

 CITY OF TUCSON	City of Tucson Central Safety Services Number: S-023 Subject:	Page 1 of 46
		Effective Date: August 1, 2004
	Cranes and Rigging	Reviewed/ Revised: January 1, 2013

1.0 PURPOSE

This procedure provides employees with a uniform directive for the safe operation, maintenance and inspection of cranes, hoists, derricks, and slings.

2.0 SCOPE

This procedure applies to all employees within the City of Tucson who are required to use cranes, hoists, derricks, and slings in order to perform of their duties.

The policies and procedures contained in this section are intended to assist in identifying and complying with OSHA Safety Standards. In all cases where there is a difference between specific OSHA standards and the cranes, hoists, derricks, and slings policies set forth in this chapter, the stricter of the two shall apply.

3.0 DEFINITIONS

Equipment Definitions

Auto Crane: A mechanically or powered hoisting device anchored to the bed or side of a mechanic's truck when used in activities related to equipment maintenance and repair. The Operator of an Auto Crane will be trained and Qualified to operate this equipment and shall be additionally trained in:

- Power line recognition and safe distance measures
- Signaling
- Rigging

Floor-operated Crane: Means a crane which is pendant or non-conductive rope controlled by an operator on the floor or on an independent platform. The Operator of a Floor-operated Crane will be trained and Qualified to operate this equipment and shall be additionally trained in:

- Signaling
- Rigging

Gantry Crane: Means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway structure. The Operator of a Gantry Crane will be trained and Qualified to operate this equipment and shall be additionally trained in:

- Signaling

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- Rigging

Truck (Mobile) Crane: Consists of a rotating superstructure with power plant, operating machinery and boom, mounted on an automotive truck equipped with a power plant for travel. Its function is to hoist and swing loads at various radii. The Operator of a Truck (mobile) Crane while performing maintenance activities covered under OSHA Standard 1910.180 shall be trained and Qualified to operate this equipment and shall be additionally trained in:

- Power line recognition and safe distance measures
- Signaling
- Rigging

and while performing Construction-like activities covered under the OSHA Standard 1926.1400 shall be classroom trained, passing both a written and practical examination administered by a third party vendor and shall be Certified to operate a Truck Crane.

Definitions

Accessory: Is a secondary part or assembly of parts which contributes to the overall function and usefulness of a machine.

Appointed: Means assigned specific responsibilities by the employer or the employer's representative.

ANSI: Means the American National Standards Institute.

Angle Indicator: Is an accessory which measures the angle of the boom to the horizontal.

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

Axis of rotation: Is the vertical axis around which the crane superstructure rotates.

Axle: Means the shaft or spindle with which or about which a wheel rotates. On truck- and wheel-mounted cranes it refers to an automotive type of axle assembly including housings, gearing, differential, bearings, and mounting appurtenances.

Base (mounting): Is the traveling base or carrier on which the rotating superstructure is mounted such as a truck.

Boom (crane): Is a member hinged to the front of the rotating superstructure with the outer end supported by ropes leading to a gantry or A-frame and used for supporting the hoisting tackle.

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Boom angle: Is 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: Is 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-off automatic boom stop device or limiter. This type of device disengages boom hoist power when the boom reaches a pre-determined operating angle.

Boom stop: Is a device used to limit the angle of the boom at the highest position.

Brake: Is a device used for retarding or stopping motion by friction or power means.

Cab: Is a housing which covers the rotating superstructure machinery and/or operator's station. On truck-crane trucks a separate cab covers the driver's station.

Certified: Means a truck (mobile) crane operator performing construction-like activities regulated by OSHA Standard 1926.1400, and who has completed and passed classroom and practical examination administered by a third-party, qualified evaluator.

Clearance: Is the distance from any part of the crane to a point of the nearest obstruction.

Clutch: Is a friction, electromagnetic, hydraulic, pneumatic, or positive mechanical device for engagement or disengagement of power.

Competent Person: Means one who is capable of identifying existing and predictable hazards in surrounding or working conditions which are unsanitary, hazardous, or dangerous to employees and who has the authorization to take prompt, corrective measures to eliminate them.

Controlling Entity: Means an employer that is the prime contractor, general contractor, construction manager or any legal entity (city) which has the overall responsibility for a construction project.

Counter weight: Is a weight used to supplement the weight of the machine in providing stability for lifting working loads.

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Crab Steer: A feature on a truck-mounted crane that when engaged, allows both front and rear wheels to be controlled (turned) in tandem.

Crane Inspection Log: Is a file of all Pre-use inspections, Periodic Inspections and Annual inspections for the specific crane. This log should be kept where the crane is normally stored when not in service.

Designated: Means selected or assigned by the employer or the employer's representative as being certified or qualified to perform specific duties.

Designated Spotter: A person meeting training requirements and is therefore Qualified as their sole responsibility to monitor separation between a power line and: equipment, load line, load, (including rigging or tag lines) and ensures through communication that the operator does not breach minimum approach distances to power lines.

Drag Brake: Is a brake which provides retarding force without external control.

Drift Point: Means a point on a travel motion controller which releases the brake while the motor is not energized. This allows for coasting before the brake is set.

Drum: Is the cylindrical members around which ropes are wound for raising and lowering the load or boom.

Dynamic: Means loads introduced into the machine or its components by forces in motion.

Encroachment: Is where any part of the crane, load line or load (including rigging or tag lines) breaches the minimum approach distance to a power line.

Exempted Equipment (for Operator Certification): Machinery adapted to lift: Excavators, Wheel loaders, Backhoes, Forklifts (excepting when configured to lift by means of winch or hook), Wreckers, Digger Derricks (when utilized for auguring, placing/removing electric poles, and placing associated electrical equipment on poles), Dedicated Drilling Rigs, Tree Trimming and Tree Removal equipment, Material Delivery Equipment.

Fail-safe: Means a provision designed to automatically stop or safely control any motion in which a malfunction occurs.

Fall Zone: the area under the load in which it can be reasonably foreseen that suspended materials could fall.

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Frequent (Pre-use/Daily) Inspection Log: Is a form utilized by the operator to provide a daily (or “Pre-use”) checklist of basic operating and safety features of the crane. This form is to remain with the crane while it is in operation.

Gantry (A-frame): Is a structural frame, extending above the superstructure, to which the boom support ropes are reeved.

Hoist: Is an apparatus which may be part of a crane, exerting a force for lifting or lowering.

Hoist chain: Means the load bearing chain in the hoist.

Hoist motion: Means the vertical motion of a crane which raises or lowers the load.

Holding brake: Is a brake that automatically prevents motion when the power is off.

Jib: Is 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.

Load (working): Means the external load, in pounds, applied to the crane, including the weight of load-attaching equipment such as load blocks, shackles, and slings.

Load block (upper): Means the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended from the boom point.

Load block (lower): Means the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.

Load hoist: Is a hoist drum and rope reeving system used for hoisting and lowering loads.

Load ratings: Are crane ratings in pounds established by the manufacturer in accordance with section 6.2.

Magnet: Means an electromagnet device carried on a crane hoist to pick up loads magnetically.

Operators: Are defined by the requirements set forth in Section 5.0, Education and Training, paragraph B of this procedure.

Operation Aids: Are devices that assist an operator by providing additional information or automatically taking control of a crane function.

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Outriggers: Are extendable or fixed metal arms, attached to the mounting base, which rest on supports at the outer ends.

Periodic Inspection Log: Means a monthly (Once in a thirty-day period) inspection of the operating and safety features of the specific crane. This log should be incorporated into the Crane Inspection Log.

Power Line: Means electrical transmission and distribution lines.

Qualified: Means a person recognized by completion of classroom training and examination, coupled with a practical examination, has successfully demonstrated the ability to perform work associated with the operation of cranes, signaling, rigging and designated spotting for power lines. .

Rated load: Means the maximum load for which a crane or individual hoist is designed and built by the manufacturer and shown on the equipment nameplate(s).

Rear Steer: A feature on a truck-mounted crane that when engaged, allows the rear wheels to be turned while the front wheels remain straight line, similar to the operation of some forklifts.

Rigging: Refers to the manner of wrapping or securing material to the crane hook for lifting by means of utilizing varying means of slings, bridles, or steel rope.

Reeving: Means a rope system in which the rope travels around drums and sheaves.

Rope: Refers to a wire rope unless otherwise specified.

Running sheave: Means a sheave which rotates as the load block is raised or lowered.

Side loading: Means a load applied at an angle to the vertical plane of the boom.

Sling: Is an assembly which connects the load to the material handling equipment.

Sling manufacturer: Is a person or organization that assembles sling components into their final form for sale to users.

Standby crane: Is a crane which is not in regular service but which is used occasionally or intermittently as required.

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Standing (guy) rope: Is a supporting rope which maintains a constant distance between the points of attachment to the two components connected by the rope.

Stop: Is a device to limit the travel of a crane trolley or crane bridge. This device is normally attached to a fixed structure and normally does not have energy absorbing capabilities.

Structural competence: Means the ability of the machine and its components to withstand the stresses imposed by applied loads.

Superstructure: Means the rotating upper frame structure of the machine and the operating machinery mounted thereon.

Swing: Means the rotation of the superstructure for movement of loads in a horizontal direction about the axis of rotation.

Swing mechanism: Means the machinery involved in providing rotation of the superstructure.

Tackle: Is an assembly of ropes and sheaves arranged for hoisting and pulling.

Transit : Means the moving or transporting of a crane from one job site to another.

Travel: Means the function of the machine moving from one location to another, on a job site.

Travel mechanism: Is the machinery involved in providing travel.

Trolley: Is the unit which travels on bridge rails and carries the hoisting mechanism.

Wheel base: Means the distance between centers of front and rear axles. For a multiple axle assembly the axle center for wheel base measurement is taken as the midpoint of the assembly.

Whipline (auxiliary hoist): Is a separate hoist rope system of lighter load capacity and higher speed than provided by the main hoist.

Winch head: Is a power driven spool for handling of loads by means of friction between fiber or wire rope and spool.

4.0 RESPONSIBILITY

A. Department/Division Managers

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1. Department shall ensure employees have been trained according to the policies set forth in this procedure and are qualified or certified in the operation of the crane(s) they are designated to operate.
2. Departments that have cranes performing construction-like activities as defined under OSHA Standard 1926.1400 shall designate individuals to receive classroom and practical examination administered by a third-party, qualified evaluator to achieve operator certification required by OSHA Standard.

B. Supervisor Responsibilities

1. Supervisors shall ensure that only qualified or certified employees operate a crane and shall ensure that employees that fail to operate a crane in a safe manner shall be subject to revocation of qualification and re-trained in the safe operation of the equipment.
2. In direct communication with the crane operator shall determine that ground conditions are firm, drained and graded to a sufficient extent so that in conjunction (if necessary) with the use of supportive materials, the equipment manufacturer's specifications for adequate support and level operation are achieved.

C. Operator Responsibility

1. Only qualified employees shall operate a crane or rig loads for a crane and in cases where certification is required, only certified operators will operate a crane.

D. Central Safety Services

1. The Central Safety Services Section, in cooperation with all affected Departments/Divisions within the City of Tucson, will ensure that each workplace that utilizes cranes shall be afforded training in the process of safe operation, scheduled inspection, pre-use inspections, designated spotting, signaling and rigging.

5.0 EDUCATION AND TRAINING

A. Education

1. Central Safety will provide generalized classroom training and examination on crane:
 - a. Operation
 - b. Crane Types
 - c. Inspection
 - d. Power Line Requirements
 - e. Designated Spotters
 - f. Rigging Equipment and Inspection
 - g. Signaling

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2. Departments shall provide practical training and examination designed by the Competent Person that demonstrate techniques for crane operation including, but not limited to:
 - a. Inspection procedures for the specific type of crane in operation, per the manufacturer's operating manual;
 - b. Proper operation of the crane per the manufacturer's operating manual, including picking, moving and landing loads;
 - c. Understanding of a load chart and/or the use and limitation of Operational Aids.
 - d. Rigging loads for lifting;
 - e. Hand signals, including Standard Signals for Controlling Mobile Cranes in Operation (Appendix I)

B. Levels of Training

1. Qualified Crane Operator

- a. Training, authored or approved by Central Safety Services shall be required for all employees that operate mechanical or manual overhead cranes, derrick cranes (including digger derricks), gantry or A-frame cranes and auto cranes utilized for maintaining facilities or equipment.
- b. Training for an Authorized Crane Operator shall consist of classroom training in crane operation and include hand signals and overhead power line recognition. This training shall be combined with a practical exercise component designated and administered by the Operator's Department. The practical exercise component will be designed and administered by department Competent Person and shall include the tasks defined in Section 5.0, Paragraph A2.
- c. Employees passing both the Classroom and Practical tests shall receive a Crane Operators Authorization Card issued by Central Safety Services. This card shall detail the type of crane(s) the employee is trained to operate and qualified to operate for the City of Tucson. The Authorization card shall be kept in the employee's possession while operating any type of crane for the City of Tucson. Authorization shall be required every five (5) years.
- d. Supervisors are responsible for validating that a Qualified Employee has demonstrated an understanding of the training specified above and the demonstrated ability to operate crane equipment in a safe manner before allowing the employee to routinely operate said equipment.
- e. When a supervisor has reason to believe that any qualified or Authorized employee who has already been trained, does not have the

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understanding and skill required by 5.0, paragraph A, the employer shall retrain these employees.

- f. Circumstances where retraining is required include, but are not limited to, situations where:
- Changes in the workplace render previous training obsolete;
 - Changes to or in the type of equipment renders previous training obsolete;
 - Unsafe operation has been identified.
- g. Departments shall verify that each affected employee has received and understands the required training through written documentation that contains the name of each employee trained, the date(s) of training (or re-training), and the subject of qualification, and the results of the written and practical examinations.

2. Qualified Designated Spotter

- a. Employees that will assist Qualified or Certified Crane Operators in the awareness of overhead power lines within the defined area of crane operation shall be required to attend and pass classroom training in Overhead Power Line Recognition in order to become Qualified Designated Spotter.
- b. A Designated Spotter shall be authorized by by Central Safety Services to provide operator spotting of overhead power lines or other unanticipated hazards for a Qualified or Certified Crane Operator. Annual refresher authored or approved by Central Safety Services is recommended.

3. Qualified Signaler

- a. Employees that will assist Qualified or Certified Crane Operators by performing hand signal operation and direction shall be required to attend and pass classroom training in Signaling as prescribed in (Appendix I).
- b. Qualification Requirements
1. A Qualified Signaler shall:
- Know and understand the Standard Method (Appendix I) for hand signals;
 - Be competent in the application of the types of signals;
 - Have a basic understanding of the lifting equipment and limitations, including crane dynamics involved in boom swing and stopping loads, and boom deflection and hoisting loads;
 - Read and understand this procedure;

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- Demonstrate knowledge by passing an examination test administered by Central Safety Services and a practical exam administered by the department.

- c. A Qualified Signaler shall be authorized by Central Safety Services to signal for a Qualified or Certified crane operator. Annual refresher authored or approved by Central Safety Services is recommended.

4. Qualified Rigger

- a. Employees that will assist Qualified or Certified Crane Operators by performing rigging of materials for lifting shall be required to attend and pass classroom training on rigging techniques, rigging materials and rigging inspection.
- b. The Department Competent Person shall design a practical exercise in rigging to consist of:
 - Understanding of three (3) "Hitch Types" used in rigging;
 - Understanding of wire rope and bridle slings;
 - Lift Material evaluation and selection of appropriate rigging equipment;
 - Rigging of material and lifting by a qualified Operator to judge stability and balance of the lifted load;
 - Utilization of a tag line to limit load swing.
- c. A Qualified Rigger shall be authorized to rig for a Qualified or Certified Crane Operator by Central Safety Services good for a period of five (5) years. Annual refresher authored or approved by Central Safety Services is recommended

5 Certified Operator

- a. Employees that operate a Truck (Mobile) crane while performing construction or "construction-like activities (repair) shall receive specialized training conducted by a qualified third-party contractor. This training shall include the classroom materials applicable to the employer's equipment and a pass/fail written examination and a pass/fail practical test utilizing the employer's equipment or similar. Passing the classroom and practical exercise will deem the employee Certified to operate a Truck (Mobile) Crane. Evidence of Certification shall be in the possession of the employee at all times while operating a Truck (Mobile) Crane.
- b. Qualified Operators receiving training in the operation of a Truck (Mobile) Crane while performing construction or construction-like activities may do so only under the direct supervision of a Certified Crane Operator.

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6. Certification (2014)

- a. Only certified crane operators who have completed Advanced Training and hold Certification shall be allowed to operate a Truck (Mobile) Crane while performing construction or construction-like activities (repair).
- b. Certification by a qualified third-party entity shall be required every five (5) years.

6.0 OPERATING PRACTICES

A. Fit for Duty

1. When the operator is physically or mentally unfit, an operator shall not engage in the operation of equipment.
2. A City Employee who is taking any medication, whether prescribed or non-prescribed, *which may interfere with the safe and effective performance of duties or operation of City equipment*, is required to advise Human Resources-Employee Leave Management Division of that fact, before beginning work.
3. In the event that there is a question regarding an employee's ability to safely and effectively perform assigned duties while using such medication, clearance from the City Physician shall be required; **the employee should not be allowed to operate equipment until clearance from the City Physician is obtained.**
4. Failure to advise Human Resources of the use of any medication which may interfere with the safe and effective performance of duties or operation of City equipment may result in discipline.
5. City employees whose blood, breath or urine, when tested, contains an alcohol concentration of .04 percent or above is presumed to be impaired by the use of alcohol. Employees with an alcohol concentration of less than .04 percent may be considered impaired, depending upon a consideration of all the circumstances.
6. Employees who perform driving duties which require a Commercial Drivers license with alcohol concentrations of .02 to .04 percent will be removed from driving duties and all safety sensitive functions for a period of not less than 24 hours following the administration of the test, and are subject to disciplinary action.

B. Ground Conditions

1. The Competent Person and the Crane Operator shall evaluate any outdoor surface prior to setting up and operating a crane to determine if the ground is firm, drained and graded to a sufficient extent so that in

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conjunction (if necessary) with the use of supportive materials, the equipment manufacturer's specifications for adequate support and level operation are achieved.

C. Hazard Assessment

1. Prior to positioning the crane and beginning operations the Competent Person and Crane Operator shall identify the work zone and exercise one of the following options:
 - a. Demarcating Boundaries (such as with flags, or a device such as a range limiting device or range control warning device) and prohibiting the operator from operating outside those boundaries, or;
 - b. Defining the work zone as the area 360 degrees around the equipment up to the equipments maximum working radius.
 - c. Assistance for overhead power lines can be obtained from Tucson Electric Power by accessing the TEP Website (www.TEP.org), selecting the Overhead and Excavation hyperlink, selecting the category of work that defines the hazard, and completing the Protection Application Form and submitting it to TEP and awaiting scheduling to proceed under the observation of TEP Supervision.
 - d. The above procedure is fully detailed in OSHM S-013 – Bluestake Program.

D. Overhead Electrical Power Lines

1. If it is determined that overhead electrical power lines (or any overhead utility lines) are located within twenty feet (20'), the Competent Person and Crane Operator shall select one of the following options:
 - a. De-energize and ground – Confirm with utility owner that the energized line has been de-energized and is visibly grounded at the worksite.
 - b. Using a Designated Spotter, maintain a twenty foot (20') clearance from energized lines, ensuring that no part of the equipment, load line, load, rigging or tag lines will get closer than twenty feet (20') of the power line by implementing the measures specified in Section 6.0, Paragraph E, **Encroachment Precautions.**
 - c. Table A Clearance – Determine the electrical line voltage and the minimum approach distance permitted under Table A, including any part of the equipment, load line, load, rigging or tag lines would get closer than the minimum approach distance permitted.

- d. Operation under energized, electrical power lines is prohibited, unless the operating boom of the crane, in the fully extended position, will remain outside of the twenty foot (20') plane of the power line or outside of the Minimum Approach Distance defined in Table A.

Table A – Minimum Clearance (Approach) Distances	
Voltage (Nominal kV, alternating current)	Minimum Clearance Distance (feet)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1,000	45
Over 1,000	Distance Specified by the Utility Owner

E. Encroachment Precautions

1. If the Department selects Option b or Option c from Section D, Paragraph 1, all of the following requirements shall be met:
 - a. Conduct an on-site planning meeting to inform the Operator and all affected employees regarding the location and hazards of the overhead power line(s), including the steps that will be implemented to prevent encroachment and electrocution.
 - b. Utilize a Designated Spotter.
 - c. Taglines shall be of non-conductive material.
 - d. Erect and maintain an elevated warning line barricade (TEP) or line-of-site signs in full view of the crane operator. Warning lines and signs shall be located twenty feet (20') from the power line, or at the approach distance verified by the Utility according to the voltages defined in Table A.
 - e. Utilize a Proximity Alarm or Proximity Warning Limiter to prevent encroachment; *or* deploy a Designated Spotter who shall remain in continuous contact with the Crane Operator.

F. Traveling Under/Near Power Lines – No Load

1. Travel on job sites (and on the public right-of-way) shall occur with the boom mast in the fully lowered and cradled position. The boom mast shall be secured for travel on the public right-of-way
2. Clearances specified in Table B shall be maintained.

Table B- Minimum Clearance Distances While Traveling with No Load
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Voltage (Nominal, kV alternating current)	While Traveling – Minimum Clearance Distance – In feet
Up to 0.75	4
.75 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1,000	20
Over 1,000	Distance Specified by the Utility Owner or Registered Professional Engineer who is a Qualified Person with respect to Electrical Power Transmission and Distribution

3. If any part of the equipment while traveling will get closer than twenty feet (20') to the power line, a Designated Spotter will be deployed to communicate position and clearance information to the crane operator.

G. Inspections

1. Prior to initial use all new and altered cranes shall be inspected to insure compliance with provisions of this section.
2. The inspection procedure for cranes in regular service is divided into three (3) general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are herein designated as "frequent", "periodic" and "Annual-Third Party".

A. Frequent (Daily or Pre-use) Inspection

1. Items such as the following shall be inspected for defects at intervals as defined in 6.0, paragraph G of this section or as specifically indicated including observation during operation for any defects which might appear between regular inspections. Any deficiencies such as listed shall be carefully examined and reported to Competent Person so determination can be made as to whether they constitute a safety hazard. A safety hazard will result in immediate dead-line of the equipment until repair is completed:
 - All control mechanisms for maladjustment interfering with proper operation;
 - All safety devices for malfunction;
 - Deterioration or leakage in air or hydraulic systems;
 - All control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter;
 - Crane hooks with deformations or cracks. For hooks with cracks or having more than 10 percent (10%) in excess of normal throat

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opening or more than 10 degree (10°) twist from the plane of the unbent hook;

- Rope reeving for noncompliance with manufacturer's recommendations;
- Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation.

2. All results of the Frequent Inspection shall be noted in the Pre-use Inspection log for the specific crane. The Pre-use Inspection log shall remain with the crane operator while the crane is in use. All Pre-use Inspections shall be documented according to the direction set forth in section 6.0, paragraph I.

B. Periodic (Monthly – Once every Thirty [30] day period) Inspection

1. Inspections shall include the requirements of section 6.0, paragraph G. In addition, cranes shall be inspected periodically for any deficiencies such as listed below and shall be immediately reported to a supervisor by the operator and together they shall be carefully examined and determination made as to whether the deficiencies constitute a safety hazard:

- Deformed, cracked, or corroded members in the crane structure and boom;
- Loose bolts or rivets;
- Cracked or worn sheaves and drums;
- Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers and locking devices;
- Excessive wear on brake and clutch system parts, linings, pawls, and ratchets;
- Load, boom angle, and other indicators over their full range, for any significant inaccuracies;
- Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with safety requirements;
- Excessive wear of chain-drive sprockets and excessive chain stretch;
- Travel steering, braking, and locking devices, for malfunction;
- Excessively worn or damaged tires.

2. Inspection results shall be documented according to the directions found in section 6.0, paragraph D.

C. Annual Third-Party Inspection

1. An annual inspection shall be scheduled with General Services Department, Fleet Services Division to review the safety and operating features of the crane. Any Deficiencies shall be listed in repair priority.

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- a. **Type I Deficiencies** shall cause the crane to be dead-lined. Repairs shall be completed and a daily inspection shall be completed prior to placing the crane back in service.
- b. **Type II Deficiencies** shall be scheduled for repair within Fifteen (15) days of the inspection. A daily inspection shall be completed prior to returning the crane to operation.
- c. **Type III Deficiencies** shall be addressed and corrected during the next scheduled maintenance for the crane.

D. Inspection Records

1. Frequent (Daily or Pre-use) Inspection which includes the date of inspection, the signature of the person who performed the inspection and the vehicle number shall be kept with the vehicle.
2. Periodic inspection results on critical items delineated in 6.0, paragraph B of this section shall be made every 30 days. These records shall be kept readily available at the location where the crane is normally stored.
3. Annual Third-Party Inspection shall be signified by placing of an Inspection Sticker directly on the equipment. The sticker shall note the Month, date and year of the Annual Inspection. A deficiency report will be filed with Fleet Services. Deficiencies noted in the Annual Third-Party Inspection shall be addressed as referenced in Paragraph C.

E. Inspection - Cranes Not in Regular Use

1. A crane which has been idle for a period of three (3) months or more, shall be given an inspection conforming with requirements of sections 6.0, paragraphs B, #1, prior to being placed into service. Cranes that have been idle for a period up to 12 months shall be subject to the Annual Third-Party and certified for use by the vendor, before being placed into service.

F. Fall Protection

1. On all equipment where operators may climb to operate or perform inspection, fall protection to a height six feet (6') or over, in the form of stair/step access railings with slip-resistant features (properties) and walking surfaces with slip-resistant features (properties).
2. Operators and any other affected employee shall be trained in the fall hazards associated with the operation and inspection of the equipment.

H. Crane Wire Rope Inspection

1. A Competent Person shall perform a visual inspection of wire rope prior to use. The inspection shall consist of rope observation (running and standing) that are likely to be used during the operation of the crane.

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2. Category 1

- a. Significant distortion of the wire rope structure such as kinking, crushing, un-stranding, bird-caging, signs of core failure or steel core protrusion between the outer strands.
- b. Significant corrosion.
- c. Electric arc damage (from a source other than power lines) or heat damage.
- d. Improperly applied end connections.
- e. Significantly corroded, cracked, bent or worn end connections.

3. Category 2

- a. Visibly broken wires as in; six randomly broken wires in one lay, or 3 broken wires in one strand in one rope lay, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.
- b. In rotation resistant ropes; two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
- c. In pendant or stranding wires; 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.
- d. A diameter reduction of more than five percent (5%) from nominal diameter.

4. Category 3

- a. In rotation resistant rope, core protrusion or other distortion indicating core failure.
- b. Prior electrical contact with power line.
- c. A broken strand.

5. Critical Wire Inspection Items

- a. Rotational resistant wire rope in use.
- b. Wire rope being used for boom hoists and luffing points, 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.

6. Removal from Service

- a. **Category 1** – If the Competent Person determines an immediate safety hazard is present, the wire rope will be replaced or severed (shortened) eliminating the damaged portion. Splicing wire rope is prohibited. Shortened wire rope shall have two (2) wraps of the wire

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rope remaining on the drum at with the boom and/or load is I the lowest position.

- b. **Category 2** - If the Competent Person determines an immediate safety hazard is present the wire rope will be replaced unless approved by the manufacturer or returned to service after elimination of the damaged portion as in Category 1.
- c. **Category 3** - If the Competent Person determines an immediate safety hazard is present the wire rope will be replaced or localized, excepting damage from an energized power line, after elimination of the damaged portion as described in Category 1. Repair of wire rope contacting an energized power line is prohibited.

I. Safety Devices

- 1. All mobile cranes shall have a level indicator that is either built in to the equipment or is available on the equipment.
- 2. All cranes shall have a boom stop
- 3. Cranes with foot-petal brakes shall be equipped with locks.
- 4. Hydraulic outriggers jacks and stabilizers jacks shall have an integral holding device/check valve.
- 5. All mobile cranes shall have a horn either built into the equipment or is on the equipment and immediately available to the operator.
- 6. Truck (Mobile) cranes shall have a rated Fire Extinguisher secured in the operational cab.

J. Operational Aids

- 1. A Truck (mobile) crane shall have substantial and durable rating chart with clearly legible letters and figures shall be provided with each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at the control station.
- 2. A Truck (Mobile) crane shall have a boom angle or radius indicator readable from the operator's station.
- 3. A Truck (Mobile) crane shall have a Boom Length Indicator except where rated capacity is independent of the of the boom length.
- 4. A Truck (Mobile) crane (manufactured after March 29, 2003) rated at over 6,000 lbs. shall have a load weighing device or rated capacity limiter.

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K. Work Area Control

1. Where the Truck (Mobile) Crane has a swing radius, the operator and/or Competent Person shall establish and mark a safety zone that defines the Axis of Rotation for the superstructure to prevent:
 - a. Striking an employee;
 - b. Pinching or crushing an employee against another part of the equipment or another object.
2. To prevent employees from entering the Axis of Rotation, the department shall:
 - a. Train each employee assigned to work on or near the equipment in how to recognize struck-by and pinch-point hazards;
 - b. Erect and maintain control lines, warning lines, barriers or similar to mark the boundaries of the Axis of Rotation as the Hazard Zone. The Hazard Zone shall be clearly marked by a combination of signs (Danger – Swing/Crush Zone) and high visibility marking on the equipment.
3. No employee shall enter the area under the load, so defined as the Fall Zone, except for employees:
 - a. Engaged in hooking, unhooking the load, or guiding the load;
 - b. Engaged in the initial attachment of the load;
 - c. Operating a concrete hopper or concrete bucket;
 - d. Receiving a load.

L. Operation

1. Before leaving the crane (other than an Auto Crane) unattended, the operator shall:
 - a. Land any attached load, bucket, lifting magnet, or other device;
 - b. Disengage the clutch;
 - c. Set travel, swing, boom brakes, and other locking devices;
 - d. Put controls in the “off” position;
 - e. Stop the engine;
 - f. Secure crane against accidental travel;
 - g. When a wind alarm is given or on leaving the crane overnight, ground chocks shall be set on truck and crawler cranes;
 - h. Crane booms shall be lowered to ground level or otherwise fastened securely against displacement by wind loads or other outside forces.
2. The Operator shall not circumvent a Lockout or Out-of-Service sign. If there is a warning sign on the switch or engine starting controls, the

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operator shall not close the switch or start the engine until the warning sign has been removed by the person placing it there.

3. Before closing the switch or starting the engine, the operator shall see that all controls are in the "off" position and all personnel are in the clear.
4. If the power fails during the operation, the operator shall:
 - Set all brakes and locking devices;
 - Move all clutch or other power controls to the "off " position;
 - If practical, the suspended load should be landed under brake control.
5. Booms shall not contact any obstruction. The crane shall not be utilized to drag or pull a load sideways.
6. Booms which are being assembled or disassembled on the ground or without the support of the boom should be securely blocked to prevent dropping of the boom and boom sections.
7. At no time shall employees be allowed to ride the hook, headache ball or other attachment device at the terminal end of the line rope, unless the crane has been affixed with an approved man lift platform or basket. The platform shall be designed for the specific purpose of transporting employees and shall be installed to the manufacturer specifications and the load capacity, in person(s) or in pounds shall be prominently displayed on the man lift device.

M. Authority to Stop Operation

Whenever there is a concern as to safety, the operator shall have the authority to stop and refuse to handle loads until a Competent Person has determined that safety has been assured.

N. Signals – General Requirements

1. A Qualified Signaler (Refer to Section 5.0, Paragraph 3) must be provided in each of the following circumstances:
 - The point of operation, meaning the load travel or area near or at the load placement, is not in full view of the operator
 - When equipment is traveling, the view in the direction of travel is obstructed.
 - Due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.
2. Signals to the operator shall only be given by hand, voice, audible.
3. Hand Signals

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- a. When using hand signals, the Standard Method must be used (Appendix I). Exception: Where use of the Standard Method for hand signals is infeasible, or where an operator or use of an attachment is not covered in the Standard Method, non-standard hand signals may be used in accordance with the following paragraph.
 - b. When using non-standard hand signals, the qualified signaler, operator and lift director (where there is one) must contact each other prior to the operation and agree on the non-standard hand signals that will be used.
 - c. Hand Signal Charts shall be posted on the equipment or conspicuously posted in the vicinity of the operating controls.
4. Voice/Audible Signals
- a. The terminology used for voice/audible given by the qualified signaler must be given in the same terminology that conforms to the Hand Signals (Appendix I).
 - b. During the operation while utilizing voice signals, the commands become inaudible to the operator or the communication device is interrupted or fails at any time, voice signals shall cease and be the operation stopped until communication is re-established , or replaced by Hand Signals given in the Standard Method (Appendix I).
 - c. Electronic signaling methods shall be tested on-site, prior to the beginning of the operation and shall be conducted on a channel dedicated to the operator, signaler and Competent Person. The operator shall utilize a “hands-free” or voice-activated system.

O. Tandem Lifts

1. Lifts involving two or more cranes are complex operations requiring skill and pre-planning and should be executed only under qualified supervision. A lifting procedure, detailing the aspects of the lift, load capacity, and crane lifting capacities is required for all tandem or multiple crane lifts. One person shall control the operation and shall maintain constant contact with the crane operators. For Tandem or Multiple crane lifts, the minimum requirements should be included in the Lift Procedure:
 - a. Exact weight of the load must be determined;
 - b. Ground conditions must be stable, compact and level. If level conditions cannot be met, correction should include blocking, mats or soil compaction;

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- c. Longest load radius of each crane for the complete operation must be measured exactly;
 - d. Boom length and boom angles must be determined exactly;
 - e. Net rated capacity of each crane must be determined for the entire lift;
 - f. No crane should be loaded to more than 75% of its NET capacity;
 - g. Carrying capacity of each crane must be determined;
 - h. Rigging should be divided according to crane carrying capacity;
 - i. Line, swing and boom speeds must be matched;
 - j. Swing and boom motions should be kept to minimum;
 - k. Cranes should not travel with load;
 - l. Signalmen, riggers and operators will be briefed by the supervisor on all aspects of the lift, and shall have the opportunity to view the Tandem or Multiple Lift Procedure;
 - m. Conduct a practice lift, with no load;
 - n. Hoist lines shall be kept completely vertical at all times. If hoist lines deviate from vertical, the lift will be stopped.
2. A Tandem Lift Checklist is found in Appendix II of this procedure.

P. OVERHEAD AND GANTRY CRANES

1. This section applies to overhead and gantry cranes and others having the same fundamental characteristics. Inspections and documentation shall be performed in a manner identical to those inspection procedures defined in section 6.0 Paragraphs G and H. Operation shall be performed in a manner similar to Section 6.0, Paragraphs K and L.
2. Only Qualified Personnel shall be permitted to operate an Overhead or Gantry Crane
3. The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block and this marking shall be clearly legible from the ground or floor.
3. Minimum clearance of 3 inches overhead and 2 inches laterally shall be provided and maintained between crane and obstructions.
4. Where passageways or walkways are provided obstructions shall not be placed so that safety of personnel will be jeopardized by movements of the crane.
5. Stops shall be provided at the limits of travel of the trolley. Stops shall be fastened to resist forces applied when contacted.
6. Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components which might constitute a

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hazard under normal operating conditions shall be guarded in a secure method. Electrical equipment shall be protected from grease, oil and moisture. Guards for live parts shall be substantial and so located that they cannot be accidentally deformed so as to make contact with the live parts.

7. Each independent hoisting unit of a crane shall 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.
8. For floor-operated cranes, the controller or controllers if rope operated shall automatically return to the "off" position when released by the operator.
9. Pushbuttons in pendant stations shall return to the "off" position when pressure is released by the crane operator.
10. Rope shall be secured to the drum as follows:
 - a. No less than two wraps of rope shall remain on the drum when the hook is in its extreme low position;
 - b. Rope end shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer.
11. A hook shall meet the manufacturer's recommendations and shall not be overloaded.
12. Hooks shall be inspected prior to use and shall not:
 - a. deviate from the center line (twist) greater than ten (10°) degrees
 - b. have a throat opening greater than ten percent (10%) of the manufacturer's setting. An extended throat opening is normally visualized if the safety latch will not meet the safety catch and there is an observed opening.
 - c. have an effective and operational safety catch.

Q. Rigging

1. Riggers shall be trained and qualified in the safe use and practices of rigging equipment and shall undergo both classroom examination administered by Central Safety Services and practical testing administered by the department in order to attain certification.
2. Prior to use, the rigging and all fastenings and attachments shall be inspected for damage or defects by a Competent Person designated by the employer. Additional inspections shall be performed during rigging

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use, where service conditions warrant. Damaged or defective rigging shall be immediately removed from service. Daily or Pre-use inspections shall be documented by the date of the inspection, identification of the equipment by serial number and signature of person inspecting the rigging.

3. Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in Appendix 4, Tables H-1 through H-20 in this subpart, following OSHA 1926.251(f)(2) for the specific equipment.
4. Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to employees.
5. In-house design or 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 shall be proof-tested prior to use to 125% of their rated load.

R. Alloy Steel Chains

1. Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and sling manufacturer.
2. Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links, or other attachments, when used with alloy steel chains, shall have a rated capacity at least equal to that of the chain.
3. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
4. Rated capacity (working load limit) for alloy steel chain slings shall conform to the values shown in Table H-1 following OSHA 1926.251(f) (2) for the specific equipment.
5. Whenever wear at any point of any chain link exceeds that shown in Table H-2 following OSHA 1926.251(f)(2) for the specific equipment, the assembly shall be removed from service.
6. In addition to the inspection required by other paragraphs of this section, a thorough periodic inspection of alloy steel chain slings in use shall be made on a regular basis, to be determined on the basis of
 - a. frequency of sling use;
 - b. severity of service conditions;
 - c. nature of lifts being made; and
 - d. experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.

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7. The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.

S. Wire Rope

1. Tables H-3 through H-14 following OSHA 1926.251(f) (2) for the specific equipment shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings with various types of terminals. For sizes, classifications, and grades not included in these tables, the safe working load recommended by the manufacturer for specific, identifiable products shall be followed, provided that a safety factor of not less than 5 is maintained.
2. Protruding ends of strands in splices on slings and bridles shall be covered or blunted.
3. The following limitations shall apply to the use of wire rope:
 - a. An eye splice made in any wire rope shall have not less than three full tucks. However, this requirement shall not operate to preclude the use of another form of splice or connection which can be shown to be as efficient and which is not otherwise prohibited;
 - b. Except for eye splices in the ends of wires and for endless rope slings, each wire rope used in hoisting or lowering, or in pulling loads, shall consist of one continuous piece without knot or splice;
 - c. Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire rope clips or knots;
 - d. Wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect;
 - e. When U-bolt wire rope clips are used to form eyes, Table H-20 following OSHA 1926.251(f)(2) for the specific equipment shall be used to determine the number and spacing of clips;
 - f. When used for eye splices, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope;
 - g. Slings shall not be shortened with knots or bolts or other makeshift devices;
 - h. Sling legs shall not be kinked;
 - i. Slings used in a basket hitch shall have the loads balanced to prevent slippage;
 - j. Slings shall be padded or protected from the sharp edges of their loads;
 - k. Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load;

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- l. Shock loading is prohibited;
 - m. A sling shall not be pulled from under a load when the load is resting on the sling.
4. Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200 deg. F (93.33 deg. C). When non-fiber core wire rope slings of any grade are used at temperatures above 400 deg. F (204.44 deg. C) or below minus 60 deg. F (15.55 deg. C), recommendations of the sling manufacturer regarding use at that temperature shall be followed.
 5. Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.
 6. All welded end attachments shall not be used unless proof tested by the manufacturer or equivalent entity at twice their rated capacity prior to initial use. The employer shall retain a certificate of proof test, and make it available for examination.

T. Natural Rope and Synthetic Fiber Slings

1. When using natural or synthetic fiber rope slings, Tables H-15, 16, 17, and 18 following OSHA 1926.251(f)(2) for the specific equipment shall apply.
2. All splices in rope slings provided by the employer shall be made in accordance with fiber rope manufacturer's recommendations.
3. In manila rope, eye splices shall contain at least three full tucks, and short splices shall contain at least six full tucks (three on each side of the centerline of the splice).
4. Inlayed synthetic fiber rope, eye splices shall contain at least four full tucks, and short splices shall contain at least eight full tucks (four on each side of the centerline of the splice).
5. Strand end tails shall not be trimmed short (flush with the surface of the rope) immediately adjacent to the full tucks. This precaution applies to both eye and short splices and all types of fiber rope. For fiber ropes under 1-inch diameter, the tails shall project at least six rope diameters beyond the last full tuck. For fiber ropes 1-inch diameter and larger, the tails shall project at least 6 inches beyond the last full tuck. In applications where the projecting tails may be objectionable, the tails 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).

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6. For all eye splices, the eye shall be sufficiently large to provide an included angle of not greater than 60 deg. at the splice when the eye is placed over the load or support.
7. Knots shall not be used in lieu of splices.
8. Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20 deg. F (-28.88 deg. C) to plus 180 deg. F (82.2 deg. C) without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.
9. Fiber rope slings shall not be used if end attachments in contact with the rope have sharp edges or projections.
10. Natural and synthetic fiber rope slings shall 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.

U. Synthetic Webbing (Nylon, Polyester, Polypropylene)

1. The employer shall have each synthetic web sling marked or coded to show:
 - a. Name or trademark of manufacturer;
 - b. Rated capacities for the type of hitch;
 - c. Type of material;
 - d. Rated capacity shall not be exceeded.
2. Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing's width.
3. Fittings shall be:
 - a. Of a minimum breaking strength equal to that of the sling;
 - b. Free of all sharp edges that could in any way damage the webbing.
4. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

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5. When synthetic web slings are used, the following precautions shall be taken:
 - a. Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolic is present;
 - b. Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present;
 - c. Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.
6. Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180 deg. F (82.2 deg. C). Polypropylene web slings shall not be used at temperatures in excess of 200 deg. F (93.33 deg. C).
7. Synthetic web slings shall 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. Snags, punctures, tears or cuts;
 - d. Broken or worn stitches;
 - e. Distortion of fittings.

V. Shackles and Hooks

1. Table H-19 following OSHA 1926.251(f)(2) for the specific equipment shall be used to determine the safe working loads of various sizes of shackles, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products, provided that a safety factor of not less than 5 is maintained.
2. The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. The employer shall maintain a record of the dates and results of such tests.

7.0 ADVICE AND COUNCIL

Reference current version:

OSHA 1910.179

OSHA 1910.180

OSHA 1910.181

OSHA 1926.1400

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Appendix I OSHA Appendix A to Subpart CC of part 1926 – Standard Hand Signals

Appendix II Tandem Lift Checklist

Appendix III Crane Use – Hazard Analysis

Appendix IV Pre-use Inspection Checklist

Appendix V Daily Chain Inspection Log

Appendix VI Backing Checklist

Appendix VII Tucson Airport Authority – Use of Cranes in Close Proximity to TIA

Appendix VIII Sling Inspection Record

Appendix IX Sling/Chain Inspection Record

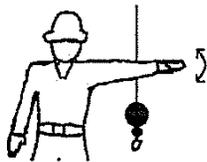
Appendix X Wire Rope Inspection Record

Appendix XI Crane Detailed Inspection and Maintenance Record

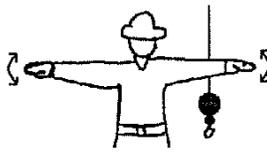


Appendix I

Appendix A to Subpart CC of Part 1926—Standard Hand Signals.



STOP – With arm extended horizontally to the side, palm down, arm is swung back and forth.



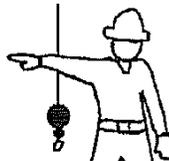
EMERGENCY STOP – With both arms extended horizontally to the side, palms down, arms are swung back and forth.



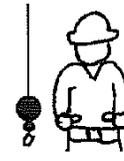
HOIST – With upper arm extended to the side, forearm and index finger pointing straight up, hand and finger make small circles.



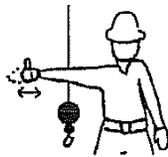
RAISE BOOM – With arm extended horizontally to the side, thumb points up with other fingers closed.



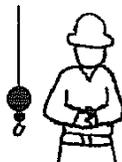
SWING – With arm extended horizontally, index finger points in direction that boom is to swing.



RETRACT TELESCOPING BOOM – With hands to the front at waist level, thumbs point at each other with other fingers closed.



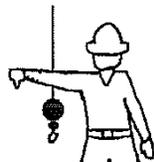
RAISE THE BOOM AND LOWER THE LOAD – With arm extended horizontally to the side and thumb pointing up, fingers open and close while load movement is desired.



DOG EVERYTHING – Hands held together at waist level.



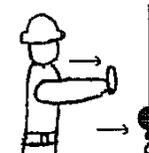
LOWER – With arm and index finger pointing down, hand and finger make small circles.



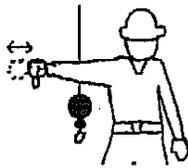
LOWER BOOM – With arm extended horizontally to the side, thumb points down with other fingers closed.



EXTEND TELESCOPING BOOM – With hands to the front at waist level, thumbs point outward with other fingers closed.



TRAVEL/TOWER TRAVEL – With all fingers pointing up, arm is extended horizontally out and back to make a pushing motion in the direction of travel.



LOWER THE BOOM AND RAISE THE LOAD – With arm extended horizontally to the side and thumb pointing down, fingers open and close while load movement is desired.



MOVE SLOWLY – A hand is placed in front of the hand that is giving the action signal.



USE AUXILIARY HOIST (whipline) – With arm bent at elbow and forearm vertical, elbow is tapped with other hand. Then regular signal is used to indicate desired action.



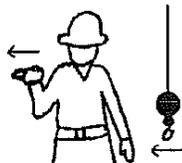
CRAWLER CRANE TRAVEL, BOTH TRACKS – Rotate fists around each other in front of body; direction of rotation away from body indicates travel forward; rotation towards body indicates travel backward.



USE MAIN HOIST – A hand taps on top of the head. Then regular signal is given to indicate desired action.



CRAWLER CRANE TRAVEL, ONE TRACK – 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.



TROLLEY TRAVEL – With palm up, fingers closed and thumb pointing in direction of motion, hand is jerked horizontally in direction trolley is to travel.

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Appendix II



City of Tucson

TANDEM LIFTS Checklist

LIFTS INVOLVING TWO OR MORE CRANES ARE COMPLEX OPERATIONS REQUIRING CONSIDERABLE SKILL AND PLANNING.

IT IS ABSOLUTELY CRITICAL THAT A DETAILED PROCEDURE BE DRAWN UP. A MULTIPLE CRANE LIFT SHOULD BE METICULOUSLY PLANNED AND EVERY MOVE EVENTUALITY TAKEN INTO CONSIDERATION.

THE PLAN SHOULD INCLUDE THE FOLLOWING REQUIREMENTS: (CHECK WHEN IMPLEMENTED INTO PRE-LIFT PLAN)

1. Lift must be planned and carried out under qualified supervision.
2. Load weight must be determined exactly.
3. Ground conditions must be stable, compacted and level, and if not, then corrected by blocking, mats or compaction. ALL cranes must be in good operating condition.
4. Longest load radius of each crane for the complete operation must be measured exactly.
5. Boom length and boom angles must be determined exactly.
6. Net rated capacity of each crane must be determined for the whole operation.
7. For a multiple crane lift, no crane should be loaded to more than 75% of its NET capacity.
8. How much of the load is to be carried by each crane must be known exactly. The rigging should be arranged to divide the load as planned.
9. The line, swing and boom speeds of the cranes must be matched. If the hoist speeds are unequal, the leading crane can carry a greater share of the load. If the swing rates are not equal the cranes will sideload each other.
10. Swing and booming motions should be kept to a minimum.
11. Whenever possible the cranes should not travel with load. If travel is necessary then the cranes should have equal boom lengths.

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- 12. Signalmen, riggers and operators must know exactly what they have to do and what movements will have to be made BEFORE the lift begins.
- 13. If possible conduct a dry run without load.
- 14. All communications during the lift should be made by radio (preferably closed or hard-line rather than walkie-talkie).
- 15. It is imperative that ONE person direct and control the operation, they should be positioned to view the total operation and should maintain radio contact with the operators.
- 16. All crane and load movements should be made as smoothly as possible. Brakes and clutches should be applied gradually.
- 17. Hoist lines must be kept vertical at all times. This is absolutely CRITICAL. When the lines are not vertical the cranes are throwing extra load on each other and may be side loading each other which is a GREATER DANGER.

Signed

Date



Appendix III
City of Tucson
Supervisor /Project Coordinator HAZARD ANALYSIS
For Crane Operations

Job Number: _____	Job Location: _____
Date: _____	Requestor: _____
Completed By: _____	Customer Signature: _____

Hazardous Conditions	OK	Comments
A. Access / Build-up area		
1. Adequate road to access work area		
2. Adequate entrance into and out of Project.		
3. Use of public access – Traffic Control		
* Traffic control		
* Permits		
4. Build –up area		
5. Breakdown area		
6. Existing structures		
7. Truck/Trailer staging area		
8. Access outside/around building		
B. Ground Conditions		
1. Level (within 1% of level)		
2. Compaction to support crane loads		
3. Ramps – Grade ability		
4. Crane Restrictions (excavations/shoring/underground vaults)		
5. Waiver for ground surface by Engineer		
6. Slab thickness – Authorization- where Engineering Specs require <i>Signature</i>		
C. Utilities		
1. Overhead Power-lines		
2. Underground (BLUE STAKE) Water/Sewer/Gas/Fiber Optics		
3. Proximity to nearest Airport		
*FAA Clearance required and TAA procedure		
*Airport flag or light required		
D. Communication:		
1. Competent Designated Signaler		<i>NAME:</i>
Adequate System: Radio / Hard-line		



Appendix IV

PRE-USE CRANE INSPECTION

DATE: _____

CRANE NO: _____

OPERATOR: _____

LOCATION: _____

VEHICLE NO: _____

STARTING MILEAGE: _____

STARTING HOURS: _____

ENDING MILEAGE: _____

ENDING HOURS: _____

UNIT SHOULD NOT BE OPERATED UNTIL REPAIRS HAVE BEEN MADE

INSPECTION DESCRIPTION	METHOD OF INSPECTION	INDICATED			REPAIRED (if applicable)		DATE INSPECTED
		ACCEPT	REJECT	YES	NO	DATE	
Check control mechanisms for excessive wear.	Visual & Operational						
Check all Safety devices for malfunction.	Parts Manual & Operational						
Check for any deterioration or leakage in the air or hydraulic systems such as tubes, fittings, hoses, seals, etc.	Visual & Operational						
Check hydraulic system for proper oil level.	Visual						
Check for smooth & correct operation of each function including remote control.	Operational						
Check crane hooks *	Visual & Measure for size						
Check Wire Rope (Cable) ** Check torque of end clamp attachments	Visual						

* Crane hooks shall be taken out of service when any of the following conditions exists:

1. More than 10% excess of normal throat opening.
2. More than 10% twist-hooks cannot be repaired.

** Wire ropes shall be taken out of service when any of the following conditions exists:

1. In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
2. Wear of one third the original diameter of outside individual wires-kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.
3. Evidence of any heat damage from any cause.
4. Reductions from nominal diameter of more than 1/64 inch for diameters up to and including 5/16 inch, 1/32 inch for diameters 3/8 inch to and including 1/2 inch, 3/64 inch for diameters 9/16 inch to and including 3/4 inch.

Appendix VI



City of Tucson

Pre-Backing Safety Checklist

This form must be filled out entirely for any and all backing of cranes or other CDL equipment when any of the following criteria are met:

- There is backing into a traffic area.
- There is a potential obstruction.
- More than one signalman is needed (there must still be ONE signaler, positioned by the driver, for the driver to follow).

Date: _____ Time: _____

Location: _____

Requestor Name: _____

Supervisor: _____

Equipment Number: _____

Unit # _____

Potential Hazards: _____

Plan of Action:

Communication Methods: Hand-signals Radio Channel: _____

IF YOU ARE USING A RADIO CHANNEL, YOU MUST HAVE A DEDICATED CHANNEL.

SAFETY PROCEDURES CHECKLIST	Operators Initials	Signaler Initials
Discuss backing plan		
Note blind spots		
Personalize the communication (Name or Crane Number)		
Establish traffic control		
Ensure constant communication is maintained		
Pre-Backing Check List:		
STOP THE OPERATION If unsure or inadequate signals are provided		

	PRINT	SIGNATURE
Signaler		
Crane Operator / Driver		

Comments/Suggestions: _____

***If you are unclear about any part of this plan, STOP THE OPERATION
 CONTACT YOUR SUPERVISOR IMMEDIATELY***

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Appendix VII

PROCEDURES FOR NOTIFICATION OF CRANE USE AT AIRPORT OR WITHIN AIRSPACE OF AIRPORT

DATE ISSUED: 10/20/02

DATE MODIFIED: 4/18/05

RE: PROCEDURES TO USE CRANES WITHIN 4 MILES OF OR ON AIRPORT PROPERTIES

DOCUMENT: TAADOC188

Notification of utilizing cranes at locations that would affect airspace landing/departure procedures is imperative to the safe operation of the airport.

REFERENCES:

A/C 70/7460-2K 5.- Notices, What Kind of Structures Require FAA Notification? Proposed construction or alteration of structures and construction equipment or other temporary structures including cranes, stockpiles of equipment, earth- moving equipment.

Part 77, Subpart B, Section 77.13 - (2) greater height than an imaginary surface extending outward and upward at: (i) 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway, with runway more than 3,200 feet in length. (20,000 = 3.78 miles)

Notification of crane usage to the Federal Aviation Administration and Tucson Airport Authority is required using the following procedures:

PROCEDURES:

Cranes located within 4 miles of the airport or on airport property will require an e-filing notification at least three (3) business days before the crane is erected. You may e-mail the coordinating agency at oeaaa_helpdesk@cghitech.com (between the "oeaaa" and the work "help" is an underscore "_") giving them the following information: your first and last name, business name and address, telephone and fax numbers of the business, and business e-mail address. They in turn will e-mail or fax you your user ID and password. If you have any questions you may call them at the following help desk phone number (202) 741-2150.

Notification to the Tucson Airport Authority - inform Liisa Federico, Tucson Airport Authority FAR Part 139 Administrator at 573-4820 three business days in advance of crane usage to issue the Flight Service Station (FSS) Notice to Airmen (NOTAM) of pending work. Include location, crane height, date and times crane will be in use.

All cranes will be flagged during the day and either lowered during official sunset to sunrise or lighted per FAA Advisory Circular 70/7460-1, Obstruction Marking and Lighting.

PENALTY FOR FAILING TO PROVIDE NOTICE:

Persons who knowingly and willfully violate the notice requirement of 14 CFR Part 77 are subject to a civil penalty.



SLING CHAIN RECORD-Appendix IX

MANUFACTURER _____ SERIAL NO. _____
 TYPE _____ SIZE _____ REACH _____
 WORKING LOAD LIMIT _____ GRADE _____

ATTACHMENTS

DRAWING NO.

Conditions	Date	By	Conditions	Date	By	Conditions	Date	By
PUT IN SERVICE			REPLACED			REPLACED		
REPLACED			REPLACED			REPLACED		
REPLACED			REPLACED			REPLACED		
REPLACED			REPLACED			REPLACED		



WIRE ROPE INSPECTION REPORT-Appendix X

Machine _____ Owned By _____ Machine Location _____

Date of Inspection _____ Rope Application _____ Rope Description _____

Manufacturer's Ident. No. _____ Applicable Standards _____

Criteria for Removal:	Measured Diameter	Broken Wires		1/3 of outside wire dia.	1	End Attachments		Rope Damage	Sheave Condition	Drum Condition		Rope Lay Measurement
		In 1 Rope Lay	In 1 Strand of 1 Lay	Excessive Wear	Broken Wires	Corrosion of Rope	Fitting Condition					

Signature: _____



DAILY INSPECTIONS-Appendix XI

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
LOAD HOOK																															
CABLE DRUM																															
HOIST CABLE																															
HYDRAULIC HOSES																															
HYDRAULIC FLUID																															
CONTROL OPERATION																															
ANTI-TWO BLOCK																															
STRUCTURAL DAMAGE																															
INITIALS																															

MONTHLY INSPECTIONS

RETURN LINE FILTER	
HI-PRESSURE FILTER	
ROTATION BEARING	
ROTATION BEARING BOLTS	
ROTATION GEAR BOX	
HOIST GEAR BOX	
HOLDING VALVES	
INITIALS	

WEEKLY INSPECTIONS

	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
MOUNTING BOLTS					
ROTATION GEAR					
SHEAVE BEARINGS					
ALL OTHER BOLTS					
BOOM PIVOT					
BOOM CYLINDER					
BOOM CYLINDER PINS					
EXTENSION PIN					
INITIALS					

