head without the knowledge of the operator.

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

#### 13.11.5 Before Starting to Hoist

- a. The hoist rope will not be kinked.
- b. Multiple part lines will not be twisted around each other.
- c. The hook will be positioned over the load in such a manner as to prevent swinging of the load when lifted.
- d. If there is a slack rope condition, the rope will be properly seated on the drum and in the sheaves.

#### 13.11.6 During Hoisting

- a. There will be no sudden acceleration or deceleration of the moving load.
- b. The load, boom, or other parts of the equipment will not contact any obstruction in a way which could cause falling material or damage to the boom.

#### 13.11.7 Side loading of booms will be limited to freely suspended loads, and booms will not be used for dragging loads sideways unless the boom is specifically designed and constructed to withstand such side loading.

#### 13.11.8 Loads will not be released or detached from a crane or other hoisting apparatus until the qualified person (rigger) detaching the load has verified that the load has been secured or supported to prevent inadvertent movement.

#### 13.11.9 Holding the Load

- a. When a load of any kind is to be suspended for a period of time exceeding normal lifting operations, the drum holding mechanism will be used in addition to the brake which will also be applied.
- b. Cranes, hoists, or derricks will not be left unattended while the load is suspended unless the load is suspended over water, a barricaded area, or is blocked up or otherwise supported from below during repairs or emergency.

#### 13.11.10 On wheel-mounted cranes, no loads will be lifted over the front area except as permitted by the manufacturer or approved by a certified agent.

### 13.12 Limit Switches

#### 13.12.1 Before an electric crane is operated after the start of each shift, or as soon therein as practicable, the crane operator or a qualified person will test the operation of all limit switches over a cleared area, under no load, and will report any defect to the employer who will have the defect corrected before the crane is permitted to operate.

- 13.12.2 The limit switch will never be used as an operating control unless designed for such use, in which case there will be a second limit switch located behind the operating control limit switch.

### 13.13 Signals

- 13.13.1 A signal person will be provided when the point of operation is not in full and direct view of the operator unless a signaling or control device is provided for safe direction of the operator.
- a. Supplemental requirements for mobile cranes in construction  
A signal person will be provided if:
    - 1. When the equipment is traveling, the view in the direction of travel is obstructed.
    - 2. Due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.
- 13.13.2 Only qualified persons will be permitted to give signals.
- Exception: A stop signal may be given by any person.*
- 13.13.3 Signals to operators will be by hand, voice, or audible.
- 13.13.4 Hand Signals
- a. A uniform signal system will be used on all operations and if hand signals are used, they will be clearly understood by the operator.  
*Note: For Recommended Hand Signals see Appendix 3, Plate I)*  
*Exception: Where an operation or use of an attachment is not covered in the Standard Method, non-standard hand signals may be used in accordance with subsection 13.13.4(b).*
  - b. When using non-standard hand signals, the signal person operator, and lift director (where there is one) will contact each other prior to the operation and agree on the non-standard hand signals that will be used.
- 13.13.5 There will be conspicuously posted in the vicinity of the hoisting operations, a legible chart depicting and explaining the system of signals used.
- 13.13.6 The signals used (hand, voice, or audible), and means of transmitting the signals to the operator (such as direct line of sight, video, radio, etc.), will be appropriate for the site conditions.
- 13.13.7 During operations requiring signals, the ability to transmit signals between the operator and signal person will be maintained. If that ability is interrupted at any time, the operator will safely stop operations requiring signals until it is reestablished and a proper signal is given and understood.
- a. Signal systems other than manual will be protected against unauthorized use, breakage, weather or obstruction which will interfere with safe operation. In the event of any known malfunction, an alternate signal system will be used or all motion shall be stopped.

- 13.13.8 If the operator becomes aware of a safety problem and needs to communicate with the signal person, the operator will safely stop operations. Operations will not resume until the operator and signal person agree that the problem has been resolved.
- 13.13.9 All directions given to the operator by the signal person will be given from the operator's direction perspective.
- 13.13.10 Where a signal person(s) is in communication with more than one crane/derrick, a system will be used for identifying the crane/derrick each signal is for, as follows:
  - a. For each signal, prior to giving the function/direction, the signal person will identify the crane/derrick the signal is for, or
  - b. Will use an equally effective method of identifying which crane/derrick the signal is for.

#### **13.14 Signals – Radio, Telephone or other Electronic Transmission of Signals**

- 13.14.1 The device(s) used to transmit signals will be tested on site before beginning operations to ensure that the signal transmission is effective, clear, and reliable.
- 13.14.2 Signal transmission will be through a dedicated channel, except:
  - a. Multiple cranes/derricks and one or more signal persons may share a dedicated channel for the purpose of coordinating operations.
  - b. Where a crane is being operated on or adjacent to railroad tracks, and the actions of the crane operator need to be coordinated with the movement of other equipment or trains on the same or adjacent tracks.
- 13.14.3 The operator's reception of signals will be by a hands-free system.
- 13.14.4 The signal person will audibly or visually signal the operator if the signal person becomes aware that communication with the operator has been interrupted during hoisting operations and the operator will safely stop operations in accordance with subsection 13.13.8.

#### **13.15 Signals – Voice Signals – Additional Requirements**

- 13.15.1 Prior to beginning operations, the operator, signal person and lift director (if there is one), will contact each other and agree on the voice signals that will be used. Once the voice signals are agreed upon, these workers need not meet again to discuss voice signals unless another worker is added or substituted, or there is confusion about the voice signals, or a voice signal is to be changed.
- 13.15.2 Each voice signal will contain the following three elements, given in the following order: (1) function (such as hoist, boom, etc.) and direction; (2) distance and/or speed; (3) function and stop commands.
- 13.15.3 The operator, signal person and lift director (if there is one), will be able to effectively communicate in the language used.

### 13.16 Signal Person Qualifications – Supplemental Requirements for Cranes and Derricks in Construction

- 13.16.1 Each signal person will meet the qualification requirements [subsection 11.16.3] prior to giving any signals. This requirement will be met by using either Option (1) or Option (2) of this section.
- a. **Option 1 – Third party qualified evaluator:** The signal person has documentation from a third party qualified evaluator [See Appendix 1 – Definitions] showing that the signal person meets the qualification requirements. [See subsection 13.16.3].
  - b. **Option 2 – Employer’s qualified evaluator:** Don H. Mahaffey Drilling Co.’s qualified evaluator [See Appendix 1 – Definitions], assesses the individual and determines that the individual meets the qualification requirements [see subsection 13.16.3] and provides documentation of that determination. An assessment by an Don H. Mahaffey Drilling Co.’s qualified evaluator under this option is not portable – other employers are not permitted to use it to meet the requirements of this subsection.
  - c. Documentation will be made available for whichever option is used while the signal person is employed by Don H. Mahaffey Drilling Co.. The documentation will specify each type of signaling (e.g. hand signals, radio signals, etc.) for which the signal person meets the requirements of subsection 13.16.3.
- 13.16.2 If subsequent actions by the signal person indicate that the individual does not meet the qualification requirements [see subsection 13.16.3], the individual will not be allowed to continue working as a signal person until re-training is provided and a reassessment is made in accordance with subsection 11.16.1) that confirms that the individual meets the qualification requirements.
- 13.16.3 Each signal person will:
- a. Know and understand the type of signals used.
  - b. Be competent in the application of the type of signals used.
  - c. Have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads.
  - d. Know and understand the relevant requirements of subsection 13.13 through 13.15.
  - e. Demonstrate that they meet the requirements in subsections 13.16.3 (a) through (d) through an oral or written test, and through a practical test of the signals to be used.

### 13.17 Overhead Loads

- 13.17.1 Operations will be conducted and the job controlled in a manner that will avoid exposure of employees to the hazard of overhead loads. Wherever loads must be passed directly over workers, occupied work spaces or occupied passageways, safety type hooks or equivalent means of preventing the loads from becoming disengaged will be used.

- 13.17.2 While the operator is not moving a suspended load, no employee will be within the fall zone.

*Exceptions:*

- a. Employees engaged in hooking, unhooking or guiding a load, or*
- b. Employees engaged in the initial attachment of the load to a component or structure; or*
- c. Employees operating a concrete hopper or concrete bucket, or*
- d. Oiler or assistant to the operator.*

- 13.17.3 When employees are engaged in hooking, unhooking, or guiding the load, or in the initial connection of a load to a component or structure and are within the fall zone, all of the following criteria will be met:

- a. The materials being hoisted will be rigged to prevent unintentional displacement.
- b. Hooks with self-closing latches or their equivalent will be used.
- c. The materials will be rigged by a qualified rigger.

- 13.17.4 Only employees needed to receive a load are permitted to be within the fall zone when a load is being landed.

- 13.17.5 During a tilt-up or tilt-down operation:

- a. No employee will be directly under the load.
- b. Only employees essential to the operation are permitted in the fall zone (but not directly under the load). An employee is essential to the operation if the employee is conducting one of the following operations and it can be demonstrated that it is infeasible for the employee to perform that operation from outside the fall zone:
  - 1. Physically guide the load;
  - 2. Closely monitor and give instructions regarding the load's movement; or
  - 3. Either detach it from or initially attach it to another component or structure (such as, but not limited to, making an initial connection or installing bracing).

*Notes:*

- a. Boom free fall is prohibited when an employee is in the fall zone of the boom or load.*
- b. Load line free fall is prohibited when an employee is directly under the load.*

## **13.18 Provisions for Preventing Accidents in the Area of High-Voltage Lines**

Provisions for preventing accidents due to overhead high-voltage lines will be in conformance with the High-Voltage Electrical Safety Orders, Article 37 of the California Code of Regulations.

### 13.19 Power Line Safety (Up to and Including 350kV) – Equipment Operations

- 13.19.1 Before beginning equipment operations, the following will be implemented:
- a. Identify the work zone by either:
    1. Demarcating boundaries (such as with flags, or a device such as a range limit device or range control warning device) and prohibiting the operator from operating the equipment past those boundaries, or
    2. Defining the work zone as the area 360 degrees around the equipment, up to the equipment's maximum working radius.
  - b. Determine if any part of the equipment, load line or load (including rigging and lifting accessories), if operated up to the equipment's maximum working radius in the work zone, could get closer than 20 feet to a power line. If so, the following requirements will be met in Option (1), Option (2), or Option (3) of this section, as follows:
    1. **Option (1) – De-energize and ground:** Confirm from the utility owner/operator that the power line has been de-energized and visibly grounded at the worksite.
    2. **Option (2) – 20 foot clearance:** Ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet to the power line by implementing the measures specified in subsection 12.19.2 of this section.
    3. **Option (3) – Table A clearance:**
      - I. Determine the line's voltage and the minimum approach distance permitted under Table A.
      - II. Determine if any part of the equipment, load line or load (including rigging and lifting accessories), while operating up to the equipment's maximum working radius in the work zone, could get closer than the minimum approach distance of the power line permitted under Table A. If so, the requirements of 12.19.2 of this section will be followed to ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer to the line than the minimum approach distance.
- 13.19.2 Where encroachment precautions are required under Option (2) or Option (3) of this section, all of the following requirements will be met:
- a. Conduct a planning meeting with the operator and the other workers who will be in the area of the equipment or load to review the location of the power line(s), and the steps that will be implemented to prevent encroachment/electrocution.
  - b. If tag lines are used, they will be non-conductive
  - c. Erect and maintain an elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 feet from the power line (if using Option (2) of this section) or at the minimum approach distance under Table A (if using Option (3) of this section). If the operator is unable to see the elevated warning line, a dedicated spotter will be used as described in subsection 10.19.2(d) in addition to implementing one of the measures described in subsections 13.19.2(d)(2) and (3).



- d. Implement at least one of the following measures:
  - 1. A dedicated spotter who is in continuous contact with the operator. Where this measure is selected, the dedicated spotter will:
    - I. Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: A clearly visible line painted on the ground, a clearly visible line of stanchions, a set of clearly visible line-of-sight landmarks (such as a fence post behind the dedicated spotter and a building corner ahead of the dedicated spotter).
    - II. Be positioned to effectively gauge the clearance distance.
    - III. Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
    - IV. Give timely information to the operator so that the required clearance distance can be maintained.
  - 2. A device that automatically warns the operator when to stop movement, such as a range control warning device. Such a device will be set to give the operator sufficient warning to prevent encroachment.
  - 3. A device that automatically limits range of movement, set to prevent encroachment.

13.19.3 Where Option (3) of this section is used, the utility owner/operator of the power lines will provide the requested voltage information within two working days of the Don H. Mahaffey Drilling Co.'s request.

13.19.4 Operations below power lines:

- a. No part of the equipment, load line, or load (including rigging and lifting accessories) is allowed below a power line unless it has been confirmed that the utility owner/operator has de-energized and (at the worksite) visibly grounded the power line, except where one of the exceptions in subsection 13.19.4(b) of this section applies.
- b. Exception: 13.19.4(a) of this section is inapplicable where it can be demonstrated that one of the following applies:
  - 1. For equipment with non-extensible booms: The uppermost part of the equipment, with the boom at true vertical, would be more than 20 feet below the plane of the power line or more than the Table A of this section minimum clearance distance below the plane of the power line.
  - 2. For equipment with articulating or extensible booms: The uppermost part of the equipment, with the boom in the fully extended position, at true vertical, would be more than 20 feet below the plane of the power line or more than the Table A of this section minimum clearance distance below the plane of the power line.
  - 3. It can be demonstrated that compliance with subsection 13.19.4(a) of this section is infeasible and meets the requirements of subsection 13.21.



- 13.19.5 Power lines presumed energized  
It will be assumed that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.
- 13.19.6 When working where a hazardous electrical charge is induced in the equipment or materials being handled, the transmitter or other source will be de-energized or one of the following precautions will be taken:
- a. The equipment will be electrically grounded and if tag lines are used they shall be non-conductive;
  - b. A non-conductive insulating link will be used between the hook and the load; or
  - c. A non-conductive hoisting rope will be used.
- 13.19.7 Training
- a. Each operator and crew member assigned to work with the equipment will be trained on all of the following:
    1. The procedures to be followed in the event of electrical contact with a power line. Such training will include:
      - I. Information regarding the danger of electrocution from the operator simultaneously touching the equipment and the ground.
      - II. The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
      - III. The safest means of evacuating from equipment that may be energized.
      - IV. The danger of the potentially energized zone around the equipment (step potential) and the methods for emergency evacuation in an energized condition.
      - V. The need for crew in the area to avoid approaching or touching the equipment and the load.
      - VI. Safe clearance distance from power lines.
    2. Power lines are presumed to be energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.
    3. Power lines are presumed to be uninsulated unless the utility owner/operator or a registered engineer who is a qualified person with respect to electrical power transmission and distribution confirms that a line is insulated. The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
    4. The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
    5. The procedures to be followed to properly ground equipment and the limitations of grounding.
  - b. Employees working as dedicated spotters will be trained to enable them to effectively perform their task, including training on the applicable requirements of this section.
  - c. Training under this section shall be administered in accordance with Don H. Mahaffey Drilling Co.'s Injury and Illness Prevention Program.

- 13.19.8 A safety device (see subsection 13.1), operational aid, or a means to prevent power line contact or electrocution, when used to comply with this section, will meet the manufacturer's procedures for use and conditions of use.

<b>Table A</b> <b>Minimum Clearance Distances</b>	
<b>Voltage (nominal, kV, alternating current)</b>	<b>Minimum Clearance Distance (feet)</b>
Up to 50	10
Over 50 to 175	15
Over 175 to 350	20
Over 350 to 550	27
Over 550 to 1,000	45
Over 1,000	(as established by the utility owner/ operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200.

## **13.20 Power Line Safety (Over 350kV)**

The requirements of subsection 13.34 and subsection 13.19 will apply to power lines over 350 kV except:

- For power lines at or below 1000kV, wherever the distance "20 feet" is specified, the distance "50 feet" will be substituted; and
- For power lines over 1000kV, the minimum clearance distance will be established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.

## **13.21 Power Line Safety (All Voltages) – Equipment Operations Closer Than the Table A Zone**

- Equipment operations in which any part of the equipment, load line, or load (including rigging and lifting accessories) is closer than the minimum approach distance under Table A of subsection 13.19 to an energized power line is prohibited except as permitted by the High-Voltage Electrical Safety Orders.
- Except where overhead electrical distribution and transmission lines have been de-energized and visibly grounded, the operation, erection, or handling of tools, machinery, apparatus, supplies, or materials, or any part thereof, over power lines is prohibited.

*Exception to 12.21.2: Tower cranes equipped with limit switches or other systems that automatically control slew, trolley and boom travel to prevent moving any portion of the load or load line within a horizontal proximity to*

*power lines closer than the minimum clearances set forth in Table A of subsection 13.19.*

### **13.22 Power Line Safety - While Traveling Under or Near Power Lines with No Load.**

- 13.22.1 This section establishes procedures and criteria that will be met for equipment traveling under or near a power line on a construction site with no load. Equipment traveling on a construction site with a load is governed by subsections 13.19, 13.20, and 13.21, whichever is appropriate, and subsection 13.1.3 and 13.1.4.
- a. The provisions of Electrical Safety Orders, Group 2, Article 37, of the California Code of Regulations will also apply to any work in proximity to overhead power lines where more protective.
- 13.22.2 It will be assured that:
- a. The boom/mast and boom/mast support system are lowered sufficiently to meet the requirements of this section.
  - b. The clearances specified in Table T of this section are maintained.
  - c. The effects of speed and terrain on equipment movement (including movement of the boom/mast) are considered so that those effects do not cause the minimum clearance distances specified in Table T of this section to be breached.
  - d. If any part of the equipment while traveling will get closer than 20 feet to the power line, a dedicated spotter who is in continuous contact with the driver/operator will be used. The dedicated spotter will:
    1. Be positioned to effectively gauge the clearance distance.
    2. Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
    3. Give timely information to the operator so that the required clearance distance can be maintained.
  - e. When traveling at night, or in conditions of poor visibility, in addition to the measures specified in subsections 13.22.2(a)-(d) of this section, the following will be ensured:
    1. The power lines are illuminated or another means of identifying the location of the lines is used.
    2. A safe path of travel is identified and used.

<b>Table T</b> <b>Minimum Clearance Distances while Traveling with no Load</b>	
<b>Voltage (nominal, kV, alternating current)</b>	<b>While traveling Minimum clearance distance (feet)</b>
Up to 0.60	4
Over .60 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1,000	20
Over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)

### 13.23 Crane or Derrick Suspended Personnel Platforms

- 13.23.1 The subsection applies to the design, construction, use, and maintenance of personnel platforms, and the hoisting of personnel platforms on load lines of cranes and derricks.
- 13.23.2 The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous or is not possible because of structural design or worksite conditions.
- 13.23.3 Operational Criteria
- Hoisting of the personnel platform will be performed in a slow, controlled, cautious manner with no sudden movements of the crane or derrick, or the platform.
  - Load lines will be capable of supporting, without failure, at least seven times the maximum intended load, except that where rotation resistant rope is used, the lines shall be capable of supporting without failure, at least ten times the maximum intended load. The required design factor is achieved by taking the current safety factor of 3.5 [required under section 4884(b) of the California Code of Regulations] and applying the 50 percent derating of the crane capacity which is required by subsection 13.23.3(e) of this program.
  - Load and boom hoist drum brakes, swing brakes, and operator actuated secondary braking and locking devices such as pawls or dogs or automatic secondary brakes will be engaged when the occupied personnel platform is in a stationary working position.
  - The crane will be uniformly level in accordance with the manufacturer's specifications, not to exceed one percent of level grade, and located on footing that a qualified person has determined to be firm and stable. Cranes equipped with outriggers or stabilizers will have them all fully deployed following manufacturer's specifications, insofar as applicable, when hoisting employees.

- e. Capacity:
  - 1. **Use of suspended personnel platforms** - The total weight of the loaded personnel platform and related rigging will not exceed 50 percent of the rated capacity for the radius and configuration of the crane or derrick, except during proof testing.
  - 2. **Use of boom-attached personnel platforms** - When approved by the crane manufacturer or certified agent - The total weight of the loaded personnel platform will not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
  - 3. **Hoisting personnel without a personnel platform** - When hoisting personnel without a personnel platform pursuant to exceptions to subsection 10.23.8, the total load will not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
- e. The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.
- f. Only wire rope or steel chain slings and pendants will be used for suspending personnel platforms.
- g. Personnel hoisting operations will not begin unless the devices listed in this section are in proper working order. If a device stops working properly during such operations, the operator will safely stop operations. Personnel hoisting operations will not resume until the device is again working properly. Alternative measures are not permitted. (See Don H. Mahaffey Drilling Co.'s Energy Control (Lockout/Tagout) program.)

#### 13.23.4 Instruments and Components

- a. Cranes, except articulating boom cranes, and derricks with variable angle booms will be equipped with the following:
  - 1. A boom angle indicator, readily visible to the operator.
  - 2. A boom hoist limiting device.
- b. Cranes with telescoping booms will be equipped with a device to indicate clearly to the operator, at all times, the boom's extended length, or an accurate determination of the load radius to be used during the lift will be made prior to hoisting personnel.
- c. An anti-two-block device will be used which when activated, disengages all crane functions that can cause two-blocking.  
When a derrick is used to hoist personnel platforms, limiting devices will be installed to prevent two-blocking.  
*Exception: This device is not required when hoisting personnel in pile driving operations. Instead, subsection 13.23.14 of this subsection specifies how to prevent two-blocking during such operations.*
- d. The load line hoist drum will have a system or device on the power train, other than the hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering).  
*Note: Free fall of the load line hoist in use is prohibited; the use of equipment in which the boom hoist mechanism can free fall is also prohibited.*
- e. Articulating boom cranes will be equipped with a properly functioning automatic overload protection device.

- f. Equipment with a luffing jib will be equipped with:
  - 1. A jib angle or radius indicator, readily visible to the operator, and
  - 2. A jib hoist limiting device.

#### 13.23.5 Personnel Platforms -Design Criteria

- a. The personnel platform and suspension system will be designed by a register engineer.
- b. The suspension system will be designed to minimize tipping of the platform due to movement of employees occupying the platform.
- c. The personnel platform itself, except the guardrail system and body belt/harness anchorages, will be capable of supporting, without failure, its own weight and at least five times the maximum intended load. Criteria for guardrail systems and body belt/harness anchorages are contained in article 2 of the General Industry Safety Orders and article 24 of the Construction Safety Orders of the California Code of Regulations respectively.
- d. The system used to connect the personnel platform to the equipment will limit the platform to within 10 degrees of level, regardless of boom/jib angle.

#### 13.23.6 Platform Specifications

- a. Each personnel platform will be equipped with a guardrail system which meet the requirements of article 2 of the General Industry Safety Orders and will be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than 1/2 inch.
- b. A grab rail will be installed inside the entire perimeter of the personnel platform.
- c. Access gates, if installed, will not swing outward during hoisting.
- d. Access gates, including sliding or folding gates, will be equipped with a restraining device to prevent accidental opening.
- e. Headroom will be provided which allows employees to stand upright in the platform.
- f. In addition to the use of hard hats, employees will be protected by overhead protection on the personnel platform when employees are exposed to falling objects.
- g. All rough edges exposed to contact by employees will be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.
- h. All welding of the personnel platform and its components will be performed by a certified welder familiar with the weld grades, types and material specified in the platform design.
- i. The personnel platform will be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform and its rated load capacity.

#### 13.23.7 Personnel Platform Loading

- a. The personnel platform will not be loaded in excess of its rated load capacity.
- b. The number of employees occupying the personnel platform will not exceed the number required for the work being performed.



- c. Personnel platforms will be used only for employees, their tools, and the materials necessary to do their work, and will not be used to hoist only materials or tools when not hoisting personnel.
- d. Materials and tools for use during a personnel lift will be secured to prevent displacement.
- e. Materials and tools for use during a personnel lift will be evenly distributed within the confines of the platform while the platform is suspended.

#### 13.23.8 Rigging

- a. When a wire rope bridle is used to connect the personnel platform to the load line, each bridle leg will be connected to a master link or shackle in such a manner to ensure that the load is evenly divided among the bridle legs.
- b. Hooks and other detachable devices
  - 1. Hooks used in the connection between the hoist line and the personnel platform (including hooks on overhaul ball assemblies, lower load blocks, or other attachments assemblies or components) will be:
    - I. Of a type that can be closed and locked, eliminating the hook throat opening.
    - II. Closed and locked when attached.
  - 2. Shackles used in place of hooks shall be of the alloy anchor type, with either:
    - I. A bolt, nut and retaining pin, in place; or
    - II. Of the screw type, with the screw pin secured from accidental removal.
  - 3. Where other detachable devices are used, they will be of the type that can be closed and locked to the same extent as the devices addressed in subsections 13.23.8(b)(1) and (2). Such devices will be closed and locked when attached.
- c. Rigging hardware (including wire rope slings, shackles, rings, master links, and other rigging hardware) will be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component.
  - 1. Rotation resistant wire rope slings and slings made of synthetic or natural fibers will not be used.

#### 13.23.9 Trial Lift, Inspection, and Proof Testing

- a. A trial lift with the unoccupied personnel platform loaded at least to the anticipated lift weight will be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift will be performed immediately prior to placing personnel on the platform. The operator will determine that all systems, controls and safety devices are activated and functioning properly; that no interferences exist; that all configurations necessary to reach those work locations will allow the operator to remain under the 50 percent limit as established in subsection 13.23.3(e) and that the load radius to be used during the lift has been accurately determined. Materials and tools to be used during the actual lift can be loaded in the platform, as



- provided in 13.23.7 for trial lift. Where there is more than one location to be reached from a single set-up position, either individual trial lifts for each location, or a single trial lift, in which the platform is moved sequentially to each location, will be performed; the method selected will be the same as the method that will be used to hoist the personnel.
- b. The trial lift will be repeated prior to hoisting employees whenever the crane or derrick is moved and set up in a new location or returned to a previously used location. Additionally, the trial lift will be repeated when the lift route is changed unless the operator determines that the route change is not significant, i.e. the route change would not affect the safety of hoisted employees.
  - c. After the trial lift, and just prior to hoisting personnel, the platform will be hoisted a few inches with the personnel and materials/tools on board and inspected by a qualified person to ensure that it is secure and properly balanced. Employees will not be hoisted unless the following conditions are determined to exist:
    - 1. Hoist ropes will be free of kinks and other deficiencies in accordance with subsections 16.1.1-16.1.2 and subsection 16.6;
    - 2. Multiple part lines will not be twisted around each other;
    - 3. The primary attachment will be centered over the platform; and
    - 4. The hoisting system will be inspected if the load rope is slack to ensure all ropes are properly positioned on drums and sheaves.
  - d. A visual inspection of the crane or derrick, rigging, personnel platform, and the crane or derrick base support or ground will be conducted by a qualified person immediately after the trial lift to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure. The qualified person will also confirm that the test weight has been removed prior to lifting personnel.
  - e. Any defects found during inspections which fails to meet a requirement of this standard or otherwise creates a safety hazard will be corrected before hoisting personnel.
  - f. At each jobsite, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging will be proof tested to 125 percent of the platform's rated capacity by holding it in a suspended position for five minutes with the test load evenly distributed on the platform (this may be done concurrently with the trial lift). After proof testing, a qualified person will inspect the platform and rigging. Any deficiencies found will be corrected and another proof test will be conducted. Personnel hoisting will not be conducted until the proof testing requirements are satisfied.

#### 13.23.10 Work Practices

- a. Employees will:
  - 1. Keep all parts of the body inside the platform during raising, lowering, and horizontal movement. This provision does not apply to an occupant of the platform when necessary to position the platform or while performing the duties of a signal person.
  - 2. Not stand, sit on, or work from the top or intermediate rail or toeboard, or use any other means/device to raise their working height above the platform floor.

3. Not pull the platform out of plumb in relation to the hoisting equipment.
- b. Before employees exit or enter a hoisted personnel platform that is not landed, the platform will be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.
  1. If the platform is tied to the structure, the operator will not move the platform until the operator receives confirmation that it is freely suspended.
- c. Tag lines will be used unless their use creates an unsafe condition.
- d. The crane or derrick operator will remain at the controls, on site, and in view of the platform or in communication with the platform personnel or signal person at all times while the platform is occupied and elevated.
- e. Environmental conditions
  1. Wind - When wind speed (sustained or gusts) exceeds 20 mph at the personnel platform, a competent person will determine if, in light of the wind conditions, it is safe to lift personnel. If it is not safe, the lifting operation will not begin (or, if already in progress, will be terminated).
  2. Other weather and environmental conditions - A competent person will determine if, in light of indications of dangerous weather conditions, or other impending or existing danger, it is safe to lift personnel. If it is not safe, the lifting operation will not begin (or, if already in progress, will be terminated).
- f. Fall protection
  1. Except over water, employees occupying the personnel platform will be provided and use a personal fall arrest system with lanyard appropriately attached to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage. When working over water, the requirements of Section 1602 of the Construction Safety Orders of the California Code of Regulations will apply.
  2. The fall arrest system, including the attachment point (anchorage) used to comply with subsection 13.23.10(f)(1), will comply with Article 24 of the Construction Safety Orders of California Code of Regulations.
- g. No lifts will be made on another of the crane's or derrick's loadlines while personnel are suspended on a platform.
- h. Direct attachment of a personnel platform to a luffing jib is prohibited.
- i. When using equipment to hoist employees, the employees will be in a personnel platform that meets the requirements of this section.

Exceptions: A personnel platform is not required for hoisting employees:

- a. Into and out of drill shafts that are up to and including 8 feet in diameter [see subsection 13.23.14 for requirements for hoisting these employees].
- b. In pile driving operations [see subsection 13.23.15 for requirements for hoisting these employees].
- c. Solely for transfer to or from a marine worksite in a personnel transfer device [see subsection 13.23.16 for requirements for hoisting these employees].

- d. In storage tank (steel or concrete), shaft and chimney operations.

#### 13.23.11 Traveling

- a. Hoisting of employees while the crane is traveling is prohibited, except for portal, tower and cranes on fixed tracks or railways.
- b. Under any circumstances where a crane would travel while hoisting personnel, the following procedures will be implemented to safeguard employees:
  - 1. Travel will be limited to the load radius of the boom used during the lift; and
  - 2. The boom will be parallel to the direction of the travel;
  - 3. A complete trial run will be performed to test the route of travel before employees are allowed to occupy the platform. This trial run can be performed at the same time as the trial lift required by subsection 11.23.10(a) of this program which tests the route of the lift.
  - 4. Crane travel will be restricted to a fixed track or railway.
    - I. Where a runway is used, it must be a firm, level surface designed, prepared and designated as a path of travel for the weight and configuration of the equipment being used to lift and travel with the personnel platform. An existing surface may be used as long as it meets these criteria.

#### 13.23.12 Pre-lift Meeting

- a. A meeting attended by the crane or derrick operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed will be held to review the appropriate requirements of subsection 13.23 of this programs and the procedures to be followed.
- b. This meeting will be held prior to the trial lift at each new work location and will be repeated for any employees newly assigned to the operation.

#### 13.23.13 Hoisting Personnel Near Power Lines

Hoisting personnel within 20 feet of a power line that is up to 350kV, and hoisting personnel within 50 feet of a power line that is over 350kV, is prohibited, except for work covered by the High Voltage Electrical Safety Orders of the California Code of Regulations.

#### 13.23.14 Hoisting Personnel in Drill Shafts

When hoisting employees into and out of drill shafts that are up to and including 8 feet in diameter, all of the following requirements will be met:

- a. The employee will be in either a personnel platform or on a boatswain's chair.
- b. If using a personnel platform, subsections 13.23.1-13.23.13 of this section apply.
- c. If using a boatswain's chair:
  - 1. The following subsections apply: 13.23.3, 13.23.4, 13.23.6, 13.23.8, 13.23.9, 13.23.10, 13.23.11, 13.23.12, and 13.23.13.

Where the terms “personnel platform” or “platform” are used in these subsections, replace them with “boatswain’s chair.”

2. A signal person will be stationed at the shaft opening.
3. The employee will be hoisted in a slow, controlled descent and ascent.
4. The employee will use personal fall protection equipment, including a full body harness, attached independent of the crane/derrick.
5. The fall protection equipment will meet the applicable requirements of Article 2 of the General Industry Safety Orders and Article 24 of the Construction Safety Orders of the California Code of Regulations.
6. The boatswain’s chair itself (excluding the personal fall arrest system anchorages), will be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
7. No more than one person will be hoisted at a time.

#### 13.23.15 Hoisting personnel for pile driving operations.

When hoisting an employee in pile driving operations, the following requirements will be met:

- a. The employee will be in a personnel platform or boatswain’s chair.
- b. For lattice boom and telescopic boom mobile cranes: Clearly mark the cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, and use a spotter who is in direct communication with the operator to inform the operator when this point is reached.
- c. If using a boatswain’s chair, subsections 13.23.14 will apply. Where the terms “personnel platform” or “platform” are used in these subsections, substitute “boatswains chair.”

*Exception: In lieu of personal fall protection attached independent of the crane/derrick per subsection 13.23.14(c)(4), personal fall protection may be independently attached to the lower load block or overhaul ball.*

#### 13.23.16 Hoisting Personnel for Marine Transfer

When hoisting employees solely for transfer to or from a marine worksite, the following requirements will be met:

- a. The employee will be in either a personnel platform or a personnel transfer device.
- b. If using a personnel platform, subsections 13.23.1 through 13.23.13 of this section apply.
- c. If using a personnel transfer device:
  1. The following subsections apply: 13.23.3, 13.23.4, 13.23.6, 13.23.8, 13.23.9, 13.23.10, 13.23.11, 13.23.12, and 13.23.13. Where the terms “personnel platform” or “platform” are used in these subsections, replace them with “marine-hoisted personnel transfer device.”
  2. The transfer device will be used only for transferring workers.
  3. The number of workers occupying the transfer device will not exceed the maximum number it was designed to hold.
  4. Each employee will wear a U.S. Coast Guard personal flotation device approved for industrial use.

#### 13.23.17 Hoisting Personnel for Storage Tank (Steel or Concrete), Shaft and Chimney Operations

When hoisting an employee in storage tank (steel or concrete), shaft and chimney operations, the following requirements will be met:

- a. The employee will be in a personnel platform except when the employer can demonstrate that use of a personnel platform is infeasible; in such a case, a boatswain's chair will be used.
- b. If using a personnel platform, subsections 13.23.1 through 13.23.13.
- c. If using a boatswain's chair the provisions of subsection 13.23.14 will apply. Where the terms "personnel platform" or "platform" are used in these subsections, substitute them with "boatswain's chair."
- d. When there is no adequate structure for attachment of required personal fall arrest equipment, the attachment will be to the lower load block or overhaul ball.

### 13.24 Work Near Transmitter Towers

Prior to work near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized or tests will be made to determine if an electrical charge is induced on the crane. The following precautions will be taken when necessary to dissipate induced voltages:

- a. The equipment will be provided with an electrical ground directly to the upper rotating structure supporting the boom; and
- b. Ground jumper cables will be attached to materials being handled by boom equipment when an electrical charge is induced while working near energized transmitters. Crews will be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.
- c. Combustible and flammable materials will be removed from the immediate area prior to operations.

### 13.25 Crane and Hoisting Equipment Operators – Qualifications

13.25.1 Only employees authorized by Don H. Mahaffey Drilling Co. and trained in the safe operation of cranes or hoisting apparatus shall be permitted to operate such equipment.

13.25.2 Trainees may be authorized to operate cranes or hoisting apparatus provided they are under the supervision of a qualified operator.

### 13.26 Mobile Crane and Tower Crane-Operator Qualifications and Certification (Applicable to Cranes in General Industry Only)

#### 13.26.1 Qualifications

Only operators who have a valid certificate of competency (certificate) issued in accordance with this section by an Accredited Certifying Entity for the type of crane to be used will be permitted to operate a crane covered by this section. Certificates will be issued to operators who:

- a. Pass a physical examination conducted by a physician or other licensed health care professional (e.g. physician's assistant or nurse practitioner) which at a minimum will include the examination criteria

- specified in the American Society of Mechanical Engineers (ASME) B30.5-2000 standard, Chapter 5-3.1.2(a)(1-5, 7, 8) or the U.S. Department of Transportation (US DOT) physical examination requirements contained in 49 CFR Sections 391.41 through 391.49.
- b. Pass a substance abuse test - The level of testing will be consistent with the standard practice for the industry where the crane is in use and this test will be conducted by a recognized laboratory service.
  - c. Pass a written examination developed, validated, and administered in accordance with generally accepted industry best practices. The exam will test knowledge and skills identified as necessary for safe crane operations and will, at a minimum, demonstrate the following:
    - 1. Operational characteristics and controls, including characteristic and performance questions appropriate to the crane type for which qualification is sought;
    - 2. Emergency control skills, such as a response to fire, power line contact, loss of stability, or control malfunction;
    - 3. A demonstration of basic arithmetic skills necessary for crane operation and the ability to read and comprehend the crane manufacturer's operation and maintenance instruction materials, including load capacity information (load charts) for the crane for which certification is sought;
    - 4. Technical knowledge of the subject matter criteria listed in 29 CFR 1926, Subpart CC, Appendix C applicable to the specific type of equipment the individual will operate. Use of the Appendix C criteria meets the requirements of this provision.
    - 5. Technical knowledge applicable to:
      - I. The suitability of the supporting ground and surface to handle expected loads.
      - II. Site hazards.
      - III. Site access.
  - d. Pass a "hands-on" examination to demonstrate proficiency in operating the specific type of crane, which at a minimum will include pre-start and post-start inspection, maneuvering skills, shutdown, and securing procedures.

#### 13.26.2 Certification

Certificates will be valid for a maximum of five (5) years. An Accredited Certifying Entity shall issue the certificate of competency to operators who successfully demonstrate the qualifications set forth in 13.26.1(a)-(d) of this section.

- a. The accredited certifying entity will have procedures for operators to re-apply and be re-tested in the event an operator applicant fails a test or is decertified.

#### 13.26.3 Accreditation Certifying Entity

The crane operator testing organization providing the certification will be accredited by an approved nationally recognized accrediting agency based on that agency's determination that industry-recognized criteria for written testing materials, practical examinations, test administration, grading, facilities/equipment, and personnel have been met.



- a. The accredited certifying entity will have its accreditation reviewed by the nationally recognized accrediting agency at least every three years.

#### 13.26.4 Re-Certification

Crane operators will re-certify every five (5) years and shall be required to meet all of the qualifications set forth in subsection 13.26.1. Operators with at least one-thousand (1,000) hours of documented experience operating the specific type of crane for which re-certification is sought as covered by this section during the immediately preceding certification period and who meet the physical examination, substance abuse, and written examination requirements set forth in subsections 13.26.1(a),(b),(c) of this section will not be required to take the "hands-on" examination specified in subsection (a)(4) to re-certify.

- 13.26.5 Trainees may be authorized to operate mobile or tower cranes provided they are under the direct supervision of an operator possessing a valid certificate of competency for the type of crane operated by the trainee. The term direct supervision means the supervising operator is in the immediate area of the trainee and within visual sighting distance and able to effectively communicate with the trainee. When performing direct supervision, the supervising operator will have no other duties other than to observe the operation of the crane by the trainee.

- a. The operator-in-training will not operate the equipment in any of the following circumstances unless the exception stated in subsection 13.26.5(a)(4) is applicable:
  - 1. If any part of the equipment, load line or load (including rigging and lifting accessories), is operated up to the equipment's maximum working radius in the work zone could get within 20 feet of a power line that is up to 350kV, or within 50 feet of a power line that is over 350kV.
  - 2. If the equipment is used to hoist personnel.
  - 3. In multiple-equipment lifts.
  - 4. If the equipment is used over a shaft, cofferdam, or in a tank farm.
  - 5. In multiple-lift rigging operations, except where the operator's trainer determines that the operator-in-training skills are sufficient for this high-skill work.

#### Exceptions:

- a. Mobile cranes having a boom length of less than 25 feet or a maximum rated load capacity of less than 15,000 pounds.
- b. Operators of electric line trucks (digger derrick trucks) as defined in Section 2700 of the Electrical Safety Orders of the California Code of Regulations, and regulated by Section 2940.7 of the High Voltage Electrical Safety Orders of the California Code of Regulations. This exception does not include mobile truck cranes designed and built in accordance with the American Society of Mechanical Engineers (ASME) B30.5 standards.
- c. Marine terminal operations regulated by Article 14 of the California Code of Regulation.



## **13.27 Operator Training, Certification, and Evaluation for Cranes and Derricks in Construction**

### **13.27.1 General Requirements for Operators**

Each operator will be trained, certified/licensed, and evaluated in accordance with this section, prior to operating any equipment covered under this program, or the person is operating the equipment during a training period as an operator-in-training in accordance with subsection 13.27.2.

### **13.27.2 Operator Training**

Each operator-in-training will be provided with sufficient training, through a combination of formal and practical instruction, prior to operating the equipment to enable the operator-in training to operate the equipment safely under limitations established by this section and any additional limitations established by Don H. Mahaffey Drilling Co..

- a. Instructions will be provided on the knowledge and skills listed in subsection 13.27.7 to the operator-in-training.
- b. The operator-in-training will be continuously monitored on site by a trainer while operating equipment.
- c. Only tasks within the operator-in-training ability will be assigned. However, except as provided in subsection 11.27.2(c)(5), the operator-in-training will not operate the equipment in any of the following circumstances unless certified in accordance with 13.27.3(c):
  1. If any part of the equipment, load line or load (including rigging and lifting accessories), if operated up to the equipment's maximum working radius in the work zone, could get within 20 feet of a power line that is up to 350 kV, or within 50 feet of a power line that is over 350 kV.
  2. If the equipment is used to hoist personnel.
  3. In multiple-equipment lifts.
  4. If the equipment is used over a shaft, cofferdam, or in a tank farm.
  5. In multiple-lift rigging operations, except where the operator's trainer determines that the operator-in-training skills are sufficient for this high-skill work.
- d. An employee who is not qualified or certified under this section will be permitted to operated equipment only as an operator-in-training and will be monitored as follows when operating equipment covered by this program.
  1. Trainees may be authorized to operate equipment provided they are under the direct supervision of an individual ("operator's trainer") who meets all of the following requirements:
    - I. The term direct supervision means the supervising individual ("operator's trainer") is in the immediate area of the trainee and within visual sighting distance and able to effectively communicate with the trainee. When performing direct supervision, the supervising operator will have no other duties other than to observe the operation of the crane by the trainee.
    - II. The operator's trainer will be an employee or agent of Don H. Mahaffey Drilling Co.'s operator-in-training.

- III. The operator's trainer has the knowledge, training and experience necessary to direct the operator-in-training on the equipment in use and possesses a valid certificate of competency for the type of crane operated by the trainee.
- 2. For equipment other than tower cranes: The operator's trainer and the operator-in-training will be in direct line of sight of each other. In addition, they will communicate verbally or by hand signals. For tower cranes: The operator's trainer and the operator-in-training will be in direct communication with each other.
- e. Retraining: Retraining in relevant topics will be provided for each operator when, based on the performance of the operator or an evaluation of the operator's knowledge, there is an indication that retraining is necessary.

#### 13.27.3 Operator Certification and Licensing

Each operator will be certified or licensed to operate the equipment in accordance with subsection 13.27.4 Option 1, or 13.27.5 Option 2 as follows.

- a. Whenever operator certification or licensure is required under this section, the certification or licensure will be provided at no cost to employees.

#### 13.27.4 Option 1: Certification by an Accredited Crane Operator Certifying Entity

- a. Certificates will be valid for a maximum of five (5) years. An Accredited Certifying Entity will issue the certificate of competency to operators who successfully demonstrate the qualifications set forth in subsection 12.27.7.
  - 1. An operator will be deemed qualified to operate a particular piece of equipment if the operator is certified under this subsection for that type, or type and capacity of equipment or for higher-capacity equipment of that type. If no accredited testing agency offers certification examinations for a particular type of equipment, an operator will be deemed to have complied with the certification requirements for this section for that equipment if the operator has been certified for the type that is most similar to that equipment and for which a certification examination is available. The operator's certificate will state the type of equipment for which the operator is certified.
  - 2. A certification issued under this option (Option 1) is portable and meets the requirements of subsection 13.27.1.
- f. For a certification to satisfy the requirements of this option, the crane operator testing organization providing the certification will be accredited by an approved nationally recognized accrediting agency based on that agency's determination that industry-recognized criteria for written testing materials, practical examinations, test administration, grading, facilities/equipment, and personnel have been met.
  - 1. The accredited certifying entity will have its accreditation reviewed by the nationally recognized accrediting agency at least every three (3) years.

- g. Crane operators will re-certify every five (5) years and will be required to meet all of the qualifications set forth in subsection 13.27.4(a). Operators with at least one-thousand (1,000) hours of documented experience operating the specific type of crane for which re-certification is sought as covered by this section during the immediately preceding certification period and who meet the physical examination, substance abuse, and written examination requirements set forth in subsection 13.27.7(a)-(c) will not be required to take the “hands-on” examination specified in subsection 13.27.7(d) to re-certify.
- h. The accredited certifying entity will have procedures for operators to re-apply and be re-tested in the event an operator applicant fails a test or is decertified.

#### 13.27.5 Option 2: Licensing by a Government Entity

- a. For purposes of this section, a government licensing department/office that issues operator licenses for operating equipment covered by this program is considered a government accredited crane operator testing organization if the criteria in subsection 13.27.5(b) are met.
- b. Licensing criteria
  - 1. The requirements for obtaining the license include passing a physical examination and a substance abuse test as prescribed in subsections 13.27.7(a) and (b) and an assessment, by written and practical tests, of the operator applicant regarding, at a minimum, the knowledge and skills listed in subsections 13.27.7(c) and (d).
  - 2. The testing meets industry recognized criteria for written testing materials, practical examinations, test administration, grading, facilities/equipment and personnel.
  - 3. The government authority that oversees the licensing department/office, has determined that the requirements in subsections 13.27.5(b)(1) and (2) have been met.
  - 4. The licensing department/office has testing procedures for re-licensing designed to ensure that the operator continues to meet the requirements in subsection 13.27.7.
- c. A license issued by a government accredited crane operator testing organization that meets the requirements of this option:
  - 1. Meets the operator qualification requirements of this section for operation of equipment only within the jurisdiction of the government entity.
  - 2. Is valid for the period of time stipulated by the licensing department/office, but no longer than 5 years.

#### 13.27.6 Evaluation

- a. Through an evaluation, each operator will be qualified by a demonstration of the following:
  - 1. The skills and knowledge, as well as the ability to recognize and avert risk, necessary to operate the equipment safely, including those specific to the safety devices, operational aids, software, and the size and configuration of the equipment. Size and configuration includes, but is not limited to, lifting capacity, boom length, attachments, luffing jib, and counterweight set-up.

2. The ability to perform the hoisting activities required for assigned work, including, if applicable, blind lifts, personnel hoisting, and multi-crane lifts.
- b. For operators employed prior to April 6, 2020, a previous assessment of the operator may be relied upon in lieu of conducting a new evaluation of the operator's existing knowledge and skills.
- c. The evaluation required under subsection 13.27.6(a) will be conducted by an individual who has the knowledge, training, and experience necessary to assess equipment operators.
- d. The evaluator will be an employee or agent of the employer. Where Don H. Mahaffey Drilling Co. assigns evaluations to an agent, Don H. Mahaffey Drilling Co. will retain the duty to ensure that the requirements in subsection 13.27.6 are satisfied. Once the evaluation is completed successfully, the operator may be allowed to operate other equipment where it can be demonstrated that there is no required substantially different skills, knowledge, or ability to recognize and avert risk to operate.
- e. The completion of the evaluation will be documented. This document will provide: The operator's name; the evaluator's name and signature; the date; and the make, model, and configuration of equipment used in the evaluation. The documentation will be made available at the worksite while the operator is employed by Don H. Mahaffey Drilling Co.. For operators assessed per subsection 13.27.6(b), the documentation will reflect the date of the Don H. Mahaffey Drilling Co.'s determination of the operator's abilities and the make, model and configuration of equipment on which the operator has previously demonstrated competency.
- f. Where retraining is provided to an operator when required under subsection 13.27.2(d)(3), the operator will be re-evaluated with respect to the subject of the retaining upon completion.

#### 13.27.7 Certification Criteria

Only operators who have a valid certificate of competency (certificate) issued in accordance with this section by an Accredited Certifying Entity for the type of crane to be used will be permitted to operate a crane covered by this program. Certificates will be issued to operators who:

- a. Pass a physical examination conducted by a physician or other licensed health care professional (e.g. physician's assistant or nurse practitioner) which at a minimum will include the examination criteria specified in the American Society of Mechanical Engineers (ASME) B30.5-2000 standard, Chapter 5-3.1.2(a)(1-5, 7, 8) or the U.S. Department of Transportation (US DOT) physical examination requirements contained in 49 CFR Sections 391.41 through 391.49.
- b. Pass a substance abuse test: The level of testing will be consistent with the standard practice for the industry where the crane is in use and this test will be conducted by a recognized laboratory service.
- c. Pass a written examination developed, validated, and administered in accordance with generally accepted industry best practices. The exam will test knowledge and skills identified as necessary for safe crane operations and will, at a minimum, demonstrate the following:

1. The individual knows the information necessary for safe operation of the specific type of equipment the individual will operate, including all of the following:
    - I. The controls and operational/performance characteristics.
    - II. Emergency control skills, such as a response to fire, power line contact, loss of stability, or control malfunction;
    - III. Use of, and the ability to calculate (manually or with a calculator), load/capacity information on a variety of configurations of the equipment.
    - IV. Procedures for preventing and responding to power line contact.
    - V. Technical knowledge of the subject matter criteria listed in 29 CFR 1926, Subpart CC, Appendix C, applicable to the specific type of equipment the individual will operate. Use of the Appendix C criteria meets the requirements of this program.
    - VI. Technical knowledge applicable to the suitability of the supporting ground and surface to handle expected loads, site hazards, and site access.
    - VII. This program, including applicable incorporated materials.
  2. The individual is able to read and locate relevant information in the equipment manual and other materials containing information referred to in subsection 13.27.7(c)(1).
- d. Pass a “hands-on” examination to demonstrate proficiency in operating the specific type of crane, which at a minimum will include the following:
1. Ability to recognize, from visual and auditory observation, the items listed in subsection 16.1.
  2. Operational and maneuvering skills.
  3. Application of load chart information.
  4. Application of safe shut-down and securing procedures.

#### 13.27.8 Reciprocity

Operators trained, certified under Option 1, evaluated, and certified under this subsection, are qualified to work on projects in construction and in general industry.

##### *Exceptions to this Subsection:*

- a. Operators of derricks and sideboom cranes, or equipment with a maximum manufacturer-rated hoisting/lifting capacity of 2,000 pounds or less are not required to comply with this subsection.  
*Note: The training and qualification requirements of subsection 13.27 will continue to apply in those cases.*
- b. Operator qualification or certification under this subsection is not required for operation of articulating/knuckle-boom cranes having a boom length of less than 25 feet or a maximum rated load capacity of less than 15,000 pounds when used to deliver material to a construction site.
- c. Operators of electric line trucks (digger derrick trucks) as defined in Section 2700 of the Electrical Safety Orders, and regulated by Section 2940.7 of the High Voltage Electrical Safety Orders of the California Code of Regulations. This exception does not include mobile truck

- cranes designed and built in accordance with the American Society of Mechanical Engineers (ASME) B30.5 standards.*
- d. *Marine terminal operations regulated by Article 14 of the California Code of Regulations.*

### **13.28 Operating Practices**

- 13.28.1 Loose material, tools, lunch box, clothing, etc., will be stored in a manner which will not interfere with the operation of the crane or derrick controls.
- 13.28.2 The operator will respond to signals only from the appointed signal person, but shall obey a stop signal from any person.
- 13.28.3 Whenever the operator doubts the safety of a movement, the operator will have authority to stop the hoisting operation until a qualified person and the operator determine and agree that safety has been assured.
- 13.28.4 A warning signal will be sounded as required, particularly when approaching workers.
- 13.28.5 Before leaving the crane unattended, the operator will be required to:
- a. Land or properly secure any attached load, bucket, lifting magnet, or other device.
  - b. Disengage clutch.
  - c. Set travel, swing, boom brakes, and other locking devices unless otherwise specified by the certified agents.
  - d. Put controls in the "off" position.
  - e. Stop the engine or motor.
  - f. Secure crane against accidental travel.
- 13.28.6 Before closing the switch or starting the engine, all controls will be in the "off" position and all personnel in the clear.
- 13.28.7 If power fails during operation, the operator will be required to:
- a. Set all brakes and locking devices
  - b. Move all clutch or other power controls to the "off" position.
  - c. If practical, the suspended load will be landed under brake control.
- 13.28.8 The operator will be required to test all controls at the start of a new shift. If any controls do not operate properly, they will be adjusted or repaired before operations are begun.

### **13.29 Operation**

- 13.29.1 Employees will comply with all manufacturer procedures applicable to the operational functions of equipment, including its use with attachments.
- 13.29.2 Accessibility of Procedures
- a. The procedures applicable to the operation of the equipment, including rated capacities (load charts), recommended operating speeds, special



- hazard warnings, instructions, and operator's manual, will be readily available in the cab at all times for use by the operator.
- b. Where rated capacities are available in the cab in electronic or other form: In the event of a failure which makes the rated capacities inaccessible, the operator shall immediately cease operations or follow safe shut-down procedures until the rated capacities (in electronic or other form) are available.
- 13.29.3 The operator will not engage in any practice or activity that diverts their attention while actually engaged in operating the equipment, such as the use of cellular phones (other than when used for signal communications).
- 13.29.4 Unavailable Operation Procedures
- a. Where the manufacturer procedures are unavailable, Don H. Mahaffey Drilling Co. will develop and ensure compliance with all procedures necessary for the safe operation of the equipment and attachments.
  - b. Procedures for the operational controls will be developed by a certified agent.
  - c. Procedures related to the capacity of the equipment will be developed and signed by a certified agent.
- 13.29.5 Tagout
- a. Tagging out of service equipment/functions  
Where equipment has been taken out of service, a tag will be placed in the cab stating that the equipment is out of service and is not to be used. Where function(s) have been taken out of service, a tag will be placed in a conspicuous position stating that the function is out of service and is not to be used.
  - b. Response to "do not operate"/tagout signs
    1. If there is a warning (tagout or maintenance/do not operate) sign on the equipment or starting control, the operator will not activate the switch or start the equipment until the sign has been removed by a person authorized to remove it in accordance with Don H. Mahaffey Drilling Co.'s Energy Control (Lockout/Tagout).
    2. If there is a warning (tagout or maintenance/do not operate) sign on any other switch or control, the operator will not activate that switch or control until the sign has been removed by a person authorized to remove it in accordance with the provisions of Don H. Mahaffey Drilling Co.'s Energy Control (Lockout/Tagout).
- 13.29.6 Storm Warning
- When a local storm warning has been issued, the competent person will determine whether it is necessary to implement manufacturer recommendations for securing the equipment.
- 13.29.7 If equipment adjustments or repairs are necessary:
- a. The operator will, in writing, promptly inform the person designated by Don H. Mahaffey Drilling Co. to receive such information and, where there are successive shifts, to the next operator; and
  - b. All affected employees will be notified, at the beginning of each shift, of the necessary adjustments or repairs and all alternative measures.



- 13.29.8 Safety devices and operational aids will not be used as a substitute for the exercise of professional judgment by the operator.
- 13.29.9 The competent person will adjust the equipment and/or operations to address the effect of wind, ice, and snow on equipment stability and rated capacity.
- 13.29.10 Counterweight/Ballast
  - a. The following applies to equipment other than tower cranes:
    - 1. Equipment will not be operated without the counterweight or ballast in place as specified by the manufacturer.
    - 2. The maximum counterweight or ballast specified by the manufacturer for the equipment will not be exceeded.
  - b. Counterweight/ballast requirements for tower cranes are specified in subsection 12.3.15.

### **13.30 Floor-Operated Cranes**

- 13.30.1 Floor-operated cranes will be operated only by the following:
  - a. Designated operators.
  - b. Maintenance and test personnel when it is necessary in the performance of their work.
  - c. Inspectors in the performance of their duties.
- 13.30.2 Personnel will be required to pass a practical operating examination. Qualifications will be limited to the specific type of equipment for which they have been examined.

### **13.31 Assembly/Disassembly – Selection of Manufacturer or Don H. Mahaffey Drilling Co.’s Procedures**

When assembling or disassembling equipment or attachments, all applicable manufacturer prohibitions will be complied with, and employees will also comply with either:

- a. Manufacturer procedures applicable to assembly and disassembly, or
- b. Don H. Mahaffey Drilling Co.’s written procedures for assembly and disassembly. Don H. Mahaffey Drilling Co.’s procedures may be used only where it can be demonstrated that the procedures used comply with this program including subsection 13.34.

### **13.32 Assembly/Disassembly - General Requirements (Applies to All Assembly and Disassembly Operations)**

- 13.32.1 Supervision—Competent-Qualified Person
  - a. Assembly/disassembly will be directed by a person who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons (“A/D director”).
  - b. Where the assembly/disassembly is being performed by only one person, that person will meet the criteria for both a competent person

- and a qualified person. For purposes of this program, that person is considered the A/D director.
- c. The process of jumping the crane or derrick will be supervised by the A/D director.
- 13.32.2 Knowledge of Procedures  
The A/D director will understand the applicable assembly/disassembly procedures.
- 13.32.3 Review of Procedures  
The A/D director will review the applicable assembly/disassembly procedures immediately prior to the commencement of assembly/disassembly unless the A/D director understands the procedures and has applied them to the same type and configuration of equipment (including accessories, if any).
- 13.32.4 Crew Instructions
- a. Before commencing assembly/disassembly operations, the A/D director will ensure that the crew members understand all of the following:
    - 1. Their tasks.
    - 2. The hazards associated with their tasks.
    - 3. The hazardous positions/locations that they need to avoid.
  - b. During assembly/disassembly operations, before a crew member takes on a different task, or when adding new personnel during the operations, the requirements in subsections 15.31.1(a)(1) through 15.31.1(a)(3) of this section will be met.
- 13.32.5 Protecting Assembly/Disassembly Crew Members Out of Operator View
- a. Before a crew member goes to a location that is out of view of the operator and is either in, on, or under the equipment, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member will inform the operator that they are going to that location.
  - b. Where the operator knows that a crew member went to a location covered by subsection 15.31.5(a), the operator will not move any part of the equipment (or load) until the operator is informed in accordance with a prearranged system of communication that the crew member is in a safe position.
- 13.32.6 Working Under the Boom, Jib or Other Components  
When pins (or similar devices) are being removed, employees will not be under the boom, jib, or other components.
- 13.32.7 Capacity Limits  
During all phases of assembly/disassembly, rated capacity limits for loads imposed on the equipment, equipment components (including rigging), lifting lugs and equipment accessories, will not be exceeded for the equipment being assembled/disassembled.

#### 13.32.8 Addressing Specific Hazards

The A/D director supervising the assembly/disassembly operation will address the hazards associated with the operation, which include:

- a. Site and ground bearing conditions - Site and ground conditions will be adequate for safe assembly/disassembly operations and to support the equipment during assembly/disassembly.
- b. Blocking material - The size, amount, condition and method of stacking the blocking will be sufficient to sustain the loads and maintain stability.
- c. Proper location of blocking - When used to support lattice booms or components, blocking will be appropriately placed to:
  1. Protect the structural integrity of the equipment, and
  2. Prevent dangerous movement and collapse.
- d. Verifying assist crane loads - When using an assist crane, the loads that will be imposed on the assist crane at each phase of assembly/disassembly will be verified in accordance with subsection 15.11.2 before assembly/disassembly begins.
- e. Boom and jib pick points - The point(s) of attachment of rigging to a boom (or boom sections or jib or jib sections) will be suitable for preventing structural damage and facilitating safe handling of these components.
- f. Center of gravity
  1. The center of gravity of the load will be identified if that is necessary for the method used for maintaining stability.
  2. Where there is insufficient information to accurately identify the center of gravity, measures designed to prevent unintended dangerous movement resulting from an inaccurate identification of the center of gravity will be used.
- g. Stability upon pin removal - The boom sections, boom suspension systems (such as gantry A-frames and jib struts), and components will be rigged or supported to maintain stability upon the removal of the pins.
- h. Snagging - Suspension ropes and pendants will not be allowed to catch on the boom or jib connection pins or cotter pins (including keepers and locking pins).
- i. Struck by counterweights - The potential for unintended movement from inadequately supported counterweights and from hoisting counterweights.
- j. Boom hoist brake failure - Each time reliance is to be placed on the boom hoist brake to prevent boom movement during assembly/disassembly, the brake will be tested prior to such reliance to determine if it is sufficient to prevent boom movement. If it is not sufficient, a boom hoist pawl, other locking device/back-up braking device, or another method of preventing dangerous movement of the boom (such as blocking or using an assist crane) from a boom hoist brake failure will be used.
- k. Loss of backward stability - Backward stability before swinging the upperworks, travel, and when attaching or removing equipment components.
- l. Wind speed and weather - The effect of wind speed and weather on the equipment.

13.32.9 Cantilevered Boom Section

Manufacturer limitations on the maximum amount of boom supported only by cantilevering will not be exceeded. Where these are unavailable, a certified agent familiar with the type of equipment involved will determine in writing this limitation, which will not be exceeded.

13.32.10 Weight of Components

The weight of each of the components will be readily available.

13.32.11 Components and Configuration

- a. The selection of components, and configuration of the equipment, that affect the capacity or safe operation of the equipment will be in accordance with:
  1. Manufacturer instructions, prohibitions, limitations, and specifications. Where these are unavailable, a certified agent familiar with the type of equipment involved will approve, in writing, the selection and configuration of components; or
  2. Approved modifications that meet the requirements of Section 7.
- b. Post-assembly inspection - Upon completion of assembly, the equipment will be inspected to ensure compliance with subsection 17.31.13.

13.32.12 Shipping Pins

Reusable shipping pins, straps, links, and similar equipment will be removed. Once they are removed they will either be stowed or otherwise stored so that they do not present a falling object hazard.

13.32.13 Pile Driving

Equipment used for pile driving will not have a jib attached during pile driving operations.

13.32.14 Outriggers and Stabilizers

When the load to be handled and the operating radius require the use of outriggers or stabilizers, or at any time when outriggers or stabilizers are used, all of the following requirements will be met (except as otherwise indicated):

- a. The outriggers or stabilizers will be either fully extended or, if manufacturer procedures permit, deployed as specified in the load chart.
- b. The outriggers will be set to remove the equipment weight from the wheels, except for locomotive cranes. This provision does not apply to stabilizers.
- c. When outrigger floats are used, they will be attached to the outriggers. When stabilizer floats are used, they will be attached to the stabilizers.
- d. Each outrigger or stabilizer will be visible to the operator or to a signal person during extension and setting.
- e. Outrigger and stabilizer blocking will:
  1. Meet the requirements in subsections 13.31.8(b) and (c).
  2. Be placed only under the outrigger or stabilizer float/pad of the jack or, where the outrigger or stabilizer is designed without a jack, under

the outer bearing surface of the extended outrigger or stabilizer beam.

- f. For locomotive cranes, when using outriggers or stabilizers to handle loads, the manufacturer's procedures will be followed. When lifting loads without using outriggers or stabilizers, the manufacturer's procedures will be met regarding truck wedges or screws.

#### 13.32.15 Rigging

In addition to following the requirements of section 17 of the program and other requirements in the standards of the California Code of Regulations applicable to rigging, when rigging is used for assembly/disassembly, it will be ensured that:

- a. The rigging work is done by a qualified rigger.
- b. Synthetic slings are protected from abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity, such as distortion or localized compression.
- c. Additional requirements for the protection of all types of slings are contained in section 17 of this program.

### **13.33 Disassembly – Additional Requirements for Dismantling of Booms and Jibs (Applies to Both the Use of Manufacturer Procedures and Don H. Mahaffey Drilling Co.'s Procedures)**

*Note: "Dismantling" includes dismantling for changing the length of booms and jibs.*

- 13.33.1 None of the pins in the pendants are to be removed (partly or completely) when the pendants are in tension.
- 13.33.2 None of the pins (top or bottom) on boom sections located between the pendant attachment points and the crane/derrick body are to be removed (partly or completely) when the pendants are in tension.
- 13.33.3 None of the pins (top or bottom) on boom sections located between the uppermost boom section and the crane/derrick body are to be removed (partly or completely) when the boom is being supported by the uppermost boom section resting on the ground (or other support).
- 13.33.4 None of the top pins on boom sections located on the cantilevered portion of the boom being removed (the portion being removed ahead of the pendant attachment points) are to be removed (partly or completely) until the cantilevered section to be removed is fully supported.

### **13.34 Assembly/Disassembly – Don H. Mahaffey Drilling Co.'s Procedures – General Requirements**

- 13.34.1 Where company procedures are used instead of manufacturer procedures for assembly/disassembly, it will be ensured that the procedures:
  - a. Prevent unintended dangerous movement, and prevent collapse, of any part of the equipment.
  - b. Provide adequate support and stability of all parts of the equipment.

- c. Position employees involved in the assembly/disassembly operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized.

13.34.2 Procedures will be developed by a certified agent.

### **13.35 Power Line Safety (Up to and Including 350kV) – Assembly and Disassembly**

- 13.35.1 Before assembling or disassembling equipment, it will be determined if any part of the equipment load line, or load (including rigging and lifting accessories) could get, in the direction or area of assembly/disassembly, closer than 20 feet to a power line during the assembly/disassembly process. If so, the requirements in Option 1, Option 2, or Option 3 of this subsection will be met as follows:
  - a. Option 1 - De-energize and ground: Confirm from the utility owner/operator that the power line has been de-energized and visibly grounded at the worksite.
  - b. Option 2 - 20 foot clearance: Ensure that no part of the equipment, load line or load (including rigging and lifting accessories), gets closer than 20 feet to the power line by implementing the measures specified in subsection 13.34.2 of this subsection.
  - c. Option 3 - Table A clearance:
    - 1. Determine the line's voltage and the minimum clearance distance permitted under Table A.
    - 2. Determine if any part of the equipment, load line, or load (including rigging and lifting accessories), could get closer than the minimum clearance distance to the power line permitted under Table A. If so, employees will follow the requirements of subsection 13.34.2 to ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer to the line than the minimum clearance distance.
- 13.35.2 Where encroachment precautions are required under Option (2), or Option (3) of this section, all of the following requirements will be met:
  - a. Conduct a planning meeting with the Assembly/Disassembly director (A/D director), operator, assembly/disassembly crew and the other workers who will be in the assembly/disassembly area to review the location of the power line(s) and the steps that will be implemented to prevent encroachment/ electrocution.
  - b. If tag lines are used, they shall be nonconductive.
  - c. At least one of the following additional measures will be in place. The measure selected from this list will be effective in preventing encroachment. The additional measures are:
    - 1. Use a dedicated spotter who is in continuous contact with the equipment operator. The dedicated spotter will:
      - i. Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: A clearly visible line painted on the ground; a clearly visible line of stanchions; a set of clearly visible line-of-sight landmarks (such as a fence post



behind the dedicated spotter and a building corner ahead of the dedicated spotter).

- II. Be positioned to effectively gauge the clearance distance.
  - III. Where necessary, use equipment that enables the dedicated spotter to communicate directly with the operator.
  - IV. Give timely information to the operator so that the required clearance distance can be maintained.
- 2. A proximity alarm set to give the operator sufficient warning to prevent encroachment.
  - 3. A device that automatically warns the operator when to stop movement, such as a range control warning device. Such a device will be set to give the operator sufficient warning to prevent encroachment.
  - 4. A device that automatically limits range of movement, set to prevent encroachment.
  - 5. An elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings.

13.35.3 Assembly/disassembly below power lines is prohibited. No part of a crane/derrick, load line, or load (including rigging and lifting accessories), whether partially or fully assembled, is allowed below a power line unless it has been confirmed that the utility owner/operator has de-energized and (at the worksite) visibly grounded the power line.

13.35.4 Assembly/disassembly inside Table A clearance prohibited. No part of a crane/derrick, load line, or load (including rigging and lifting accessories), whether partially or fully assembled, is allowed closer than the minimum approach distance under Table A to a power line unless the employer has confirmed that the utility owner/operator has de-energized and (at the worksite) visibly grounded the power line.

13.35.5 Voltage Information

Where Option (3) of this section is used, the utility owner/operator of the power lines will provide the requested voltage information within two working days of the Don H. Mahaffey Drilling Co.'s request.

13.35.6 Power Lines Presumed Energized

It will be assumed that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.

13.35.7 Posting of Electrocution Warnings

There will be at least one electrocution hazard warning conspicuously posted in the cab so that it is in view of the operator and (except for overhead gantry and tower cranes) at least two on the outside of the equipment.



### 13.36 Fall Protection – Supplemental/Specific Requirements for Cranes

#### 13.36.1 Application

- a. Subsections 13.35.2, 13.35.3(b), 13.35.5, and 13.35.6 apply to all equipment covered by this program except tower cranes.
- b. Subsections 13.35.3(a) and 13.35.4 apply to all equipment covered by this program.
- c. Subsections 13.35.3(c) and 13.35.7 apply only to tower cranes.

#### 13.36.2 Boom Walkways (Lattice Booms)

- a. Equipment manufactured after July 7, 2012, with lattice booms will be equipped with walkways on the boom(s) if the vertical profile of the boom (from cord centerline to cord centerline) is 6 or more feet.
- b. Boom walkway criteria.
  1. The walkways will be at least 12 inches wide.
  2. Guardrails, railings and other permanent fall protection attachments along walkways are:
    - I. Prohibited on booms supported by pendant ropes or bars if the guardrails/railings/attachments could be snagged by the ropes or bars.
    - II. Prohibited if of the removable type (designed to be installed and removed each time the boom is assembled/disassembled).
    - III. Where not prohibited, guardrails or railings, if provided, may be of any height up to, but not more than, 45 inches.

#### 13.36.3 Steps, Handholds, Ladders, Grabrails, Guardrails and Railings

- a. Originally-equipped steps, handholds, ladders and guardrails/railings/grabrails will be maintained in good condition.
- b. Equipment (other than tower cranes) manufactured after July 7, 2012, will be equipped so as to provide safe access and egress between the ground and the operator work station(s), including the forward and rear positions, by the provision of devices such as steps, handholds, ladders, and guardrails/railings/grabrails.
- c. Tower cranes manufactured after July 7, 2012, will be equipped so as to provide safe access and egress between the ground and the cab, machinery platforms, and tower (mast), by the provision of devices such as steps, handholds, ladders, and guardrails/railings/grabrails.
- d. Walking/stepping surfaces, except for crawler treads, will have slip resistant features/properties (such as diamond plate metal, strategically placed grip tape, expanded metal, or slip-resistant paint).

#### 13.36.4 Personal Fall Arrest and Fall Restraint Systems

Personal fall arrest and fall restraint systems shall conform to the requirements of Construction Safety Orders Article 24, Fall Protection of the California Code of Regulations.

#### 13.36.5 For non-assembly/disassembly work, fall protection equipment will be provided and used for employees who are on a walking/working surface with an unprotected side or edge more than 7-1/2 feet above a lower level as follows:

- a. When moving point-to-point:
  1. On non-lattice booms (whether horizontal or not horizontal).

2. On lattice booms that are not horizontal.  
Exception: On horizontal lattice booms where the fall distance is 15 feet or less.
- b. While at a work station on any part of the equipment (including the boom, of any type), except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

*Exceptions to subsection 13.35.5:*

- a. For tower cranes, see subsection 11.35.7 of the subsection.
- b. Marine terminal operations are regulated by Article 14 of the California Code of Regulations.

- 13.36.6 For assembly/disassembly work, fall protection equipment will be provided and used for employees who are on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level.

*Exception:*

- a. When the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.
- b. For tower cranes, see subsection 13.35.7 of this subsection.

#### 13.36.7 Tower Cranes

- a. For work other than erecting, climbing, and dismantling, fall protection equipment will be provided and used for employees who are on walking/working surface with an unprotected side or edge more than 7-1/2 feet above a lower level.  
*Exception: When the employee is in the cab, or on the deck.*
- b. For erecting, climbing, and dismantling work, fall protection equipment will be provided and used for employees who are working on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level.

### 13.37 Training – Supplemental Requirements for Cranes in Construction

- 13.37.1 Each operator will be trained in accordance with subsection 13.27.1 and 13.27.2 on the safe operation of the equipment the operator will be using.
- 13.37.2 Each operator covered by this program will be trained in the following practices:
  - a. Whenever moving a boom off a support, first raise the boom a short distance (sufficient to take the load of the boom) to determine if the boom hoist brake requires adjustment.  
*Note: Where more specific manufacturer's instructions are available for this process, they will apply.*
    1. If the brake does not hold and cannot be adjusted to hold, the condition will be repaired.
    2. See subsections 13.29.5 and 13.29.7 for additional requirements.
  - b. Where available, the manufacturer's emergency procedures for halting unintended equipment movement.

## 14 SAFETY DEVICES AND OPERATIONAL AIDS

### 14.1 Safety Devices

- 14.1.1 The following safety devices are required on all equipment covered by this program, as applicable, unless otherwise specified:

*Note: See subsection 11.5*

- a. Crane level indicator:
  1. The equipment will have a crane level indicator that is either built into the equipment or is available on the equipment.
  2. If a built-in crane level indicator is not working properly, it will be tagged out or removed. If a removable crane level indicator is not working properly, it will be removed.  
*Exception: This requirement does not apply to portal cranes and derricks.*
- b. Boom stops, except for derricks and hydraulic booms.
- c. Jib stops (if a jib is attached), except for derricks.
- d. Equipment with foot pedal brakes will have locks.
- e. Hydraulic outrigger jacks and hydraulic stabilizer jacks will have an integral holding device/check valve.
- f. Equipment on rails, except for portal cranes, will have rail clamps and rail stops.
- g. The equipment will have a horn that is either built into the equipment or is on the equipment and immediately available to the operator.
- h. Anti-two-blocking device:
  1. Telescopic boom cranes.
  2. Lattice boom cranes.
  3. Articulating boom cranes.
- i. Boom angle or radius indicator - The equipment will have a boom angle or radius indicator readable from the operator's station.  
*Exception: Boom angle or radius indicator not applicable to articulating cranes.*
- j. A jib angle indicator will be provided if the equipment has a luffing jib.
- k. Load weighing and similar devices.
- l. Boom hoist limiting device - For equipment manufactured after December 16, 1969, a boom hoist limiting device is required.
- m. Luffing jib limiting device - Equipment with a luffing jib will have a luffing jib limiting device.

14.1.2 Proper Operation Required

Operations will not begin unless all of the safety devices listed in this subsection are in proper working order. If a required safety device stops working properly during operations, the operation shall be safely stopped. If any device listed in this section is not in proper working order, the equipment will be taken out of service and operations will not resume until the device is again working properly. Alternative measures are not permitted to be used.

*Exceptions to 14.1.2:*

- a. For subsection 14.1.1 (i) and (j), see subsection 8.4.
- b. For subsection 14.1.1 (k), see subsection 8.4.

## 14.2 Operational Aids

14.2.1 The devices listed in this section (“listed operational aids”) are required on all mobile cranes and derricks covered by this program, as applicable, unless otherwise specified.

14.2.2 Operations will not begin unless the listed operational aids, as applicable, are in proper working order.

*Exception: Where an operational aid is being repaired specified temporary alternative measures will be used; however, more protective alternative measures specified by the crane/derrick manufacturer, if any, will be followed.*

14.2.3 If a listed operational aid stops working properly during operations, the operator will safely stop operations until the device is repaired, or the device is again working properly. Any replacement part or device utilized will perform the same type function as permitted subject to the provisions of Section 3.

a. Where an operational aid is being repaired, specified temporary alternative measures will be used; however, more protective alternative measures specified by the crane/derrick manufacturer, if any, will be followed.

## 14.3 Operational Aids and Alternative Measures

Operational aids listed in this section that are not working properly will be repaired no later than 7 calendar days after the deficiency occurs subject to the provisions of subsection 14.2. See subsection 13.28 for additional requirements.

a. Boom length indicator if the equipment has a telescopic boom.  
b. The following devices are required on equipment manufactured after July 7, 2012.

1. Outrigger/stabilizer position (beam extension) device or system if the equipment has outriggers or stabilizers.

**Temporary alternative measures:** The operator will verify that the position of the outriggers or stabilizers is correct (in accordance with manufacturer procedures) before beginning operations requiring outrigger or stabilizer deployment.

2. Hoist drum rotation indicator if the equipment has a hoist drum not visible from the operator's station.

**Temporary alternative measures:** Mark the drum to indicate the rotation of the drum. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

## 15 TESTING

### 15.1 Operational Testing

- 15.1.1 In addition to prototype tests by the manufacturer, and prior to initial use, each new crane or derrick, or any crane or derrick which is structurally altered due to repair, will be inspected and tested by the certified agent to insure compliance with the provisions of this program, including the following functions where applicable:
  - a. Hoisting and lowering boom and load
  - b. Swing mechanism
  - c. Travel mechanisms, trolley, bridge, carrier
  - d. Limit switches, locking, and other safety devices
- 15.1.2 Visual examination will be made of welds and other attachments of the critically stressed members.
- 15.1.3 Where the complete production crane is not supplied by one manufacturer, such tests will be conducted at final assembly.

### 15.2 Equipment Over Three Tons Rated Capacity

All cranes and derricks used in lifting service, exceeding three tons rated capacity, and their accessory gear will not be used until it has been ascertained that such equipment has been certificated as evidenced by current and valid documents attesting to compliance with the following:

- a. Tests and examinations will be conducted annually by a currently licensed certifying agency or designee listed in the certifying agency license, and a certificate will be issued by the certifying agency.
- b. Certificates (annual and quadrennial) attesting to current compliance with testing and examination standards of requirements will be maintained for each crane or derrick and will be in a form acceptable to the Division.

*Note: The term "lifting service" as used in this section is not intended to include operations of the following equipment:*

- a. Clamshells, draglines and other similar equipment used for casting-type work
- b. Pile drivers, other than those using gravity (drop) hammers.

### 15.3 Proof Load Test and Examination of Cranes and Their Accessory Gear

- 15.3.1 Proof load tests of cranes will be carried out at the following intervals:
  - a. In the case of new cranes, before being taken into initial use and every 4 years thereafter.
  - b. In the case of uncertificated cranes which have been in use, at the time of initial certification and every 4 years thereafter.
  - c. In the case of major modifications or repairs to important structural components, before they are returned to service.
  - d. When certificated equipment is out of service for 6 months or more beyond the due date of a certification inspection, an examination equivalent to an initial certification, including proof load test, will be performed before the equipment re-enters service.

*Exception to subsection 15.3.1 for cranes having a maximum rated capacity greater than one ton but not exceeding three tons:*

- 1. Prior to initial use the crane will be tested using the criteria of subsection 15.3.3. Testing will be performed by, or under the direction of, a qualified person. The test reports will be retained on file and available with each crane.*
- 2. Quadrennial (every 4 years after initial) proof load tests are not required.*

*Notes for subsection 15.3.1:*

- a. For General Industry: Disassembly and reassembly of equipment does not require recertification of the equipment provided that the equipment is reassembled and used in a manner consistent with its certification.*
- b. Post-assembly for Cranes and Derricks in Construction: See additional requirements in subsection 15.2.*
- c. Fixed and mobile tower cranes: See additional requirements in Section 344.81 of the California Code of Regulations.*

15.3.2 Proof load tests of cranes will be carried out with the boom in the least stable direction relative to the mounting.

15.3.3 Proof load tests will be based on the manufacturer's load ratings for the conditions of use and will consist of the application of a proof load as large as possible, but not exceeding 110 percent of the maximum load ratings for the boom on the crane. Proof loads will be applied at the designed maximum and minimum boom angles or radii or as close to these as practicable and at such intermediate radii as the certifying agency may deem necessary. Trolley equipped monorail cranes and overhead cranes shall be tested to a proof load as close as possible, but not exceeding 125 percent of the manufacturer's load rating. Monorail cranes and overhead cranes will be tested by traversing the proof load weight the full length of the track, bridge/runway(s) and cross-overs, in all directions capable of operation, where practicable. In cases of foreign manufacture, the manufacturer's specifications will be subject to approval by the certified agent as being equivalent to U.S. practice. The weight of all auxiliary handling devices such as, but not limited to, magnets, hooks, slings, and clamshell buckets will be considered part of the load, except lifting devices which are designed as an integral part of the crane. Other methods of proof load testing may be substituted for the above where acceptable to the Division.

*Note: The manufacturer's load ratings are usually based upon percentage of tipping loads under some conditions and upon limitations of structural competence under others, as well as on other criteria such as type of crane mounting, whether or not outriggers are used, etc. Some cranes utilizing a trolley may have only one load rating assigned and applicable at any outreach. It is important that the manufacturer's ratings be used.*

15.3.4 An examination will be carried out in conjunction with each proof load test. The certifying agency will make a determination as to requirements for



the correction of deficiencies found. The examination will cover the following points as applicable:

- a. All functional operating mechanisms for improper function, maladjustment, cracks, distortion, or excessive component wear, with particular attention to sheaves, pins, and drums, bearings, shafts, gears, rollers, and locking devices. This will include operation with partial load, in which all functions and movements, including, where applicable, maximum possible rotation in both directions, are performed.
- b. All safety devices and operational aids for proper operation (including significant inaccuracies).
- c. Deterioration, abnormal wear or performance, or leakage in lines, tanks, valves, drains, pumps, joints, fittings and other parts of pneumatic, hydraulic or other pressurized systems.
- d. Loose gear components (i.e. hooks, etc.), including wire rope and wire rope terminals and connections, with particular attention to sections of wire rope exposed to abnormal wear and sections not normally exposed for examination. Cracked or deformed hooks will be discarded.
- e. Rope reeving for compliance with certified agent's recommendations.
- f. Deformed, cracked, or excessively corroded members in crane structure and boom.
- g. Loose bolts, rivets, or other connections.
- h. Worn, cracked, or distorted parts affecting safe operation.
- i. Excessive wear on and free operation of brake and clutch system parts, linings, pawls, and ratchets.
- j. Load, boom angle, or other indicators will be checked for any inaccuracy.
- k. It will be ascertained that there is a durable rating chart visible to the operator, covering the complete range of the certified agent's capacity ratings at all operating radii, for all permissible boom lengths and jib length, with alternate ratings for optional equipment affecting such ratings. Necessary precautions or warnings will be included and operating controls marked or an explanation of controls will be posted at the operator's position to indicate function.
- l. Careful examination of the junction areas of removable boom sections, particularly for proper seating, cracks, deformities, or other defects in securing bolts and in the vicinity of such bolts.
- m. It will be ascertained that no counterweights in excess of the certified agent's specifications are fitted.
- n. Welds for cracks.
- o. Electrical components and wiring for cracked or split insulation and loose or corroded terminations.
- p. Operator seat (when applicable): Installed and serviceable.
- q. Steps, ladders, handrails, handholds, guards, where provided or required by other sections of this program: In usable and safe condition.
- r. Such other examinations deemed necessary under the circumstances.

## **15.4 Test Weights**

- 15.4.1 Test weights will be legibly marked to indicate the documented weight.



- 15.4.2 Lifting attachments on test weights will be visually inspected prior to each use. Damaged or defective lifting attachments that are not suitable for safe use will not be used.
- 15.4.3 Embedded wire rope and reinforcing steel (rebar) will not be used as lifting attachments.

## 15.5 Proof Load Test and Examination of Derricks and Their Accessory Gear

- 15.5.1 Proof load tests of derricks shall be carried out at the same intervals as specified in subsection 15.3.1.
- 15.5.2 Proof load tests and safe working load ratings will be based on the designed load ratings at the ranges of boom angle or operating radii. Proof loads will exceed the safe working load (SWL) as follows:

SWL	Proof Load
Up to 20 tons	25 percent in excess
20-50 tons	5 tons in excess
Over 50 tons	10 percent in excess

Proof loads will be applied at the designed maximum and minimum boom angles or radii or, if this is impracticable, as close to these as practicable. The angles or radii of test will be in the certificate of test. Proof loads will be swung as far as possible in both directions. The weight of all auxiliary handling devices such as blocks, hooks, etc., will be considered a part of the load.

- 15.5.3 After satisfactory completion of a proof load test, the derrick and all component parts thereof shall be carefully examined in all applicable respects to the requirements of subsection 15.3.4.

## 15.6 Examination of Bulk Cargo Handling Devices

All bulk cargo handling devices, together with any portable extension, rigging components, outriggers, and attachment points, supporting them or any of their components vertically, need not be tested but will be examined by a certifying agency when first certificated and annually thereafter. The examination will be carried out with particular attention to the condition of rope and accessories. The equipment will not be considered satisfactory unless, in the opinion of the certifying agency as stated in subsection 15.2 it is deemed fit to serve its intended function.

## 15.7 Certificates

If the equipment meets the requirements set forth in subsection 15.2, 15.3, 15.5, and 15.6 a certificate will be issued indicating that the required tests and/or examinations have been performed and that any defects found by such examination and tests have been corrected and that the equipment is in safe operating condition at the time of examination. A copy of such certificate will be available with each crane and derrick or at the project site.

## **15.8 Determination of Crane or Derrick Safe Working Loads and Limitations in Absence of Manufacturer's Data**

15.8.1 In the event neither manufacturer's data nor design data on safe working loads (including any applicable limitations) are obtainable, the safe working load ratings assigned will be based on the certified agent's analysis. Test certificates will state the basis for any such safe working load assignment. For mobile cranes, stability will also be determined by the certified agent in accordance with SAE J 765, October 1980.

15.8.2 Analysis test reports will be readily available.

## **15.9 Safe Working Load Reduction**

If the operation in which equipment is engaged never utilizes more than a fraction of the safe working load rating, the equipment may have the crane or derrick certificated for and operated at a lesser maximum safe working load in keeping with the use and based on radius and other pertinent factors; provided, however, that the equipment concerned is physically capable of operation at the load rating and load reduction is not for the purpose of avoiding correction of any deficiency. Load rating charts will be changed accordingly.

## **15.10 Safe Working Load Increase**

In no case will safe working loads be increased beyond the manufacturer's ratings or the original design limitations unless such increase meets with the manufacturer's approval. Where the manufacturer's services are not available, or where the equipment is of foreign manufacture, engineering design analysis by, or acceptable to, the certified agent is required. All necessary structural changes will be carried out.

# **16 INSPECTION AND MAINTENANCE**

## **16.1 Inspection**

16.1.1 A qualified person will visually inspect the crane's or derrick's controls, rigging and operating mechanism prior to the first operation on any work shift. Any unsafe conditions disclosed by the inspection requirements of this section will be corrected promptly. Defective components of equipment which create an imminent safety hazard will be replaced, repaired or adjusted prior to use.

### **16.1.2 Frequency of Inspections**

Daily visual inspections by the operator or other qualified person will be made of/for:

- a. All functional mechanisms for excessive wear, or maladjustments interfering with proper operation.
- b. Lines, tanks, valves, pumps, and other parts of air, hydraulic, or other pressurized systems for contamination, deterioration or leakage, particularly lines which flex in normal operation.
- c. Hydraulic system for proper fluid level.

- d. Hooks and latches for deformation, cracks, excessive wear, or damage.
- e. Hoist or load attachment chains including end connections for excessive wear, twist, distorted or stretched links interfering with proper function.
- f. Excessive wear, broken wires, stretch, kinking, or twisting of ropes and rope slings, including end connections.
- g. Wire rope reeving for compliance with the crane manufacturer's specifications.
- h. Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt or moisture accumulation.
- i. Tires, when used to support the lifting operation, for proper inflation and condition.
- j. Ground conditions around the crane support system, including ground settling and ground water accumulation.  
*Exception: This subsection does not apply to the inspection of ground conditions for railroad tracks and their underlying support when the railroad tracks are part of the general railroad system of transportation that is regulated pursuant to the Federal Railroad Administration under 49 CFR Part 213.*
- k. The crane for level within the tolerances specified by the crane manufacturer's recommendations, both before each shift and after each move and setup.
- l. Operator cab windows for cracks, breaks, or other deficiencies that impair the operator's view.
- m. Locomotive, hammerhead tower cranes, and other specialized rail-mounted cranes in construction: Rails, rail stops, rail clamps (as applicable) and supporting surfaces when the equipment has rail traveling.  
*Exception: This subsection does not apply to the inspection of rails, rail stops, rail clamps and supporting surfaces when the railroad tracks are part of the general railroad system of transportation that is regulated pursuant to the Federal Railroad Administration under 49 CFR Part 213.*
- n. Safety devices and operational aids for proper operation.
- o. The operation of all limit switches without a load on the hook.

#### 16.1.3 Periodic Inspections

- a. Frequency:
  - 1. Periodic inspections will be conducted at least four times a year.
  - 2. Cranes handling molten metal will be inspected at least weekly when in use and necessary repairs made.
- b. The annual certification, as required by subsection 15.2.1, can serve as one of the required periodic inspections. The periodic inspections will be evenly spaced or as close to evenly spaced as scheduling permits through the year. Cranes will not be operated more than 750 hours, between periodic inspections.
- c. The inspection shall include the following in addition to the items in subsection 16.1.2 above:
  - 1. Excessive wear of all functional operating mechanisms.
  - 2. Ropes, brakes, friction clutches, chain drives, and other parts subject to wear which may be readily inspected.
  - 3. An inspection record will be maintained which includes the items inspected and the results of the inspection, the date of the

inspection, the signature of the person who performed the inspection, and the serial number or other identifier of the crane inspected. The most recent inspection record will be maintained on file.

16.1.4 Annual/Comprehensive

In any year in which no quadrennial (every four years) proof load test is required on cranes or derricks, such equipment will be examined by a qualified person as described in subsection 15.2. Such examination will be made not later than the anniversary date of the quadrennial certification and shall conform with the requirements of 15.3.4 and the following:

- a. Crane hooks with cracks or with deformation of throat opening more than 15 percent in excess of normal opening or more than 10 degree twist from plane of unbent hook will be removed from service.
- b. Ropes will be inspected for proper lubrication, excessive wear, broken strands, and proper reeving.

*Note 1: Many variable factors are involved in determining the exact time for replacement of rope and timely replacement for safety. Conditions such as the following will be sufficient reason for replacement:*

- a. *In running ropes, 6 randomly distributed broken wires in one rope lay, or 3 broken wires in one strand in one lay.*
- b. *Wear of 1/3 the original diameter of outside individual wires.*
- c. *Kinking, crushing, bird caging, or other damage resulting in distortion of the rope structure. Evidence of any heat damage.*
- d. *Reductions from nominal diameter of more than:*
  - 1. *1/64 inch for diameters up to 5/16 inch*
  - 2. *1/32 inch for diameters 3/8 inch to 1/2 inch*
  - 3. *3/64 inch for diameters 9/16 inch to 3/4 inch*
  - 4. *1/16 inch for diameters 7/8 inch to 1 1/8 inch*
  - 5. *3/32 inch for diameters 1 1/4 inch to 1 1/2 inch*
- e. *In standing ropes, more than 2 broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.*
- f. *Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.*

*Note 2: See subsection 16.9 for additional requirements for cranes in construction.*

- c. In order to establish data for judging the proper time for replacement of hoisting rope, a continuing inspection record will be maintained. The record will cover factors of deterioration as listed in subsections 16.1.2, 16.1.3, and 16.1.4.
- d. Whenever it is considered necessary by the certifying agency or authorized representative and whenever it is practical and advisable to avoid disassembly of equipment, removal of pins, etc., examination of structure or parts by electronic, ultrasonic, or other nondestructive methods will be carried out.
- e. Documentation of annual/comprehensive inspection - An inspection record will be maintained which includes the items inspected and the results of the inspection, the date of the inspection, the name and signature of the authorized certifying agent, the serial number or other identifier of the crane inspected, and other information as required

by 4885 Plates of the California Code of Regulation. Inspection records will be maintained on file for a minimum of 48 months. The most recent inspection record will be maintained on file. All documents produced under this section will be available, during the applicable document retention period, to all persons who conduct inspections under this section.

- 16.1.5 Any part of a manufacturer's procedures regarding inspections that relate to safe operation (such as to a safety device or operational aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) that is more comprehensive or has a more frequent schedule of inspection than the requirements of this section will be followed.
- 16.1.6 All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed will be given a thorough inspection before it is placed in service. This inspection will be for all types of deterioration and will be performed by a qualified person whose approval will be required for further use of the rope. A certification record will be made available for inspection which includes the date of inspection, the signature of the person who performed the inspection, and an identifier of the rope which was inspected.
- 16.1.7 Equipment that has been idle for 3 months or more will be inspected by a qualified person in accordance with the requirements of subsection 16.1.3 before initial use.

## **16.2 Inspection – Post-Assembly**

Upon completion of assembly, and before use, the crane will be inspected by a qualified person to assure that it is configured in accordance with the manufacturer's criteria.

*Note: Disassembly and reassembly of equipment does not require recertification of the equipment provided that the equipment is reassembled and used in a manner consistent with its certification.*

## **16.3 Inspection – Modifications or Additions**

- 16.3.1 Equipment that has had modifications or additions which affect the safe operation of the equipment or capacity (such as modifications or additions involving a critical part of a control system, power plant, or load sustaining structural components) will be inspected by a certified agent after such modifications/additions have been completed, prior to initial use.
- 16.3.2 Such modifications or additions will meet or exceed manufacturer's specifications and the original safety factors of the equipment will not be reduced.

- 16.3.3 The inspection will meet all of the following requirements:
- a. The inspection will assure that the modifications or additions have been done in accordance with the approval obtained pursuant to section 3.
  - b. The inspection will include functional testing of the equipment.

*Exception: These inspections may be performed by a qualified person for cranes not exceeding 3 tons rated capacity.*

#### **16.4 Repaired/Adjusted Equipment**

Equipment that has had a repair or adjustment that relates to safe operation (such as a repair or adjustment to a safety device or operational aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) will be inspected by a qualified person after such a repair or adjustment has been completed, prior to initial use. The inspection will meet all of the following requirements:

- a. The qualified person will determine if the repair/adjustment meets manufacturer equipment criteria (where applicable and available).
- b. Where manufacturer equipment criteria are unavailable or inapplicable, the qualified person will:
  1. Determine if a certified agent is needed to develop criteria for the repair/adjustment. If a certified agent is not needed, the criteria will be developed by a qualified person. If a certified agent is needed, a certified agent will develop the criteria.
  2. Determine if the repair/adjustment meets the criteria developed in accordance with subsection 16.4(b)(1).
- c. The inspection will include functional testing of the repaired/adjusted parts and other components that may be affected by the repair/adjustment.
- d. Equipment will not be used until an inspection under this section demonstrates that the repair/adjustment meets the requirements of subsection 14.4(a) or (b).

#### **16.5 Maintenance**

A preventive maintenance program, based on the certified agent's recommendations, will be established and dated. Detailed records will be available to the Division.

#### **16.6 Qualifications of Maintenance and Repair Employees**

- 16.6.1 Maintenance, inspection and repair personnel are permitted to operate the equipment only where all of the following requirements are met:
- a. The operation is limited to those functions necessary to perform maintenance, inspect the equipment, or verify its performance.
  - b. The personnel either:
    1. Operate the equipment under the direct supervision of an operator who meets the requirements of subsection 13.25 as applicable; or
    2. Are familiar with the operation, limitations, characteristics and hazards associated with the type of equipment.



- 16.6.2 Maintenance and repair personnel will meet the definition of a qualified person with respect to the equipment and maintenance/repair tasks performed.

## **16.7 Adjustments and Repairs**

- 16.7.1 Adjustments and repairs will be done by qualified persons.
- 16.7.2 Before adjustments and repairs are started on a crane or derrick, the following precautions will be taken as applicable:
- a. Cranes will be placed where they will cause the least interference to and be least interfered with by other equipment or operations in the area.
  - b. Boom and load block will be lowered to the ground or floor, if possible, or otherwise secured against dropping.
  - c. All power controls will be locked or otherwise secured in the stop position and starting means rendered inoperative.
  - d. Warnings and barriers will be placed to warn others from danger area and protect the crane under repair from being struck by other machines or equipment.
- 16.7.3 After all repairs and adjustments have been made, the crane will not be operated until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed, including all loose material.
- 16.7.4 Adjustments will be maintained to assure correct functioning of the following components:
- a. All functional operating mechanisms.
  - b. Safety devices.
  - c. Control systems.
  - d. Power plants.
  - e. Brakes.
- 16.7.5 When welding repair procedures are required on load sustaining members, instructions will be provided by the certified agent and those instructions will be followed where applicable. Welds on all critical crane or derrick parts will be performed only by qualified welders who are certified to perform high quality welding.
- 16.7.6 All repair welds performed on critically stressed members, such as boom chord, mast chord, and main deck girders (where permitted by a certified agent), will be magnetic particle tested or tested by ultrasonic or other suitable nondestructive means as well as visually inspected. All indicated repairs will be made promptly and records of the most recent test will be kept until a new test is conducted or until the part is permanently removed from service.

## **16.8 Damaged Booms**

- 16.8.1 Prior to further use, boom sections or boom suspension components that have been damaged will be repaired, restoring them to not less than the capacity of the original section or components.
- 16.8.2 Repairs to critically stressed members of a boom or boom extension, such as a boom chord, mast chord, or boom sections, will be performed in accordance with the manufacturers' or certified agent's recommendations.
- 16.8.3 New or replacement booms or boom extensions will be tested before use in accordance with subsection 15.3.

## **16.9 Inspection – Wire Rope (Additional Requirements for Cranes and Derricks in Construction)**

- 16.9.1 Apparent deficiencies
  - a. Category I - Apparent deficiencies in this category include the following:
    - 1. Significant distortion of the wire rope structure such as kinking, crushing, unstranding, birdcaging, signs of core failure or steel core protrusion between the outer strands.
    - 2. Significant corrosion.
    - 3. Electric arc damage (from a source other than power lines) or heat damage.
    - 4. Improperly applied end connections.
    - 5. Significantly corroded, cracked, bent, or worn end connections (such as from severe service).
  - b. Category II - Apparent deficiencies in this category are:
    - 1. Visible broken wires, as follows:
      - I. In running wire ropes: Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay.
      - II. In rotation resistant ropes: Two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
      - III. In pendants or standing wire ropes: More than two broken wires in one rope lay located in rope beyond end connections and/or more than one broken wire in a rope lay located at an end connection.
    - 2. A diameter reduction of more than 5% from nominal diameter.
  - c. Category III - Apparent deficiencies in this category include the following:
    - 1. In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
    - 2. Prior electrical contact with a power line.
    - 3. A broken strand.
- 16.9.2 Critical review items - The inspector will give particular attention to all of the following:
  - a. Rotation resistant wire rope in use.
  - b. Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.

- c. Wire rope at flange points, crossover points and repetitive pickup points on drums.
- d. Wire rope at or near terminal ends.
- e. Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

#### 16.9.3 Removal from service

- a. If a deficiency in Category I is identified, operations involving use of the wire rope in question will be prohibited until:
  - 1. The wire rope is replaced, or
  - 2. If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used.
- b. If a deficiency in Category II is identified, operations involving use of the wire rope in question will be prohibited until:
  - 1. The wire rope manufacturer's established criterion for removal from service or a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope will be complied with.
  - 2. The wire rope is replaced, or
  - 3. If the deficiency is localized, the problem is corrected by severing the wire rope in two;
  - 4. the undamaged portion may continue to be used.
- c. If a deficiency in Category III is identified, operations involving use of the wire rope in question will be prohibited until:
  - 1. The wire rope is replaced, or
  - 2. If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Repair of wire rope that contacted an energized power line is prohibited.
- d. Where a wire rope is required to be removed from service under this section, either the equipment (as a whole) or the hoist with that wire rope shall be tagged-out, in accordance with subsection 13.28.5 until the wire rope is repaired or replaced.

#### 16.9.4 Periodic Inspection

- a. Periodic inspections will be conducted in accordance with subsection 16.1.3.
- b. The inspection will include any deficiencies that the certifying agency that conducts the annual inspection determines under subsection 16.9.5(c)(2) will be monitored.
- c. Wire ropes on equipment will not be used until an inspection under this section demonstrates that no corrective action under subsection 16.9.3 is required.
- d. The inspection shall be documented according to subsection 16.1.3(c)(3).

#### 16.9.5 Annual/Comprehensive

- a. At least every 12 months, wire ropes in use on equipment will be inspected by a qualified person as described in subsection 16.2 and in accordance with subsection 16.1.3.

- b. In addition, the wire ropes will be inspected as follows:
  - 1. The inspection will be for deficiencies of the types listed in subsection 16.6.1.
  - 2. The inspection will be complete and thorough, covering the surface of the entire length of the wire ropes, with particular attention given to all of the following:
    - I. Critical review items listed in subsection 16.9.2.
    - II. Those sections that are normally hidden during shift and periodic inspections.
    - III. Wire rope subject to reverse bends.
    - IV. Wire rope passing over sheaves.

Exception: In the event an inspection under subsection 16.9.5(b) is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed) or due to site conditions (such as a dense urban setting), such inspections shall be conducted as soon as it becomes feasible, but no longer than an additional 6 months for running ropes and, for standing ropes, at the time of disassembly.
- c. If a deficiency is identified, an immediate determination will be made by the certifying agency as to whether the deficiency constitutes a safety hazard.
  - 1. If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question will be prohibited until:
    - I. The wire rope is replaced, or
    - II. If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used.
  - 2. If the certifying agency determines that, though not presently a safety hazard, the deficiency needs to be monitored, the deficiency will be checked in the periodic inspections.
- d. The inspection shall be documented according to subsection 16.1.4(e).

16.9.6 Joining lengths of wire rope by splicing is prohibited. If a rope is shortened by severing the wire rope in two, it will be ensured that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.

16.9.7 Rope lubricants that are of the type that hinder inspection will not be used.

16.9.8 All documents produced under this section will be available, during the applicable document retention period, to all persons who conduct inspections under this section.

#### **16.10 Wire Rope – Selection and Installation Criteria**

16.10.1 Selection of replacement wire rope will be in accordance with the recommendations of the crane manufacturer or a qualified person.

16.10.2 Wire rope will be compatible with the safe functioning of the equipment.

- 16.10.3 Rotation resistant ropes - Rotation resistant ropes will not be used for boom hoist reeving, except where the requirements of the crane manufacturer state otherwise.
- 16.10.4 End terminations on wire rope will be installed in accordance with the termination or rope manufacturer's specification.

## **17 SLINGS**

### **17.1 Safe Operating Practices**

Whenever any sling is used, the following practices will be enforced:

- a. Slings that are damaged or defective will not be used.
- b. Chain or wire rope slings will not be shortened with knots or bolts or other makeshift devices.
- c. Slings will not be kinked, or knotted.
- d. Slings will not be loaded in excess of their rated capacities as prescribed by the sling manufacturer on the identification markings permanently affixed to the sling.
- e. Slings used in a basket hitch will have the loads balanced to prevent slippage.
- f. Slings will be set to avoid slippage.
- g. Slings will be padded or protected from the sharp edges of their loads.
- h. Suspended loads will be kept clear of all obstructions.
- i. All employees will be kept clear of loads about to be lifted and of suspended loads.
- j. Hands or fingers will not be placed between the sling and its load while the sling is being tightened around the load.
- k. Shock loading is prohibited.
- l. A sling will not be pulled from under a load when the load is resting on the sling and damage to the sling may result.
- m. Tables S-1 and S-2 will be used to determine the maximum safe working loads of various sizes of wrought iron and alloy steel chains and chain slings, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products. Proof coil steel chain, also known as common or hardware chain, or other chain not recommended for slinging or hoisting by the manufacturer, will not be used for hoisting purposes.
- n. Wrought iron chains in constant use will be annealed or normalized at intervals not exceeding 6 months when recommended by the manufacturer. The chain manufacturer will be consulted for recommended procedures for annealing or normalizing. Alloy chains will not be annealed.
- o. Slings will not be used without affixed and legible identification markings.

### **17.2 Inspections**

Each day before being used, the sling and all fastenings and attachments will be inspected for damage or defects by a qualified person. Additional inspections will be performed during sling use, where service conditions warrant. Damaged or defective slings will be immediately removed from service.

## 17.3 Alloy Steel Chain Slings

### 17.3.1 Sling Identification

Alloy steel chain slings will have permanently affixed and legible markings as prescribed by the manufacturer that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one.

### 17.3.2 Attachments

- a. Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links or other attachments will have a rated capacity at least equal to that of the alloy steel chain with which they are used or the sling will not be used in excess of the rated capacity of the weakest component.
- b. Makeshift links or fasteners formed from bolts or rods, or other such attachments, will not be used.

### 17.3.3 Inspections

- a. In addition to the inspection required by subsection 15.2 of this program, a thorough periodic inspection of alloy steel chain slings in use will be made on a regular basis, to be determined on the basis of:
  1. Frequency of sling use;
  2. Severity of service conditions;
  3. Nature of lifts being made; and
  4. Experience gained on the service life of slings used in similar circumstances.Such inspections will in no event be at intervals greater than once every 12 months.
- b. For the service life of the sling, a record of the most recent month in which each alloy steel chain sling was thoroughly inspected will be made and maintained, and such record will be made available for examination by the Division upon request.
- c. The thorough inspection of alloy steel chain slings will be performed by a qualified person, and will include a thorough inspection for wear, defective welds, deformation and increase in link length. Where such defects or deterioration reduce the rated capacity the sling will be immediately removed from service.

### 17.3.4 Proof Testing

Before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, will be proof tested in accordance with the sling manufacturer's recommendations. A certificate of the proof test and for the service life of the sling will be retained and made available for examination by the Division upon request.

Minimum proof loads for alloy steel chain will be equal to twice the working load limit values shown for single slings.



**17.3.5 Sling Use**

Alloy steel chain slings will not be used with loads in excess of the rated capacities prescribed in Table S-1. Slings not included in this program will be used only in accordance with the manufacturer's recommendations.

**17.3.6 Safe Operating Temperatures**

Alloy steel chain slings will be permanently removed from service if they are heated above 1000 degrees Fahrenheit. When exposed to service temperatures in excess of 600 degrees Fahrenheit, maximum working load limits permitted in Table S-1 will be reduced in accordance with the chain or sling manufacturer's recommendations.

**17.3.7 Repairing and Reconditioning Alloy Steel Chain Slings**

- a. Worn or damaged alloy steel chain slings or attachments will not be used until repaired. When alloy steel chain slings are repaired or reconditioned and welding or heat treating is involved, such slings will be proof tested by the manufacturer or equivalent entity.
- b. Mechanical coupling links or low carbon steel repair links will not be used to repair broken lengths of chain.

**17.3.8 Effects of Wear**

If the chain size at any point of any links is less than that stated in Table S-1a, the sling will be removed from service.

**17.3.9 Deformed Attachments**

- a. Alloy steel chain slings with cracked or deformed master links, coupling links or other components will be removed from service.
- b. Slings will be removed from service if hooks are cracked, 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.

**17.4 Wire Rope Slings**

**17.4.1 Sling Use**

Wire rope slings will not be used with loads in excess of the rated capacities shown in Tables S-3 through S-14.

Slings not included in this program will be used only in accordance with the manufacturer's recommendations.

**17.4.2 Minimum Sling Lengths**

- a. Cable laid and 6 x 19 and 6 x 37 slings will have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.
- b. Braided slings will have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.
- c. Cable laid grommets, strand laid grommets and endless slings will have a minimum circumferential length of 96 times their body diameter.

#### 17.4.3 Safe Operating Temperatures

Fiber core wire rope slings of all grades will be permanently removed from service if they are exposed to temperatures in excess of 200 degrees Fahrenheit. When nonfiber core wire rope slings of any grade are used at temperatures above 400 degrees Fahrenheit, or below minus 60 degrees Fahrenheit, the sling manufacturer's recommendations will be followed.

#### 17.4.4 End Attachments

- a. Welding of end attachments, except covers to thimbles, will be performed prior to the assembly of the sling.
- b. A prototype of each welded end attachment will be proof tested by the manufacturer or equivalent entity to check the design and welding method at twice the rated capacity before production is started. Subsequent tests of random samples will be made. The manufacturer or equivalent entity will provide a certificate of such tests which will be retained and made available for examination by the Division upon request.
- c. Where rope clip attachments are used, they will be made with U-bolts on the dead or short end of the rope and the saddle on the live end. The minimum number of clips for end attachments will be not less than indicated in manufacturer's tables, but in no case will be less than three for any permanent installation. Clips will be drop-forged steel. The clips will be spaced at a distance equal to at least six times the diameter of the rope. All clip or clamp bolts will be kept tight after tightening while rope is under tension.

#### 17.4.5 Removal from Service

Wire rope slings will be immediately removed from service if any of the following conditions are present:

- a. Six randomly distributed broken wires in one rope lay, or 3 broken wires in one strand in one rope lay.
- b. Wear or scraping of one-third the original diameter of outside individual wires.
- c. Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.
- d. Evidence of heat damage.
- e. End attachments that are cracked, deformed or worn to the point where the rated capacity is reduced.
- f. 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.
- g. Corrosion that is of such severity or extent as to reduce the rated load capacity of the rope or end attachment.
- h. One or more broken wires within one rope lay of the end attachments.

#### 17.4.6 Knots

Eyes in wire rope slings will not be formed by using knots.

#### 17.4.7 It will be ensured that wire rope and wire-rope slings:

- a. Have permanently affixed and legible identification markings as prescribed by the manufacturer, and that indicate the recommended

- safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one; and
- b. Not be used without affixed and legible identification markings as required by subsection 17.4.7(a) of this subsection.

## **17.5 Metal Mesh Slings**

### **17.5.1 Sling Marking**

Each metal mesh sling will have permanently affixed durable identification stating the following:

- a. Manufacturer's name or trademark.
- b. Rated capacity in vertical basket hitch and choker hitch.

### **17.5.2 Handles**

Handles will have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

### **17.5.3 Attachments of Handles to Fabric**

The fabric and handles will be joined so that:

- a. The rated capacity of the sling is not reduced.
- b. The load is evenly distributed across the width of the fabric.
- c. Sharp edges will not damage the fabric.

### **17.5.4 Sling Coatings**

Coatings which diminish the rated capacity of a sling will not be applied.

### **17.5.5 Sling Testing**

All new and repaired metal mesh slings, including handles, will not be used unless proof tested by the manufacturer or equivalent entity at a minimum of 1 1/2 times their rated capacity. Elastomer impregnated slings will be proof tested before coating.

### **17.5.6 Proper Use of Metal Mesh Slings**

Metal mesh slings will not be used to lift loads in excess of their rated capacities as prescribed in Table S-17. Slings not included in this program will be used only in accordance with the manufacturer's recommendations.

### **17.5.7 Safe Operating Temperatures**

Metal mesh slings which are not impregnated with elastomers may be used in a temperature range from minus 20 degrees Fahrenheit. to plus 550 degrees Fahrenheit without decreasing the working load limit. Metal mesh slings impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200 degrees Fahrenheit. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations will be followed.

### **17.5.8 Repairs**

- a. Metal mesh slings which are repaired will not be used unless repaired by a metal mesh sling manufacturer or an equivalent entity.

- b. Once repaired, each sling will be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs will be made available for examination by the Division upon request.

#### 17.5.9 Removal From Service

Metal mesh slings will be immediately removed from service if any of the following conditions are present:

- a. A broken weld or broken brazed joint along the sling edge.
- b. Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion.
- c. Lack of flexibility due to distortion of the fabric.
- d. Distortion of the female handle so that the depth of the slot is increased more than 10 percent.
- e. Distortion of either handle so that the width of the eye is decreased more than 10 percent.
- f. A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.
- g. Distortion of either handle out of its plane.

### 17.6 Natural and Synthetic Fiber Rope Slings

#### 17.6.1 Sling Use

- a. Fiber rope slings made from conventional three strand construction fiber rope will not be used with loads in excess of the rated capacities prescribed in Tables S-18 through S-21.
- b. Fiber rope slings will have a diameter of curvature meeting at least the minimums specified in Figures S-4 and S-5.
- c. Slings not included in this program will be used only in accordance with the manufacturer's recommendations.

#### 17.6.2 Natural and synthetic fiber rope slings will not be used for suspending personnel platforms.

#### 17.6.3 Safe Operating Temperatures

Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20 degrees Fahrenheit to plus 180 degrees Fahrenheit without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations will be followed.

#### 17.6.4 Splicing

Spliced fiber rope slings will not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

- a. In manila rope, eye splices will consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.

- b. In synthetic fiber rope, eye splices will consist of at least four full tucks, and short splices will consist of at least eight full tucks, four on each side of the center line.
- c. Strand end tails will not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under one inch in diameter, the tail will project at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, the tail shall project at least six inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).
- d. Fiber rope slings will have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.
- e. Knots will not be used in lieu of splices.
- f. Clamps not designed specifically for fiber ropes will not be used for splicing.
- g. For all eye splices, the eye will be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

#### 17.6.5 End Attachments

Fiber rope slings will not be used if end attachments in contact with the rope have sharp edges or projections.

#### 17.6.6 Removal from Service

Natural and synthetic fiber rope slings will be immediately removed from service if any of the following conditions are present:

- a. Abnormal wear;
- b. Powdered fiber between strands;
- c. Broken or cut fibers;
- d. Variations in the size or roundness of strands;
- e. Discoloration or rotting;
- f. Distortion of hardware in the sling.

#### 17.6.7 Repairs

Repairs will only be made by the manufacturer or equivalent entity. Only fiber rope slings made from new rope shall be used. Use of repaired or reconditioned fiber rope slings is prohibited.

#### 17.6.8 It will be ensured that natural and synthetic fiber-rope slings:

- a. Have permanently affixed and legible identification markings as prescribed by the manufacturer, and that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, type of fiber material, and the number of legs if more than one; and
- b. Not be used without affixed and legible identification markings as required by subsection 17.6.8(a).

## 17.7 Synthetic Web Slings

### 17.7.1 Sling Identification

Each sling will be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.

### 17.7.2 Webbing

Synthetic webbing will be of uniform thickness and width and selvage edges will not be split from the webbing's width.

### 17.7.3 Fittings

Fittings will be:

- a. Of a minimum breaking strength equal to that of the sling; and
- b. Free of all sharp edges that could in any way damage the webbing.

### 17.7.4 Attachment of End Fittings to Webbing and Formation of Eyes

Stitching will be the only method used to attach end fittings to webbing and to form eyes. The thread will be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

### 17.7.5 Sling Use

Synthetic web slings illustrated in Figure S-6 will not be used with loads in excess of the rated capacities specified in Tables S-22 through S-24. Slings not included in this program will be used only in accordance with the manufacturer's recommendations.

### 17.7.6 Environmental Conditions

When synthetic web slings are used, the following precautions will be taken:

- a. Nylon web slings will not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.
- b. Polyester and polypropylene web slings will not be used where fumes, vapors, sprays, mists or liquids of caustics are present.
- c. Web slings with aluminum fittings will not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

### 17.7.7 Safe Operating Temperatures

Synthetic web slings of polyester and nylon will not be used at temperatures in excess of 180 degrees Fahrenheit. Polypropylene web slings will not be used at temperatures in excess of 150 degrees Fahrenheit.

### 17.7.8 Repairs

- a. Synthetic web slings which are repaired will not be used unless repaired by a sling manufacturer or an equivalent entity.
- b. A certificate of proof test and for the service life of the sling will be retained, and made available for examination by the Division upon request.
- c. Slings, including webbing and fittings, which have been repaired in a temporary manner will not be used.



**17.7.9 Removal from Service**

Synthetic web slings will be immediately removed from service if any of the following conditions are present:

- a. Acid or caustic burns;
- b. Melting or charring of any part of the sling surface;
- c. Broken or worn stitches;
- d. Distortion of fittings;
- e. Snags, punctures, tears or cuts; or
- f. Those slings with other apparent defects will be referred to the manufacturer or equivalent entity for determination of rated capacity and safety for continued use.

**17.7.10 Synthetic Web Sling Storage**

Synthetic web slings will be stored in an area or facility where they are not subject to heat above 150 degrees Fahrenheit or exposed to direct sunlight.

**17.7.11 Slings not included in this program will be used only in accordance with the manufacturer's recommendation.**

**17.8 Defective Hoist or Sling Hooks and Rings**

**17.8.1 Deformed or defective hooks or rings will not be used.**

**17.8.2 Deformed hooks or rings will be replaced or repaired and reshaped under proper metallurgical control and proof tested.**

**17.8.3 Annealing or normalizing will be done only in accordance with the chain manufacturer's specifications.**

**17.8.4 Hooks and shackles will be used in accordance with manufacturer's recommendations.**

**17.8.5 All hooks for which no applicable manufacturer's recommendations are available will be tested to twice the intended safe working load before they are initially put into use. A certification record which includes the date of the test, the signature of the person who performed the test, and an identifier of the hook which was tested will be maintained and kept readily available.**

**17.8.6 Special custom design grabs, hooks, clamps, or other lifting accessories for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads and will be proof-tested to 125 percent of the rated load prior to use.**

**17.8.7 Shackles**

It will be ensured that shackles:

- a. Have permanently affixed and legible identification markings as prescribed by the manufacturer that indicate the recommended safe working load;
- b. Not be loaded in excess of its recommended safe working load as prescribed on the identification markings by the manufacturer; and

- c. Not be used without affixed and legible identification markings as required by subsection 17.8.7(a) of this section.

## APPENDIX 1 – DEFINITIONS

**Accessory** - A secondary part or assembly of parts which contribute to the over-all function and usefulness of a machine.

**Accessory gear** - Those items specified by the crane manufacturer as being authorized for use on the load chart such as jibs, blocks, and hooks.

**A/D Director (Assembly/Disassembly Director)** - An individual who meets the requirements of this program for an A/D Director, irrespective of the person's formal job title or whether the person is non-management or management personnel.

**Angle of Loading** - Inclination of a leg or branch of a sling may be measured from the horizontal or vertical plane as shown in Figure S-5 of the California Code of Regulations. When angle of loading is less than 5 degrees from the vertical, the load may be considered a vertical load.

**Angle Indicator (Boom)** - An accessory which measures and indicates the angle of boom to the horizontal.

**Anti Two-Block Device** - A device which, when activated, disengages all crane functions that can cause two-blocking.

**Articulating Boom Crane** - A crane whose boom consists of a series of folding, pin connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.

**Assembly/Disassembly** - The assembly and/or disassembly of equipment covered under this standard. With regard to tower cranes, "erecting and climbing" replaces the term "assembly," and "dismantling" replaces the term "disassembly." Regardless of whether the crane is initially erected to its full height or is climbed in stages, the process of increasing the height of the crane is an erection process.

**Assist Crane** - A crane used to assist in assembling or disassembling a crane.

**Attachment** - Any device that expands the range of tasks that can be done by the equipment. Examples include, but are not limited to: an auger, drill, magnet, pile-driver, and boom-attached personnel platform.

**Audible Signal** - A signal made by a distinct sound or series of sounds. Examples include, but are not limited to: sounds made by a bell, horn, voice or whistle.

**Automatic Crane** - A crane which when activated operates through a preset cycle or cycles.

**Auxiliary Hoist** - A supplemental hoisting unit of lighter capacity and usually higher speed than provided for the main hoist.

**Axis of Rotation** - The vertical axis around which the crane superstructure rotates.

**Base (Mounting)** - The traveling base or carrier on which the rotating superstructure is mounted such as a car, truck, crawlers, or wheel platform.

**Basket Hitch** - A sling configuration whereby the sling is passed under the load and has both ends, end attachments, eyes or handles on the hook or a single master link.

**Blocking (also referred to as “cribbing”)** - Wood or other material used to support equipment or a component and distribute loads to the ground. It is typically used to support lattice boom sections during assembly/disassembly and under outrigger and stabilizer floats.

**Boatswain’s Chair** - A single point adjustable suspension scaffold consisting of a seat or sling (which may be incorporated into a full body harness) designed to support one employee in a sitting position.

**Bogie** - See “travel bogie.”

**Boom** - A member section of a crane or derrick, the lower end of which is affixed to a mast, base, carriage, or support, and the upper end supports a hook or other end attachment. The length of the boom shall be taken as the straight line distance between the axis of the foot pin and the axis of the end sheave pin.

**Boom (tower cranes)** - On tower cranes, if the “boom” (i.e., principal horizontal structure) is fixed, it is referred to as a jib; if it is moveable up and down, it is referred to as a boom.

**Boom Angle** - The angle between the longitudinal centerline of the boom and the horizontal. The boom longitudinal centerline is a straight line between the boom foot pin (heel pin) centerline and boom point sheave pin centerline.

**Boom Hoist** - A hoist drum and rope reeving system used to raise and lower the boom. The rope system may be all live reeving or a combination of live reeving and pendants.

**Boom Hoist Limiting Device** - Includes boom hoist disengaging device, boom hoist shut-off, boom hoist disconnect, boom hoist hydraulic relief, boom hoist kick-outs, automatic boom stop device, or derricking limiter. This type of device disengages boom hoist power when the boom reaches a predetermined operating angle. It may also set brakes or close valves to prevent the boom from lowering after power is disengaged.

**Boom Length Indicator** - Indicates the length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.

**Boom Stop** - A structural component used to limit the angle of the boom at the highest position. Includes but is not limited to structural components such as belly straps with struts/standoff, telescoping boom stops, attachment boom stops, and backstops. These devices restrict the boom from moving above a certain maximum angle and toppling over backward.

**Boom Suspension System** - A system of pendants, running ropes, sheaves, and other hardware which supports the boom tip and controls the boom angle.

**Boom-Type Excavator** - A power-operated excavating crane-type machine used for digging or moving materials. Some excavators of this type are commonly known as dipper stick shovels, backdiggers, trench hoe shovels, draglines, grab buckets, clamshell or orange peel excavators.

**Booming, Luffing or Topping** - Raising or lowering the head of a boom.

**Brake** - A device used for retarding or stopping motion by friction or power means.

**Brake (Electric)** - An electric motor acting as a brake by regenerative, counter-torque, or dynamic means.

**Brake (Electrically Operated)** - A friction brake actuated or controlled by electric means.

**Brake, Holding** - A brake that automatically prevents motion when all power is cut off from the brake holding mechanism.

**Braided Wire Rope** - A rope formed by plaiting component wire ropes.

**Braided Wire Rope Sling** - A sling made from braided rope.

**Bridge** - That part of a crane consisting of girders, trucks, end ties, footwalks and drive mechanism which carries the trolley or trolleys.

**Bridge Travel** - The crane movement in a direction parallel to the crane runway.

**Bridle Wire Rope Sling** - A sling composed of multiple legs with the top ends gathered in a fitting that goes over the lifting hook.

**Buffer** - A cushioning device at the ends of a trolley, bridge, or other moving part of a crane operating on rails to minimize shock in the event of collision.

**Builder** - The builder/constructor of equipment.

**Bulk Cargo Spout** - A spout, which may or may not be telescopic and may or may not have removable sections, but is suspended over the vessel from some overhead structure by wire rope or other means. Such a spout is often used with a thrower or trimming machine. A grain loading spout is an example of spouts covered by this definition.

**Bulk Cargo Sucker** - A pneumatic conveyor which utilizes a spoutlike device, which may be adjustable vertically and/or laterally, and which is suspended over a vessel from some overhead structure by wire rope or other means. An example of an installation of this nature is the grain sucker used to discharge grain from barges.

**Bumper** - A device which stops the moving part at the limit of travel of a trolley, bridge, or crane operating on rails and prevents further motion beyond that point.

**Cab** - An inclosure for housing the operator and/or the hoisting mechanism, power plant, and equipment controlling a crane.

**Cab-Operated Crane** - A crane controlled by an operator in a cab located on the bridge or trolley.

**Cable Body Endless Sling, Mechanical Joint** - A wire rope sling made endless from one continuous length of cable laid rope with the ends joined by one or more metallic fittings.

**Cable Laid Grommet, Hand Tucked** - An endless wire rope sling made from one continuous length of rope formed to make a body composed of 6 ropes around a rope core. The rope ends are hand tucked into the body thus forming the core. No sleeves are used.

**Cable Laid Rope** - A wire rope composed of 6 ropes laid as strands with a rope core.

**Cable Laid Rope Sling, Mechanical Joint** - A wire rope sling made from a cable laid wire rope with eyes fabricated by pressing or swaging one or more metal sleeves over the rope junction.

**Cableway** - A power operated system for moving loads in which the loads are conveyed on an overhead cable, track or carriage.

**Cage**- An open structure for housing the operator and/or the equipment controlling crane or hoist.

**Certificating Agency** - Certificating agencies are qualified agencies, and/or persons, licensed by the Division to examine, test and certify cranes and derricks in accordance with Sections 344.60 through 344.67 of Title 8 of the California Code of Regulations.

**Certified Agent** - The manufacturer, or a person who is currently registered as a professional civil, mechanical, or structural engineer by the State of California and is knowledgeable in the structure and use of the equipment.

**Certified Welder** - A welder who meets recognized certification requirements, as set forth by a nationally recognized certifying agency as defined later in this program, applicable for the task being performed.

**Chicago Boom Derrick** - A boom which is attached to a structure, an outside upright member of the structure serving as the mast, and the boom being stopped in a fixed socket clamped to the upright. The derrick is complete with load, boom, and boom point swing line falls.

**Choker Hitch** - A sling configuration with one end of the sling passing under the load and through an end attachment, handle or eye on the other end of the sling.

**Clearance** - The distance from any part of the crane to a point of the nearest obstruction.

**Climbing** - The process in which a tower crane is raised to a new working height, either by adding additional tower sections to the top of the crane (top climbing), or by a system in which the entire crane is raised inside the structure (inside climbing).

**Coatings** - Elastomers or other suitable material applied to a sling to impart desirable properties.

**Come-Along** – A mechanical device typically consisting of a chain, strap or cable attached at each end that is used to facilitate movement of materials by using a mechanical advantage.

**Controlled Load Lowering** - Lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.



**Controller, Spring Return** - A controller which when released will return automatically to a neutral position.

**Controlling Entity** - An employer that is a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project – its planning, quality and completion.

**Counterweight** - A weight used to supplement the weight of the machine in providing stability for lifting working loads.

**Crane** - A machine for lifting or lowering a load and moving it horizontally, in which the hoisting mechanism is an integral part of the machine. It may be driven manually or by power and may be a fixed or a mobile machine, but does not include stackers, lift trucks, power shovels, backhoes, or excavators. Some of the common types of cranes are defined as follows:

- a. **Boom-Type Mobile Crane** - A self-propelled crane equipped with a boom and mounted on a chassis which is supported on either rubber tires, crawler treads or railway wheels running on railroad tracks.
- b. **Cantilever Gantry Crane** - A crane in which the bridge girders or trusses are extended transversely beyond the crane runway on one or both sides. Its runway may be either on the ground or elevated.
- c. **Crawler Crane** - A crane consisting of a superstructure with power plant, operating machinery and boom, mounted on a base, equipped with crawler treads for travel.
- d. **Floor Operated Crane** - A crane which is pendant or nonconductive rope controlled by an operator on the floor or an independent platform.
- e. **Gantry Crane** - A crane similar to an overhead traveling crane, except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more movable legs running on fixed rails or other runway.
  1. **Container Handling Yard Crane** - Rubber tired gantry crane.
- f. **Hammerhead Crane** - A rotating, counterbalanced cantilever, equipped with one or more trolleys and supported by a pivot or turntable on a traveling or fixed tower.
- g. **Jib Crane** - A fixed crane consisting of a supported vertical member from which extends a horizontal swinging arm carrying a trolley hoist or other hoisting mechanism.
- h. **Locomotive Crane** - A boom-type mobile crane consisting of a self-propelled car operating on a railroad track, upon which is mounted a rotating body supporting the power-operated mechanism, together with a boom capable of being raised or lowered at its head (outer end) from which is led the wire rope or chain connected to the hoisting mechanism, for raising or lowering a load.
- i. **Monorail Crane** - A crane whose hoisting mechanism is suspended from, and is an integral part of, one or more trolleys mounted on a single track.
- j. **Motor Truck Crane** - A boom-type mobile crane mounted on a motor truck frame or rubber-tired chassis. It consists of a rotating superstructure with power plant, operating mechanism and boom.
- k. **Overhead Traveling or Bridge Crane** - A crane on a pair of parallel elevated runways, adapted to lift and lower a load and carry it horizontally parallel to, or at right angles to, the runways or both; and consisting of one or more trolleys operating on the bridge which in turn consists of one or more girders or trusses mounted on trucks operating on the elevated runways, with its operation limited to the area between the runways.
- l. **Pillar Crane** - A fixed crane consisting of a vertical member held in position at the base to resist overturning moment with constant-radius revolving boom supported at the outer end by a tension member.

- m. **Pillar Jib Crane** - A fixed crane consisting of a vertical member held at the base with a horizontal revolving arm carrying a trolley.
- n. **Polar Crane** - A bridge or gantry type crane which travels on a circular track.
- o. **Portal Crane (Whirley Type)** - A gantry crane without trolley motion, which has a boom attached to a revolving crane mounted on a gantry, with the boom capable of being raised or lowered at its head (outer end). Portal cranes may be fixed or mobile.
- p. **Power Operated Crane** - A crane whose mechanism is driven by electric, air, hydraulic or internal combustion means.
- q. **Pulpit-Operated Crane** - A crane operated from a fixed operation station not a hazard to the crane.
- r. **Remote-Operated Crane** - A crane controlled by an operator not in a pulpit or in a cab hooked to the crane, by any method other than pendant or rope control.
- s. **Standby Crane** - A crane which is not in regular service but which is used occasionally or intermittently as required.
- t. **Semi-Gantry or Single Leg Crane** - A gantry crane with 1 end of the bridge rigidly supported on one or more movable legs, running on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.
- u. **Semi-Portal Crane** - A portal crane mounted on a semi-gantry frame instead of a gantry frame.
- v. **Tower Crane** - A crane in which a boom, swinging jib or other structural member is mounted on a vertical mast or tower.
  - 1. **Tower Crane (Climber)** - A crane erected upon and supported by a building or other structure which may be raised or lowered to different floors or levels of the building or structure.
  - 2. **Tower Crane (Free Standing)** - A crane with a horizontally swinging, usually non-luffing boom which may be on a fixed base or mounted on rails.
  - 3. **Tower Crane (Mobile)** - A tower crane which is mounted on a crawler, truck or similar carrier for travel or transit.
  - 4. **Tower Crane (Self-Erector)** - A mobile tower crane that is truck carrier mounted and capable of self-erection.
- w. **Traveling Jib Crane** - A jib crane with the vertical member running on a track, its upper end guided by a parallel overhead track.
- x. **Wall Crane** - A crane having jib with or without a trolley and supported from a side wall or line of columns of a building.
- y. **Wheel Mounted Crane** - A crane consisting of a rotating superstructure with power plant, operating machinery and boom, mounted on a base or platform equipped with axles and rubber-tired wheels for travel. The base is usually propelled by the engine in the superstructure, but it may be equipped with a separate engine controlled from the superstructure. Its function is to hoist and swing loads at various radii.

**Crane Runway** - The structure upon which a crane runs, and may be:

- a. A structure consisting of columns, longitudinal bracing and elevated beams, girders, or trusses, for supporting traveling or bridge cranes.
- b. Elevated beams, girders, or trusses in a building or on the side of a building, for supporting traveling cranes.
- c. Surface tracks or rails.
- d. Tracks or rails on walls or trestles.

**Crossover Point** - Location on a wire rope which is spooled on a drum where one layer of rope climbs up on and crosses over the previous layer. This takes place at each flange of the drum as the rope is spooled onto the drum, reaches the flange, and begins to wrap back in the opposite direction.

**Cross Rod** - A wire used to join spirals of metal mesh to form the complete fabric. (See Figure S-3 of the California Code of Regulations).

**Dedicated Channel** - A line of communication assigned by the employer who controls the communication system to only one signal person and crane/derrick or to a coordinated group of cranes/derricks/signal person(s).

**Dedicated Pile Driver** - A machine that is designed to function exclusively as a pile driver. These machines typically have the ability to both hoist the material that will be pile-driven and to pile-drive that material.

**Dedicated Spotter (power lines)** - To be considered a dedicated spotter, the requirements of Section 5001.3 (Signal Person Qualifications) of the California Code of Regulations shall be met and their sole responsibility is to watch the separation between the power line and the equipment, and load line and load (including rigging and lifting accessories).

**Derrick** - An apparatus consisting of a mast or equivalent member held at the top by guys or braces, with or without a boom, for use with a hoisting mechanism and operating rope, for lifting or lowering a load and moving it horizontally.

- a. **A-Frame Derrick** - A derrick in which the boom is hinged from a cross member between the bottom ends of two upright members spread apart at the lower ends and joined at the top; the boom point secured to the junction of the side members, and the side members are braced or guyed from this junction point.
- b. **Breast Derrick** - A derrick without a boom. The mast consists of two side members spread farther apart at the base than at the top and tied together at top and bottom by rigid members. The mast is prevented from tipping forward by guys connected to its top. The load is raised and lowered by ropes through a sheave or block secured to the top crosspiece.
- c. **Gin Pole Derrick** - A derrick without a boom. Its guys are so arranged from its top to permit leaning the mast in any direction. The load is raised and lowered by ropes reeved through sheaves or blocks at the top of the mast.
- d. **Guy Derrick** - A fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by guys, and a boom whose bottom end is hinged or pivoted to move in a vertical plane with a reeved rope between the head of the mast and the boom point for raising and lowering the boom, and a reeved rope from the boom point for raising and lowering the load.
- e. **Stiffleg Derrick** - A derrick similar to a guy derrick except that the mast is supported or held in place by two or more stiff members, called stifflegs, which are capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the stifflegs to the foot of the mast.
- f. **Shearleg Derrick** - A derrick without a boom and similar to a breast derrick. The mast, wide at the bottom and narrow at the top, is hinged at the bottom and has its top secured by a multiple reeved guy to permit handling loads at various radii by means of load tackle suspended from the mast top.

**Designated Person** - A person selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

**Drag Brake** - A brake which provides retarding force without external control.

**Drum Rotation Indicator** - A device which indicates the relative speed a particular drum is turning.

**Dynamic Brake** - A method of controlling crane motor speeds when in the overhauling condition to provide a retarding force.

**Dynamic Loading** - Loads introduced into the machine or its components by forces in motion.

**Electrical Contact** - When a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.

**Emergency Stop Switch** - A manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.

**Employer-Made Equipment** - Cranes/derricks designed and built by an employer for the employer's own use.

**Encroachment** - Where any part of the crane, load line or load (including rigging and lifting accessories) breaches a minimum clearance distance that this program requires to be maintained from a power line.

**Equipment** - For the purposes of this program, the term "equipment" refers to equipment within the scope of Section 4880.

**Equipment Criteria** - Instructions, recommendations, limitations and specifications.

**Equivalent Entity** - A person or organization (including an employer) which, by possession of equipment, technical knowledge and skills, can perform with equal competence the same repairs and tests as the person or organization with which it is equated.

**Fabric (Metal Mesh)** - The flexible portion of the sling consisting of a series of transverse coils and cross rods and exclusive of terminal fittings. (See Figure S-3 of the California Code of Regulations).

**Fabric Length (Metal Mesh)** - Length of the fabric measured between the extreme ends of the spiral loops. (See Figure S-2 of the California Code of Regulations).

**Fabric Thickness (Metal Mesh)** - The fabric thickness shall be the nominal overall thickness of the spirals. (See Figure S-3 of the California Code of Regulations).

**Failure** - Load refusal, breakage, or separation of components.

**Fall Zone** - The area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.

**Flange Points** - Points of contact between rope and drum flange where the rope changes layers.

**Floating Cranes/Derricks** - Equipment designed by the manufacturer (or employer) for marine use by permanent attachment to a barge, pontoons, vessel or other means of flotation.

**Free Fall (of the load line)** - Only the brake is used to regulate the descent of the load line (the drive mechanism is not used to drive the load down faster or retard its lowering).

**Free Surface Effect** - The uncontrolled movement of liquids in compartments which reduce a vessel's stability.

**Ground Conditions** - The ability of the ground to support the equipment (including slope, compaction, and firmness).

**Handle** - A terminal fitting to which metal mesh fabric is attached. This terminal fitting may be either a male handle (triangle) or female handle (choker). (See Figure S-2 of the California Code of Regulations).

**Handle Eye** - An opening in the handle shaped to accept a hook, shackle or other lifting device.

**Handle, Female (Choker)** - A terminal fitting containing a handle eye and a slot. The slot shall be of such a dimension as to permit passage of the male handle and thereby allow use of the sling in a choker hitch.

**Handle, Male (Triangle)** - The standard terminal fitting without a choker slot.

**Hitch, Basket** - Loading with sling passed under the load with both ends, end attachments, eyes, or handles on the hook or a single master link.

**Hitch, Choker** - Loading with sling passed through one end attachment, eye or handle and suspended by the other.

**Hitch, Vertical** - Loading with the sling vertical. Load suspended on a single part or leg.

**Hoist** - An apparatus for raising or lowering a load by the application of a pulling force, but does not include a car or platform riding in guides. Some common types of hoists are defined as follows:

- a. **Base-Mounted Electric Hoist** - A hoist similar to an overhead electric hoist, except that it has a base or feet and may be mounted overhead, on a vertical plane, or in any position for which it is designed.
- b. **Clevis Suspension Hoist** - A hoist whose upper suspension member is a clevis.
- c. **Hook Suspension Hoist** - A hoist whose upper suspension member is a hook.
- d. **Monorail Hoist** - A hoist whose hoisting mechanism is suspended from one or more trolleys mounted on a single track.
- e. **Overhead Electric Hoist** - A motor-driven hoist having one or more drums or sheave for rope or chain and supported overhead. It may be fixed or traveling.
- f. **Simple Drum Hoist** - A hoist with one or more drums controlled by manually operated clutches, brakes, or ratchet and pawl on drum, and control levers, which is operated by hand or by power.

Note: This type of hoist is known to the trade as a contractor's hoist and is usually a portable unit.

1. **Double-Drum Hoist** - A simple drum hoist having two independent hoisting drums.
2. **Single-Drum Hoist** - A simple drum hoist having only one hoisting drum.

3. **Single Fixed Drum Hoist** - A single-drum hoist with the drum geared directly to the power unit instead of by means of friction clutches.

**Hoist (Hoisting)** - All crane or derrick functions such as lowering, lifting, swinging, booming in and out or up and down, or suspending a personnel platform.

**Hoist Chain** - The load bearing chain in a hoist.

**Hoisting** - The act of raising, or lowering a load with equipment covered by this standard. As used in this standard, “hoisting” can be done by means other than wire rope/hoist drum equipment.

**Hoisting Machine** - A power operated machine used for lifting or lowering a load, utilizing a drum and wire rope, excluding elevators. This shall include but not be limited to a crane, derrick and cableway.

**Hoist Motion** - That motion of a crane which raises and lowers a load.

**Include/Including** - “Including, but not limited to.”

**Insulating Link/Device** - An insulating device listed, labeled, or accepted by a nationally recognized testing laboratory in accordance with 29 CFR 1910.7.

**Jib** -

- a. A horizontal arm, for supporting a trolley or fall block, which does not change its inclination with the horizontal.
- b. An extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles.

**Jib Stop (also referred to as a jib backstop)** - The same type of device as a boom stop but is for a fixed or luffing jib.

**Land Crane/Derrick** - Equipment not originally designed by the manufacturer for marine use by permanent attachment to barges, pontoons, vessels, or other means of floatation.

**Lay** - That distance measured along a rope in which one strand makes a complete revolution around the rope axis.

**Link, Master Coupling** - Alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links. (See Figure S-1 of the California Code of Regulations).

**Link, Master (Gathering Ring)** - Forged or welded steel link used to support all members (legs) of an alloy steel chain or wire rope sling. (See Figure S-1 of the California Code of Regulations).

**Link, Mechanical Coupling (Alloy Steel Chain)** - A non-welded, mechanically closed link used primarily to attach master links, hooks, etc. to running length alloy steel chain.

**Limit Switch** - A device designed to cut off the power automatically at or near the limit of travel of a crane, trolley, hoist, or similar mechanism.



**Line Pull, Permissible** - A line pull, less than the available pull, restricted by rope strength, clutch or brake ability, or other limitation in machinery or equipment.

**List** - The angle of inclination about the longitudinal axis of a barge, pontoons, vessel or other means of floatation.

**Load** - The object(s) being hoisted and/or the weight of the object(s). Both uses refer to the object(s) and the load-attaching equipment, such as ropes, slings, shackles, and any other ancillary attachment as defined by the crane/derrick manufacturer.

**Load (Working)** - See "Load."

**Load Block (Lower)** - The assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.

**Load Block (Upper)** - The assembly of sheaves, pins, and frame suspended from the boom.

**Load Moment (or rated capacity) Indicator** - A device that automatically monitors radius, load weight, and load rating and warns the crane operator of an overload condition.

**Load Moment (or rated capacity) Limiter** - A device that automatically monitors radius, load weight, and load rating and prevents movements of the crane which would result in an overload condition.

**Load Rating** - See "Rated Capacity."

**Load Refusal** - The point where the ultimate strength is exceeded.

**Locomotive Crane** - A crane mounted on a base or car equipped for travel on a railroad track.

**Luffing Jib Limiting Device** - Includes jib hoist disengaging device, jib hoist shut-off, jib hoist disconnect, jib hoist hydraulic relief, jib hoist kick-outs, or automatic jib stop device. This type of device disengages jib hoist power when the jib reaches predetermined operating angles. It may also set brakes or close valves to prevent the jib from lowering after power is disengaged.

**Machine House** - An enclosure for housing the hoisting mechanism and power plant.

**Magnet** - An electromagnetic device carried on a crane hook to pick up loads magnetically.

**Main Hoist** - The hoist mechanism provided for lifting the maximum rated load.

**Main Switch** - A switch controlling the entire power supply to the crane.

**Man Trolley** - A trolley having an operator's cage attached thereto and may be used as an integral part of a monorail hoist or a monorail crane.

**Marine Worksite** - A construction worksite located in, on, under or above the water.

**Master Switch** - A switch which dominates the operation of contactors, relays, or other remotely operated devices.

**Molten Metal Handling Crane** - An overhead crane used for transporting or pouring molten material.

**Multi-Purpose Machine** - A machine, other than a crane or derrick, which is designed to be configured and used in various ways, at least one of which allows it to raise or lower by means of a hoist and horizontally move a suspended load.

**Nationally Recognized Accrediting Agency** - An organization that, due to its independence and expertise, is widely recognized as competent to accredit testing organizations. Examples of such accrediting agencies include, but are not limited to, Institute for Credentialing Excellence (the National Commission for Certifying Agencies) and the American National Standards Institute.

**Nonconductive** - Because of the nature and condition of the materials used, and the conditions of use (including environmental conditions and condition of the material), the object in question offers a high resistance to the passage of current under the conditions of use).

**Operational Aid** - An accessory that provides information to facilitate operation of a crane or that takes control of particular functions without action of the operator when a limiting condition is sensed. These include, but are not limited to, the devices listed in Section 5018.

**Operational Controls** - Levers, switches, pedals and other devices for controlling equipment operation.

**Operator** - A person who is operating the equipment.

**Outdoor Storage Bridge** - A gantry type crane of long span usually used for bulk storage of material. The bridge girders or trusses are rigidly or nonrigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.

**Overhead and Gantry Cranes** - Includes overhead/bridge cranes, semi-gantry, cantilever gantry, wall cranes, and storage bridge cranes.

**Overhead Loads** - For the purpose of this program, overhead loads are loads either passed or suspended directly over employee-occupied work-spaces or passageways.

**Pendant** - A rope or strand of specified length with fixed end connections.

**Power Lines** - Electric transmission and distribution lines.

**Procedures** - Includes, but is not limited to: instructions, diagrams, recommendations, warnings, specifications, protocols and limitations.

**Proof Load** - The specific load applied in performance of the proof test.

**Proof Test** - A nondestructive tension test made by the sling manufacturer or equivalent entity to verify construction and workmanship of the individual sling.

**Proximity Alarm** - A device that provides a warning of proximity to a power line and that has been listed, labeled, or accepted by a Nationally Recognized Testing Laboratory in accordance with 29 CFR 1910.7, or approved in accordance with Section 3206.

**Qualified Evaluator (not a third party)** - A person employed by the signal person's employer who has demonstrated that they are competent in accurately assessing whether individuals meet the qualification requirements in this program for a signal person.

**Qualified Evaluator (third party)** - An entity that, due to its independence and expertise, has demonstrated that it is competent in accurately assessing whether individuals meet the qualification requirements in these Orders for a signal person.

**Qualified Rigger** - A rigger who meets the criteria for a qualified person.

**Radius (Load)** - The horizontal distance from the center of rotation of a crane or derrick to the center of the vertical hoist line, hook shank or pin, or tackle with load applied.

**Range Control Warning Device** - A device that can be set to warn that the boom or jib tip is at a plane or multiple planes.

**Range Limit Device** - A device that can be set to limit movement of the boom or jib tip to a plane or multiple planes.

**Rated Capacity** - The maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

**Rated Capacity Indicator** - See load moment indicator.

**Rated Capacity Limiter** - See load moment limiter.

**Rated Capacity (Working Load Limit)** - The maximum allowable working load established by the sling manufacturer and permitted by the provisions of section 15.

**Rated Load** - The maximum load for which a crane or individual hoist is designed and built by the manufacturer and shown on the equipment nameplate(s) or load capacity chart.

**Reach (Alloy Steel Chain)** - Effective length of an alloy steel chain sling measured from the top bearing surface of the master link to the bearing surface in the base (Bowl) of the hook.

**Reeving** - A rope system in which the rope travels around drums and sheaves.

**Regenerative** - A form of dynamic braking in which the electrical energy generated is fed back into the power system.

**Registered Professional Engineer (RPE)** - A person who is registered as a professional civil, mechanical, or structural engineer by the State of California and is knowledgeable in the structure and use of the equipment.

**Repetitive Pickup Points** - When operating on a short cycle operation, the rope being used on a single layer and being spooled repetitively over a short portion of the drum.

**Rope** - Refers to wire rope unless otherwise specified.

**Running Sheave** - A sheave which rotates as the load block is raised or lowered.

**Running Wire Rope** - A wire rope that travels over sheaves or drums.

**Runway** - A firm, level surface designed, prepared and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane suspended platform. An existing surface may be used as long as it meets these criteria.

**Safety Hook** - A hook with a safety latch or arrangement to close the throat of the hook, in such manner as to prevent slings or load attachment from accidentally slipping off the hook.

**Selvage Edge** - Finished edge of synthetic webbing to prevent unraveling.

**Sideboom Crane** - A track-type or wheel-type tractor having a boom mounted on the side of the tractor, used for lifting, lowering or transporting a load suspended on the load hook. The boom or hook can be lifted or lowered in a vertical direction only.

**Side Pull** - That portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.

**Side Pull or Side Loading** - A load applied at any angle to the vertical plane of the boom.

**Sling Manufacturer** - A person or company assembling sling components into their final form for actual use. The sling manufacturer and the manufacturer of the sling material (Alloy steel chains, wire rope, metal mesh webbing, fiber rope or synthetic webbing) may or may not be identical.

**Span** - The horizontal distance center to center of runway rails.

**Special Hazard Warnings** - Warnings of site-specific hazards (for example, proximity of power lines).

**Spiral** - A single transverse coil that is the basic element from which metal mesh is fabricated.

**Stability (flotation device)** - The tendency of a barge, pontoons, vessel or other means of flotation to return to an upright position after having been inclined by an external force.

**Standard Method** - The protocol illustrated in subsection 10.13, Plate I, for hand signals.

**Standing Rope (Guy)** - A supporting rope which maintains a constant distance between the points of attachment to the two components connected by the rope.

**Strand Laid Rope** - A wire rope made with strands (usually 6 or 8) formed around a fiber core, wire strand core, or independent wire rope core (IWRC).

**Strength, Minimum Breaking** - Minimum load at which the sling will break when loaded to destruction in direct tension.

**Strength, Nominal Breaking** - Load at which the sling could be expected to break when loaded to destruction in direct tension.

**Structural Competence** - The ability of the machine and its components to withstand the stresses imposed by applied loads.

**Such as** - “Such as, but not limited to.”

**Superstructure** - See “Upperworks.”

**Supporting Materials** - Blocking, mats, cribbing, marsh buggies (in marshes/wetlands), or similar supporting materials or devices.

**Swinging or Slewing** - The act of moving a boom through a horizontal arc.

**Switch** - A device for making, breaking, or for changing the connections in an electric circuit.

**Tag Line** - A rope (usually fiber) attached to a lifted load for purposes of controlling load spinning and pendular motions or used to stabilize a bucket or magnet during material handling operations.

**Tagline** - A restraining line to control position of the load.

**Tender** - An individual responsible for monitoring and communicating with a diver.

**Tilt Up or Tilt Down Operation** - Raising/lowering a load from the horizontal to vertical or vertical to horizontal.

**Track** - A structural member that supports the trolley or crane wheels.

**Transit** - The moving or transporting of a crane from one job site to another.

**Travel** - The function of a machine moving from one location to another, on a job site.

**Travel Bogie (tower cranes)** - An assembly of two or more axles arranged to permit vertical wheel displacement and equalize the loading on the wheels.

**Trim** - The angle of inclination about the transverse axis of a barge, pontoons, vessel or other means of floatation.

**Trolley** -

1. For overhead and gantry cranes: A truck or carriage supporting the load mounted on an overhead beam, bridge, cableway or track.
2. For tower cranes: The component of the crane that moves along the jib of a hammerhead tower crane and positions the load radially.

**Trolley Travel** - The trolley movement at right angles to the crane runway.

**Truck (of an overhead, gantry, or locomotive crane)** - The framework and wheels operating on the runway or rails and supporting the bridge, trolley, or body of the crane.

**Two-Block Damage Prevention Feature** - A system which will stall when two-blocking occurs without causing damage to hoist rope or crane machinery components.

**Two-Block Warning Feature** - Warning device to alert the operator of an impending two-blocking condition.

**Two-Blocking** - A condition in which the lower load block or hook assembly comes into contact with the upper load block or boom point sheave assembly.

**Unavailable Procedures** - Procedures that are no longer available from the manufacturer, or have never been available, from the manufacturer.

**Upperstructure** - See Upperworks.

**Upperworks** - The revolving frame of equipment on which the operating machinery (and many cases the engine) are mounted along with the operator's cab.

**Wire rope** - A flexible rope constructed by laying steel wires into various patterns of multi-wired strands around a core system to produce a helically wound rope.

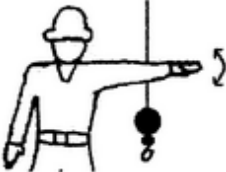
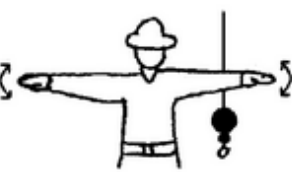



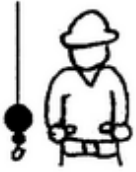




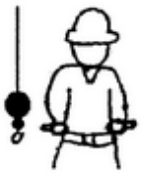



## APPENDIX 2 – EQUIPMENT CHECKLIST

Date	Equipment Name	Defects, if any	Action Taken	Inspector

## APPENDIX 3 – PLATE I





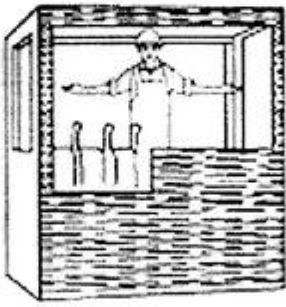

### Recommended Hand Signals for Controlling Crane Operations – Part 1

 <p><b>STOP</b> – With arm extended horizontally to the side, palm down, arm is swung back and forth.</p>	 <p><b>EMERGENCY STOP</b> – With both arms extended horizontally to the side, palms down, arms are swung back and forth.</p>	 <p><b>HOIST</b> – With upper arm extended to the side, forearm and index finger pointing straight up, hand and finger make small circles.</p>
 <p><b>RAISE BOOM</b> – With arm extended horizontally to the side, thumb points up with other fingers closed.</p>	 <p><b>SWING</b> – With arm extended horizontally, index finger points in direction that boom is to swing.</p>	 <p><b>RETRACT TELESCOPING BOOM</b> – With hands to the front at waist level, thumbs point at each other with other fingers closed.</p>
 <p><b>RAISE THE BOOM AND LOWER THE LOAD</b> – With arm extended horizontally to the side and thumb pointing up, fingers open and close while load movement is desired.</p>	 <p><b>DOG EVERYTHING</b> – Hands held together at waist level.</p>	 <p><b>LOWER</b> – With arm and index finger pointing down, hand and finger make small circles.</p>
 <p><b>LOWER BOOM</b> – With arm extended horizontally to the side, thumb points down with other fingers closed.</p>	 <p><b>EXTEND TELESCOPING BOOM</b> – With hands to the front at waist level, thumbs point outward with other fingers closed.</p>	 <p><b>TRAVEL/TOWER TRAVEL</b> – With all fingers pointing up, arm is extended horizontally out and back to make a pushing motion in the direction of travel.</p>

## Recommended Hand Signals for Controlling Crane Operations – Part 2

 <p><b>LOWER THE BOOM AND RAISE THE LOAD</b> – With arm extended horizontally to the side and thumb pointing down, fingers open and close while load movement is desired.</p>	 <p><b>MOVE SLOWLY</b> – A hand is placed in front of the hand that is giving the action signal.</p>	 <p><b>USE AUXILIARY HOIST</b> (whipline) – With arm bent at elbow and forearm vertical, elbow is tapped with other hand. Then regular signal is used to indicate desired action.</p>
 <p><b>CRAWLER CRANE TRAVEL, BOTH TRACKS</b> – Use both fists in front of body, making a circular motion about each other indicating direction of travel, forward or backward.</p>	 <p><b>USE MAIN HOIST</b> – A hand taps on top of the head. Then regular signal is given to indicate desired action.</p>	 <p><b>CRAWLER CRANE TRAVEL, ONE TRACK</b> – Indicate track to be locked by raising fist on that side. Rotate other fist in front of body in direction that other track is to travel.</p>
 <p><b>TROLLEY TRAVEL</b> – With palm up, fingers closed and thumb pointing in direction of motion, hand is jerked horizontally in direction trolley is to travel.</p>		

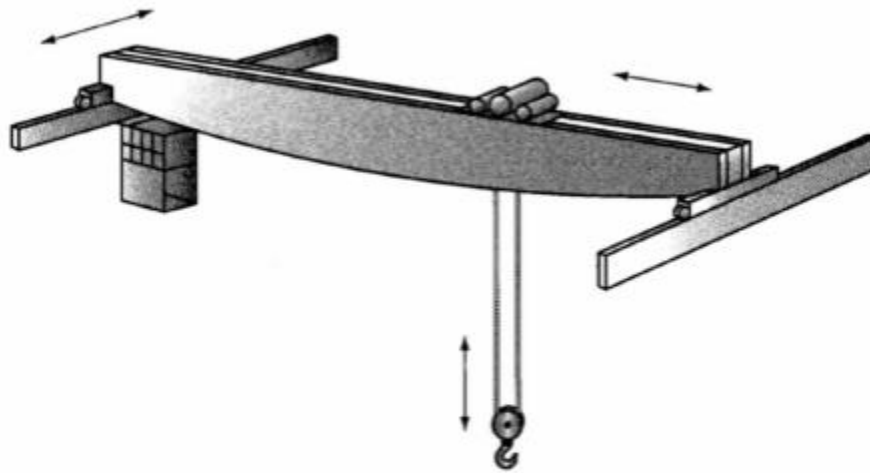
## Recommended Hand Signals for Boom Equipment Operations

 <p><b>EXTEND BOOM (Telescoping Boom)</b></p> <p>One hand signal. One fist in front and tapping chest with the thumb.</p>	 <p><b>RETRACT BOOM (Telescoping Boom)</b></p> <p>One hand signal. One fist in front of chest, thumb pointing outward and tapping the chest with the heel of the fist.</p>
 <p><b>OPEN (Clamshell)</b></p> <p>Extend arm horizontally to the side, open hand slowly.</p>	 <p><b>CLOSE (Clamshell)</b></p> <p>Extend arm horizontally to the side, close hand slowly.</p>
 <p><b>MAGNET DISCONNECTED</b></p> <p>Crane operator spreads extends both arms horizontally to the side with palms up.</p>	 <p><b>MULTIPLE TROLLEYS</b></p> <p>Hold up one finger for block marked "1" and two fingers for block marked "2", followed by a regular signal to indicate desired action.</p>

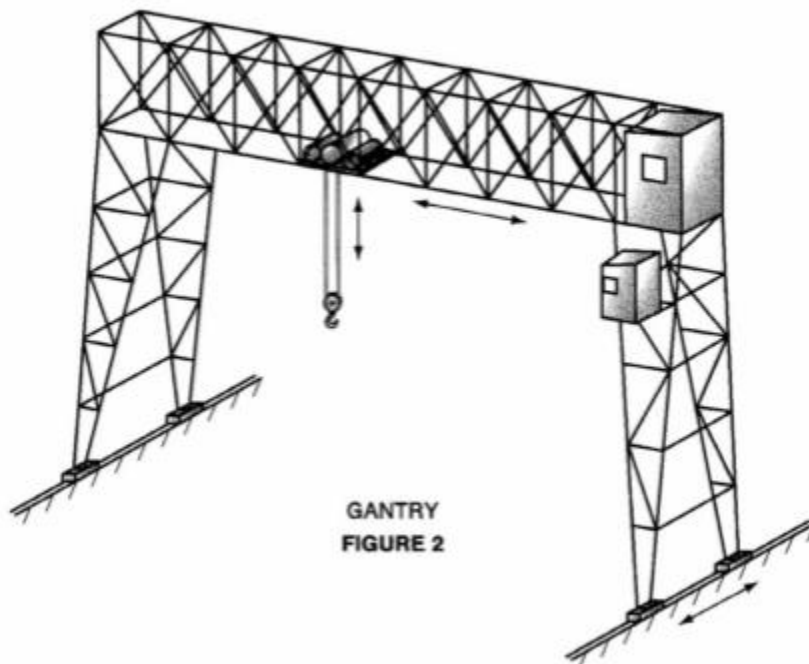
## APPENDIX 4 – PLATES

### Plate I

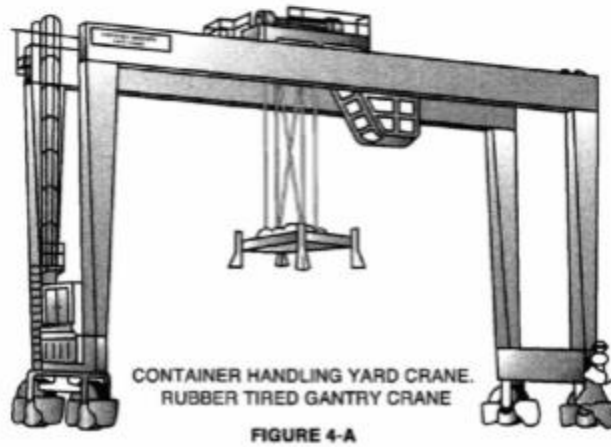
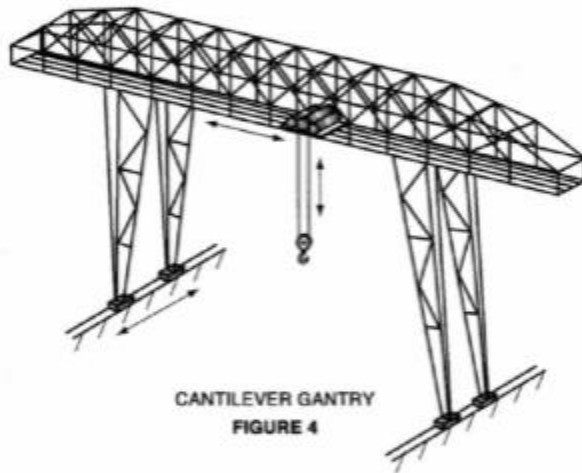
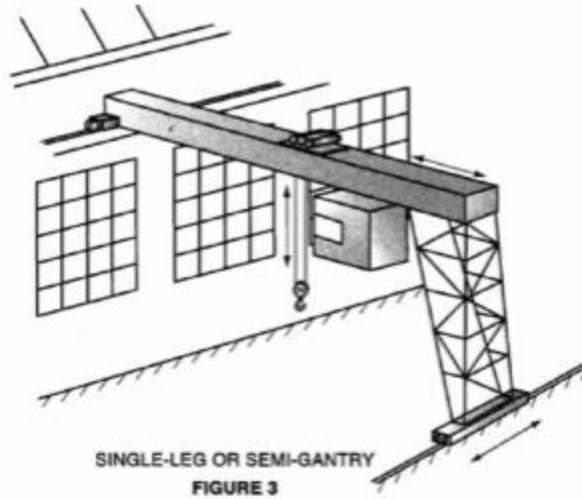
#### Types of Cranes



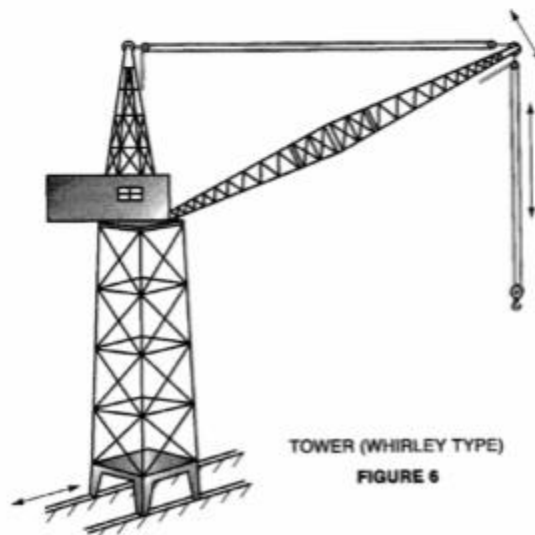
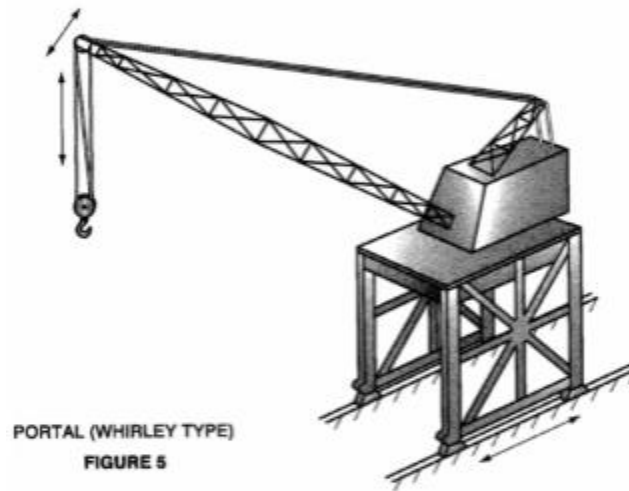
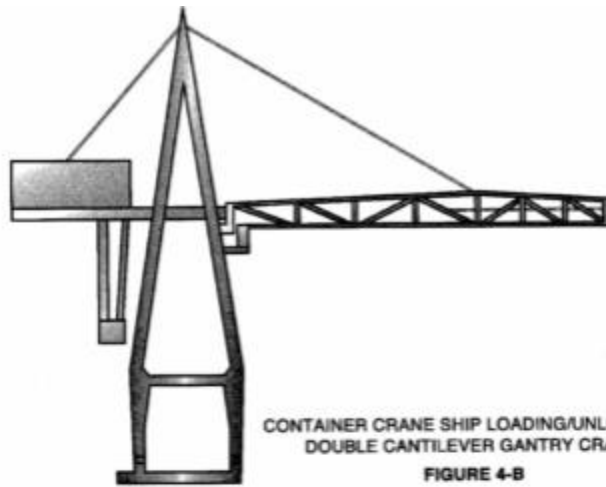
OVERHEAD TRAVELING  
FIGURE 1

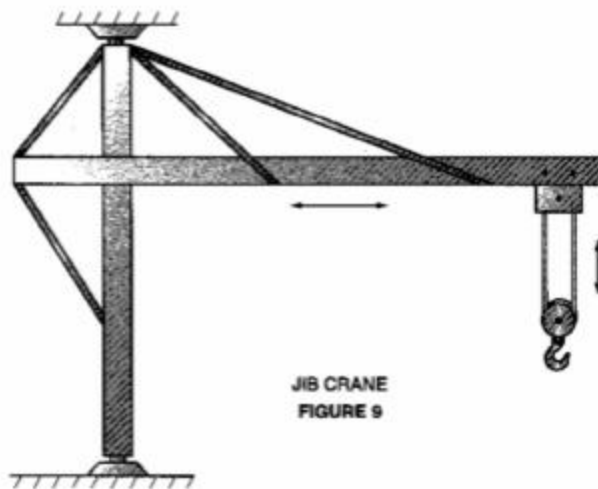
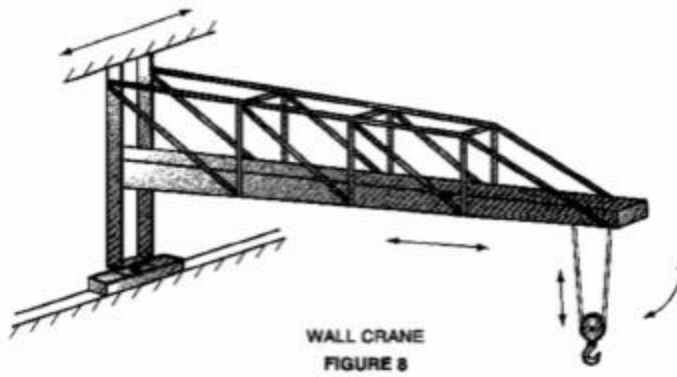
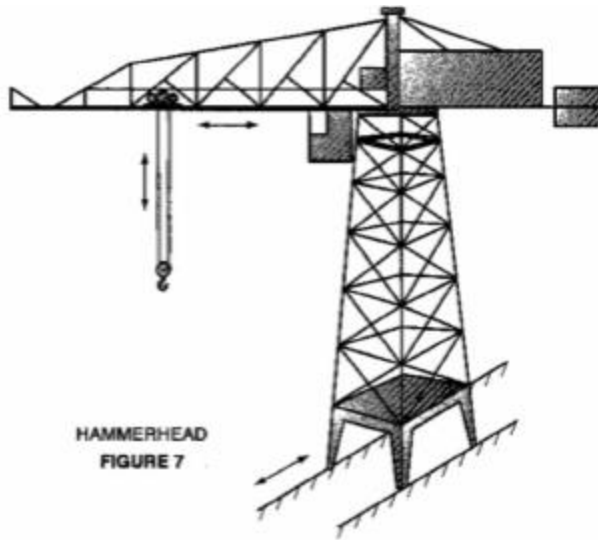


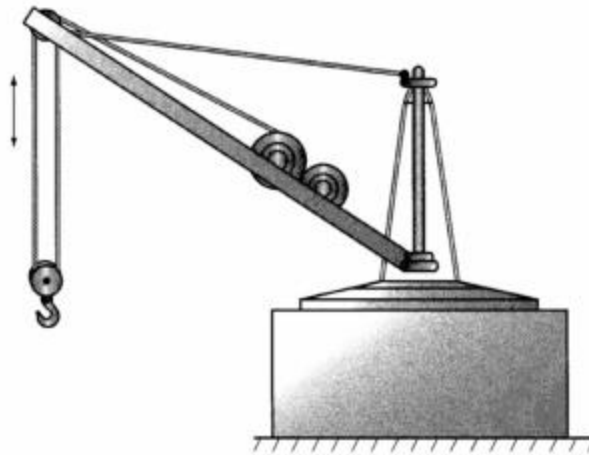
GANTRY  
FIGURE 2



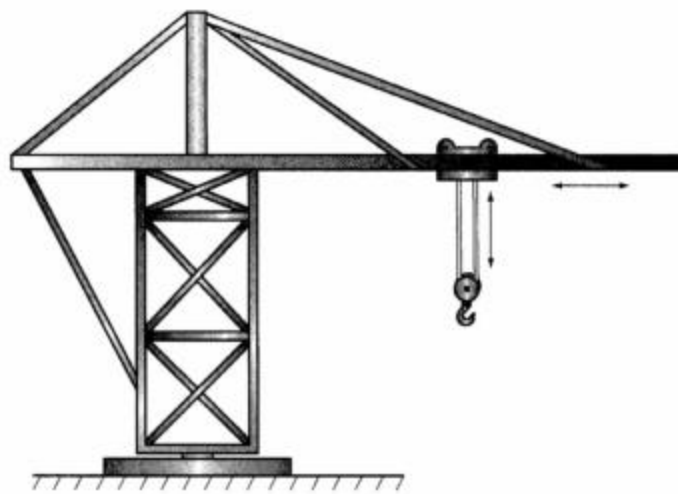




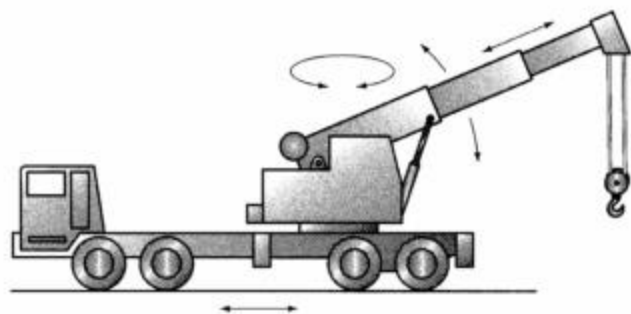




PILLAR CRANE  
FIGURE 10



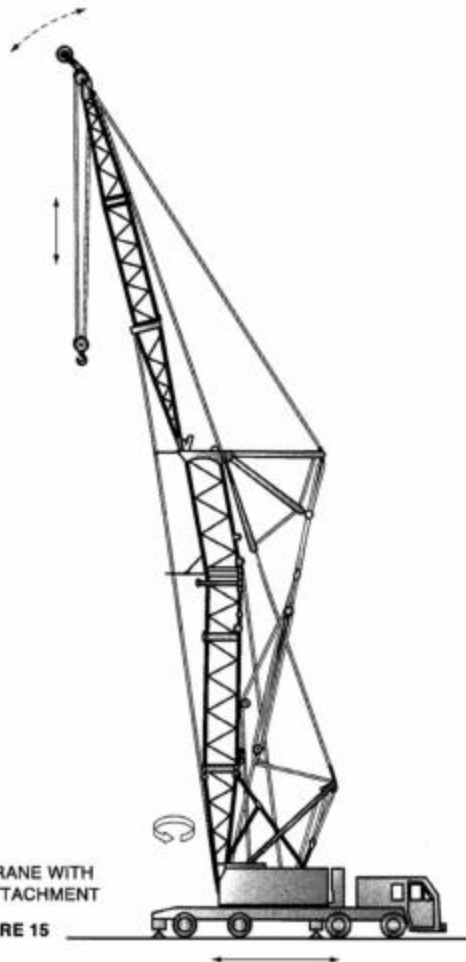
PILLAR JIB CRANE  
FIGURE 11



TRUCK CRANE TELESCOPING BOOM  
FIGURE 13



HYDRAULIC CRANE  
FIGURE 14



MOBILE CRANE WITH  
TOWER ATTACHMENT  
FIGURE 15



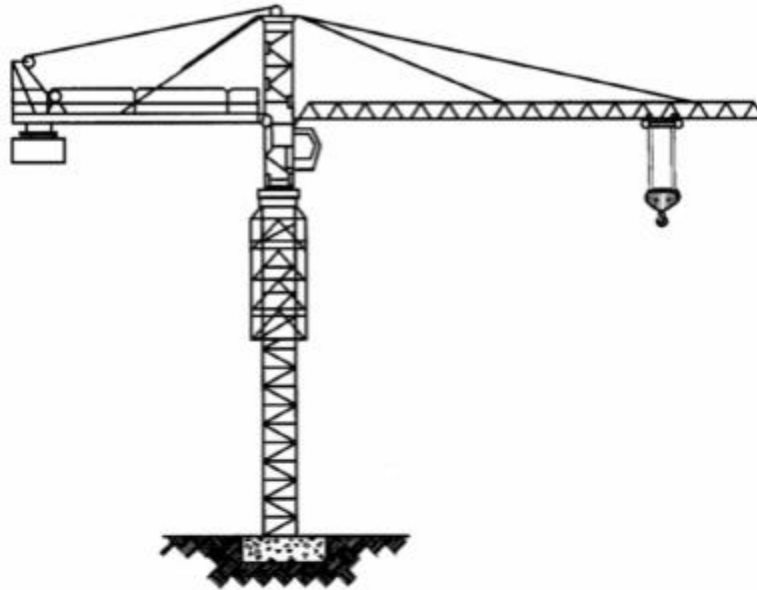
COMMERCIAL TRUCK-MOUNTED CRANE  
NON-TELESCOPING BOOM

FIGURE 15-A



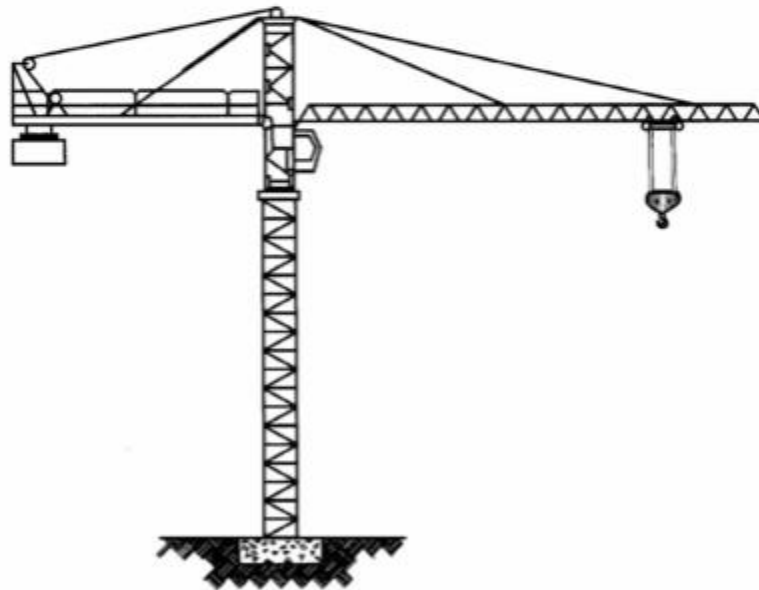
COMMERCIAL TRUCK-MOUNTED CRANE  
TELESCOPING BOOM

FIGURE 15-B



TOWER CLIMBER

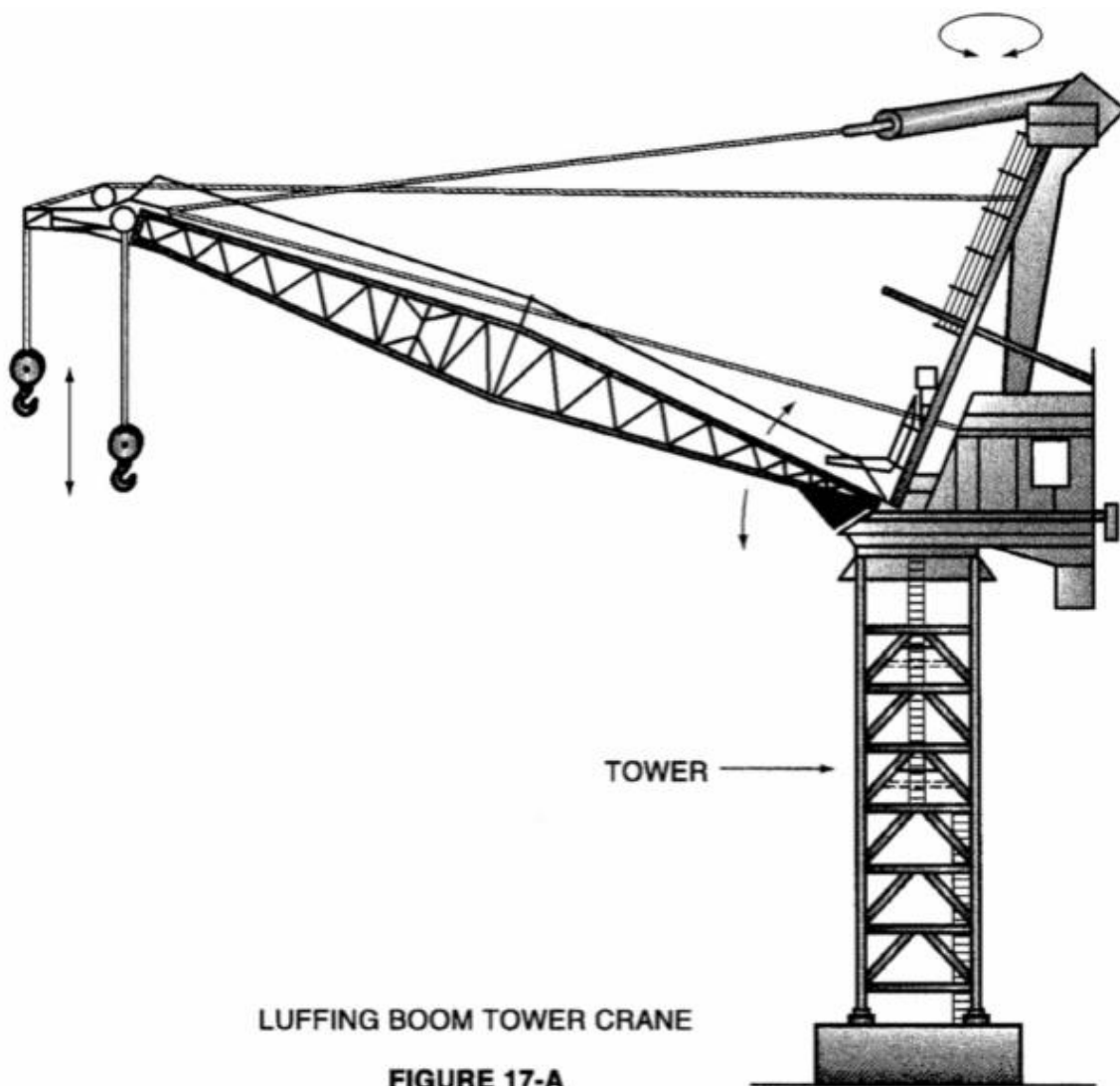
FIGURE 16

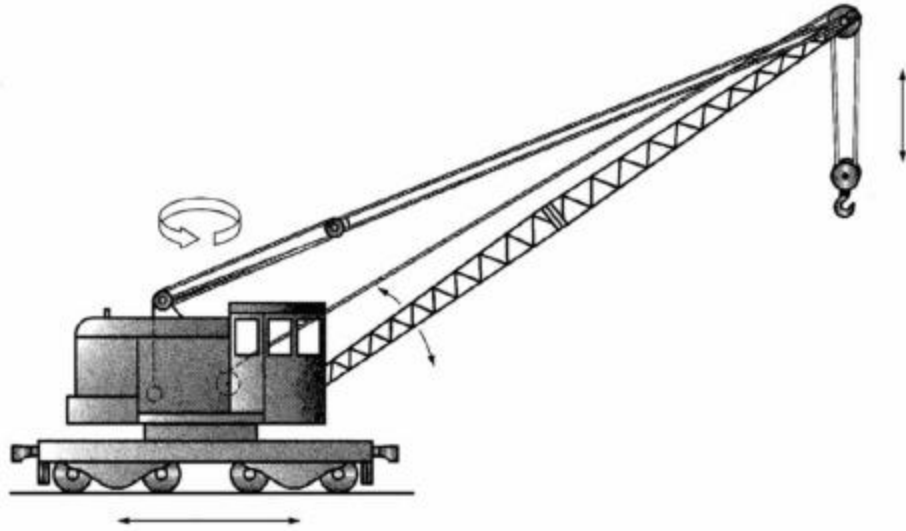


TOWER FREE STANDING

FIGURE 17

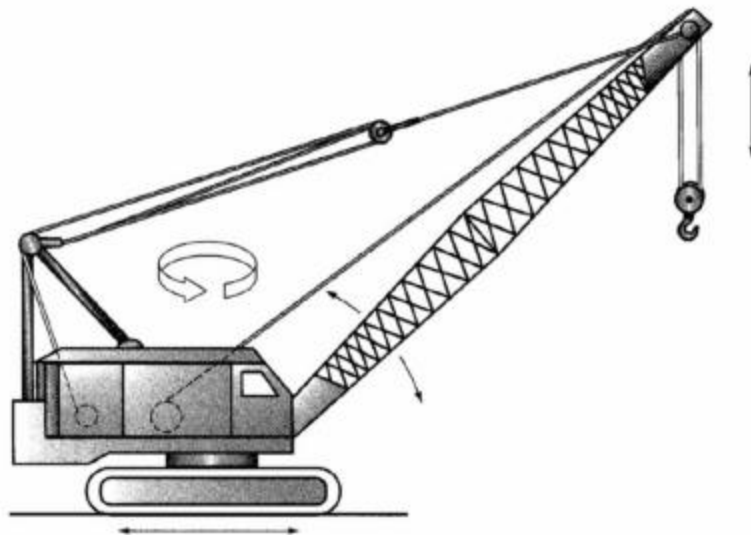






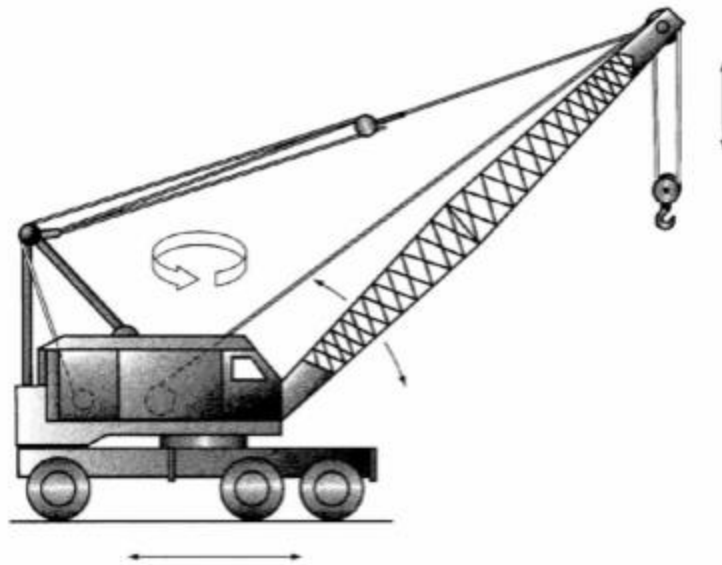
LOCOMOTIVE CRANE

FIGURE 18

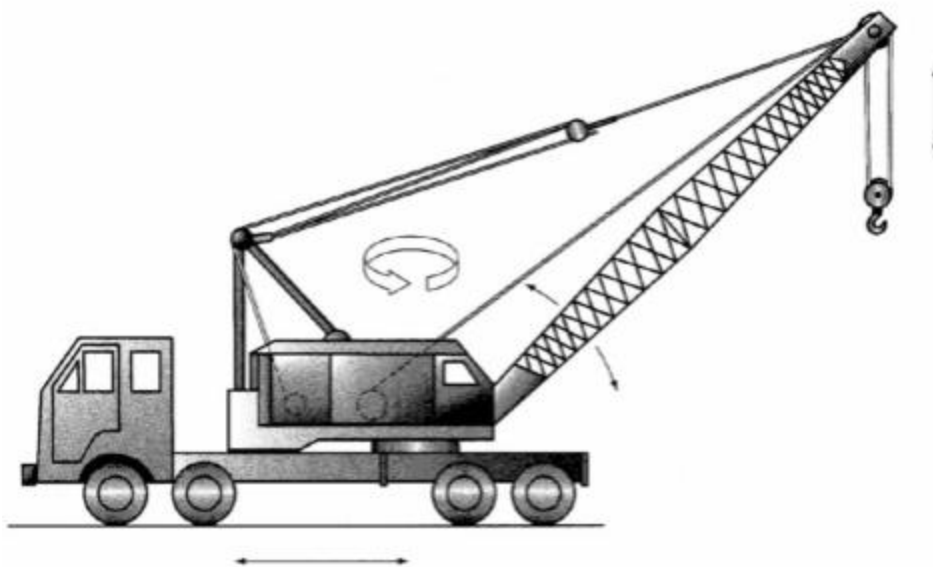


CRAWLER CRANE

FIGURE 19



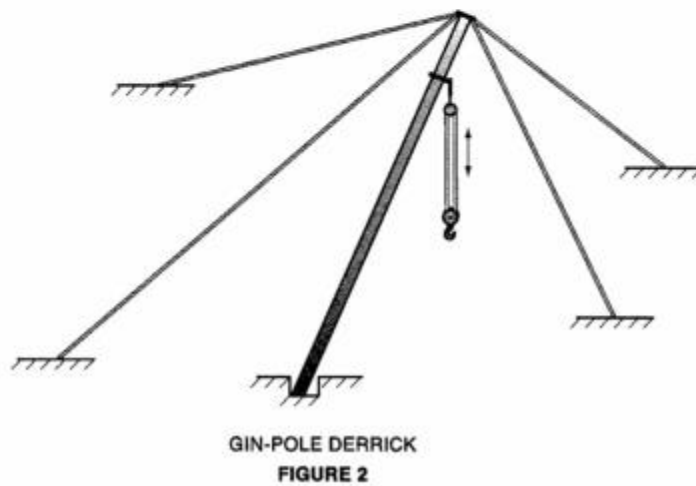
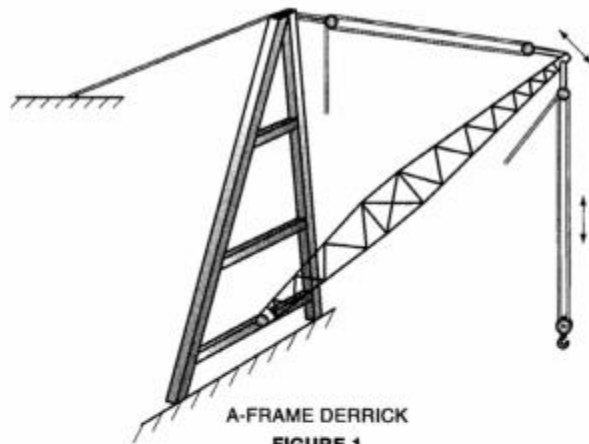
WHEEL MOUNTED CRANE  
FIGURE 20

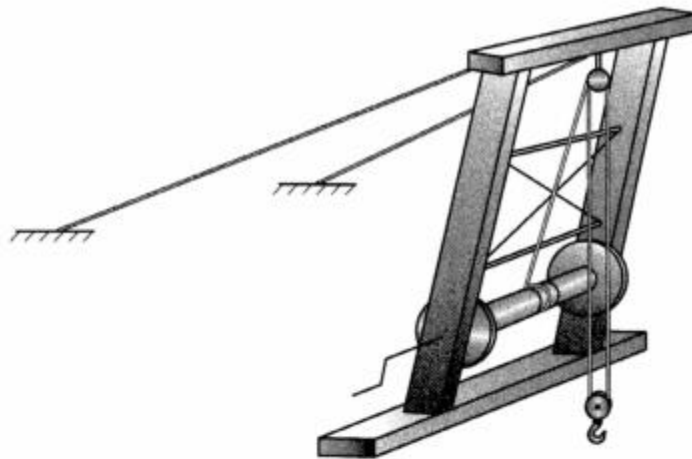


TRUCK CRANE  
FIGURE 21

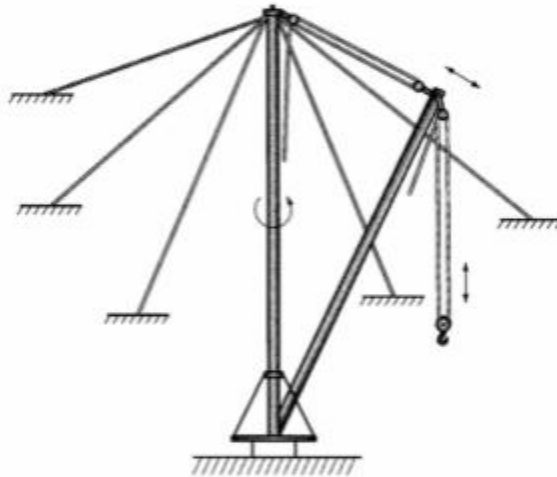
Plate II

Types of Derricks

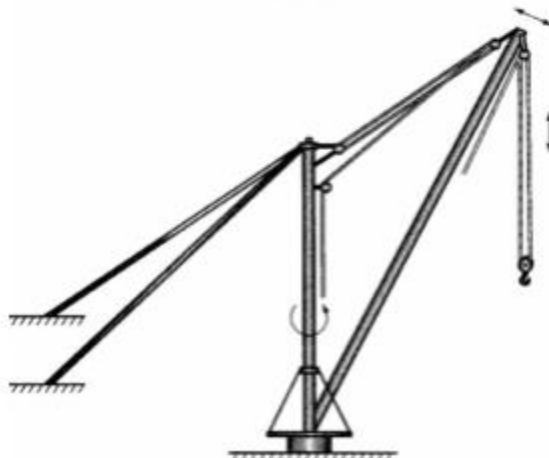




BREAST DERRICK  
FIGURE 3



GUY DERRICK  
FIGURE 4



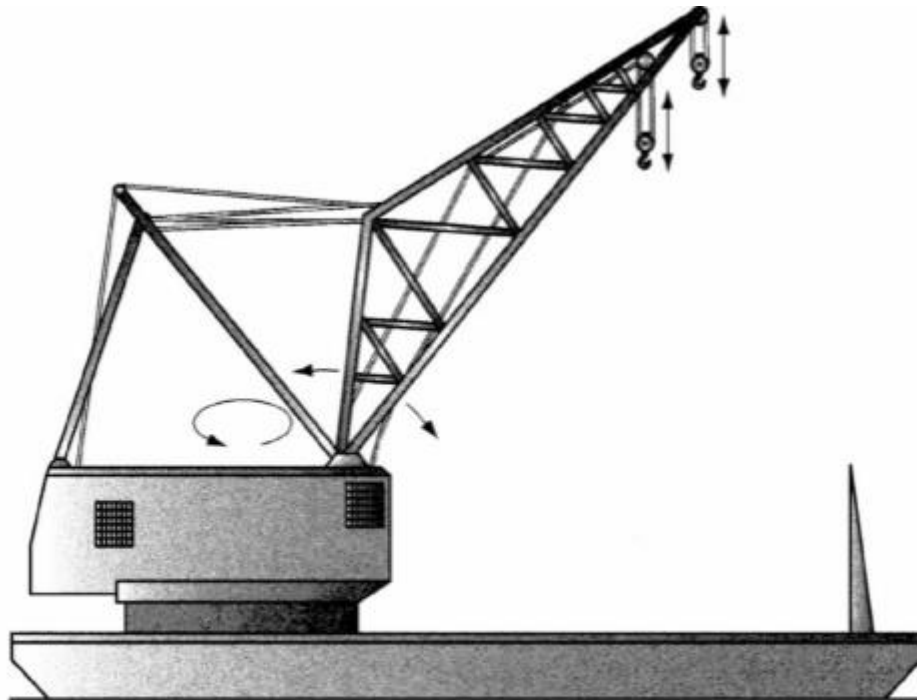
STIFF LEG DERRICK  
FIGURE 5



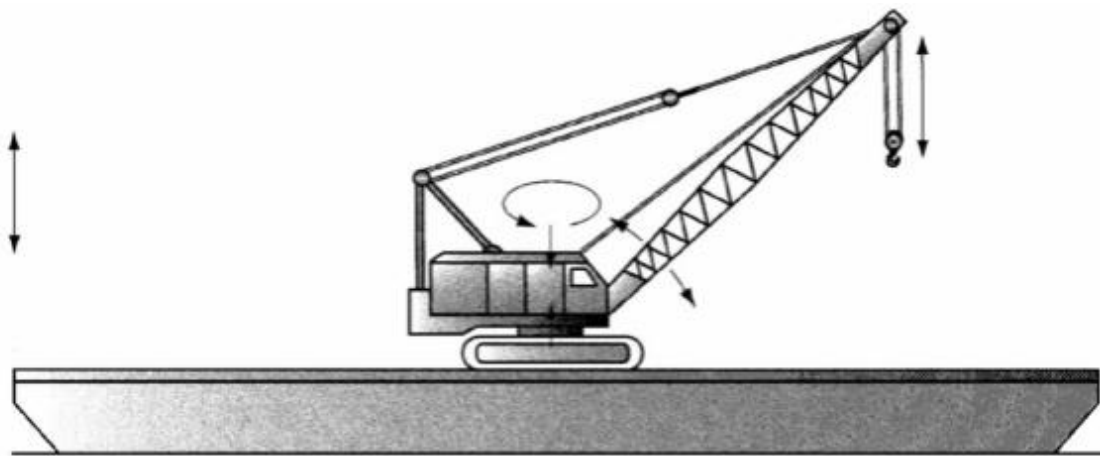
CHICAGO BOOM  
FIGURE 6

### Plate III

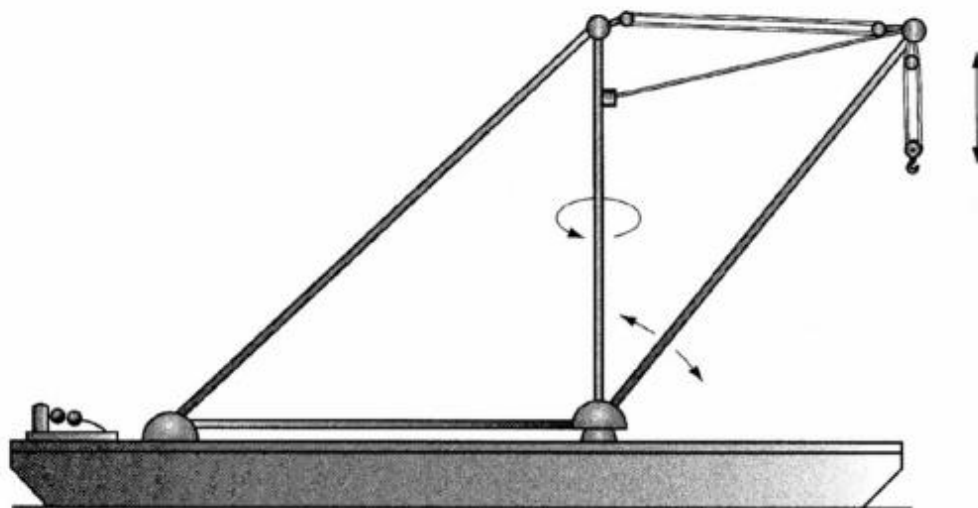
## FLOATING CRANES AND FLOATING DERRICKS



FLOATING CRANE  
FIGURE 1

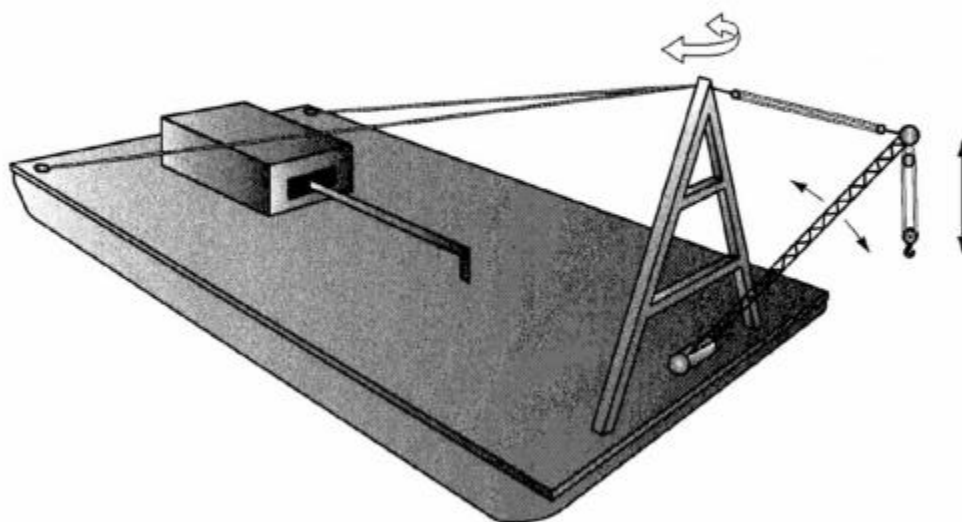


BARGE MOUNTED LAND CRANE  
FIGURE 2



FLOATING STIFFLEG DERRICK  
FIGURE 3





FLOATING A-FRAME DERRICK  
FIGURE 4