

## SECTION 16

# CRANES AND HOISTING EQUIPMENT

### 16.A GENERAL

16.A.01 Unless otherwise specified, the requirements of this Section are applicable to all cranes and hoisting equipment, to include, but not limited to, articulating cranes (knuckle-boom cranes), floating cranes, cranes on barges, locomotive cranes, mobile cranes (i.e., wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted and boom truck cranes, etc.), multi-purpose machines when configured to hoist and lower by means of a winch or hook and horizontally move a suspended load, industrial cranes, dedicated pile drivers, service/mechanic trucks with a hoisting device, cranes on a monorail, tower cranes (i.e., fixed jib/hammerhead boom, luffing boom and self-erecting), pedestal cranes, portal cranes, overhead and gantry cranes, straddle cranes, side-boom tractors, all derricks, hydraulic excavators and other such equipment when used with chains, slings or other rigging to lift suspended loads, and variations of such equipment.

16.A.02 Before any crane or hoisting equipment is placed in use, it shall be inspected and tested and certified in writing by a competent person to be in accordance with the manufacturer's recommendations and the requirements of this manual. > See **16.D, E and F.**

16.A.03 The employer shall comply with all manufacturer's instructions, procedures and recommendations applicable to the operational functions of equipment, including its use with attachments. The safe operating speeds or loads shall not be exceeded. When they are not available, the employer shall develop and ensure compliance with all procedures necessary for the safe operation of the equipment and attachments.

a. Procedures for the operational controls must be developed by a qualified person.

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b. Procedures related to the capacity of the equipment must be developed and signed by a Registered Professional Engineer (RPE) familiar with the equipment.

16.A.04 When the manufacturer's instructions or recommendations are more stringent than the requirements of this manual, the manufacturer's instructions or recommendations shall apply.

16.A.05 The use of electronic equipment for entertainment purposes while operating equipment is prohibited.

16.A.06 Mechanized equipment shall be shut down before and during fueling operations. Closed systems, with an automatic shut-off that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

16.A.07 Inspections or determinations of road and shoulder conditions and structures shall be made in advance to assure that clearances and load capacities are safe for the passage or placing of any mechanized equipment.

16.A.08 Equipment requirements, as applicable to the type equipment.

a. An operable fuel gage;

b. An operable audible warning device (horn);

c. Adequate rearview mirror or mirrors;

d. Non-slip surfaces on steps;

e. A power-operated starting device;

f. Seats or equal protection must be provided for the operator and all personnel required to be in/on equipment;

g. Whenever visibility conditions warrant additional light, all vehicles, or combinations of vehicles, in use shall be equipped

with at least two headlights and two taillights in operable condition;

h. Glass in windshields, windows, and doors shall be safety glass. Cracked or broken glass shall be replaced;

i. One (minimum) dry chemical or CO<sup>2</sup> fire extinguisher with a minimum rating of 10B:C installed in the cab or at the machinery housing;

j. All self-propelled equipment, whether moving alone or in combination, shall be equipped with a backup alarm. > See **18.B.01.**

16.A.09 Rollover protective structures (ROPS) as required by the manufacturer must be in place and maintained.

16.A.10 The manufacturer's specifications and operating manuals for hydraulic equipment and attachments utilizing quick connect/disconnect systems shall be followed. After completing a switch in attachments, the equipment operator shall take the actions necessary to ensure the quick connect/disconnect system is positively engaged.

16.A.11 All guarding and safety devices shall be provided, used and maintained:

a. All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

b. All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

c. Platforms, foot walks, steps, handholds, guardrails, and toe boards shall be designed, constructed, and installed on

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machinery and equipment to provide safe footing and access ways.

d. Equipment shall be provided with suitable working surfaces of platforms, guardrails, and hand grabs when attendants or other employees are required to ride for operating purposes outside the operator's cab or compartment. Platforms and steps shall be of nonskid materials.

16.A.12 Work Area Control. When there are accessible areas in which the equipment's rotating superstructure (permanently or temporarily mounted) poses a risk of striking and injuring an employee or pinching/crushing an employee against another part of the equipment or another object, employees shall be prevented from entering these areas (i.e., communication or risk, placement/maintenance of control or warning lines, railings or barriers).

16.A.13 The controls of excavators or similar equipment with folding booms or lift arms shall not be operated from a ground position unless so designed.

16.A.14 Personnel shall not work in, pass under, or ride in the buckets or booms of excavators in operation.

16.A.15 Maintenance/repairs of cranes and hoisting equipment.

a. Maintenance, including preventive maintenance, and repairs shall be performed in accordance with the manufacturer's recommendations. Records of maintenance and repairs conducted during the life of a contract shall be made available upon request of the GDA.

b. Replacement parts or repairs shall have at least the original design factor; replacement parts for load bearing and other critical parts shall be obtained from the original manufacturer, (if possible) or certified by a registered engineer knowledgeable in cranes.

c. All equipment shall be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running are exempt from this requirement. > See Section 12.

d. All repairs shall be made at a location that will protect repair personnel from traffic.

e. Cranes, hoisting equipment, or parts thereof that are suspended or held apart by slings, hoists, or jacks also shall be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

#### 16.A.16 Parking.

a. Whenever equipment is parked, the parking brake shall be set.

b. Equipment parked on an incline shall have the wheels chocked or track mechanisms blocked and the parking brake set.

c. All equipment left unattended at night, adjacent to a highway in normal use or adjacent to construction areas where work is in progress, shall have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

### **16.B PERSONNEL QUALIFICATIONS**

16.B.01 Cranes and hoisting equipment shall be operated only by designated qualified personnel. Proof of qualification shall be in writing. In addition to fully qualified crane and hoisting equipment operators, the following personnel may be designated to operate cranes and hoisting equipment under limited conditions (may not perform critical lifts).

a. Trainees under the direct supervision of the designated operator of the crane or hoist;

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b. Maintenance personnel who have completed all operator qualification requirements. Operation is limited only to those functions necessary to perform maintenance or verify performance of a crane or hoist;

c. Inspectors who have completed all operator qualification requirements. Operation is limited only to functions necessary to accomplish inspection.

16.B.02 Crane Operator Requirements - General (excluding vehicle mounted, rotating aerial devices (i.e., bucket trucks), see Section 22.M; excluding hydraulic excavating equipment. > See **Section 16.S**).

a. Crane Operators shall be able to communicate effectively with the lift supervisor, rigger(s), flagmen and other affected employees on site.

b. Prior to the start of work, documentation of operator qualifications shall be provided to the GDA.

c. Qualification for all crane operators shall be by written examination and practical operational testing.

d. All crane operators shall have knowledge of USACE crane safety requirements and manufacturer requirements and recommendations provided in the crane operator manual.

e. Crane operators shall demonstrate their ability to read, write and comprehend in the language of the crane manufacturer's operation and maintenance instruction materials, exhibit arithmetic skills and load/capacity chart usage and use written manufacturer procedures applicable to the class/type of equipment for which certification is being sought.

16.B.03 Crane Operator Qualifications and/or Certifications. Crane operators shall possess at least one of the following licenses or certifications:

a. Option 1. A current certification by an accredited (a nationally recognized accrediting agency) crane/derrick operator testing organization. The organization shall:

(1) Administer written and practical tests that assess operator applicants regarding necessary knowledge and skills;

(2) Provide different levels of certification based on equipment capacity and type;

(3) Have procedures for operators to re-apply and be retested in event operator applicant fails a test or is decertified;

(4) Have testing procedures for recertification;

(5) Have accreditation reviewed by the nationally recognized accrediting agency at least every 3 years;

(6) A certification issued under this option is portable and is valid for 5 years from issuance.

b. Option 2. Qualification by a professional source that qualifies crane operators (e.g., independent testing and qualifying company, a union, or a qualified consultant who can be an in-house resource) as long as the program is an audited employer program. Employer's qualification of its employee shall meet the following:

(1) Administer written and practical tests that assess operator applicants regarding necessary knowledge and skills. These tests shall be either developed by an accredited crane/derrick operator testing organization (see Option 1 above) OR approved by an examiner in accordance with the following:

(a) The examiner is certified to evaluate such tests by an accredited crane/derrick operator testing organization (see Option 1 above);

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(b) The approval shall be based on the examiner's determination that the tests meet nationally recognized test development criteria and are valid and reliable in assessing the operator applicant's knowledge and skill needed;

(2) The employer program shall be audited within 3 months of the beginning of the program and every 3 years thereafter;

(3) The employer program shall have testing procedures for recertification;

(4) Any significant deficiencies identified by the examiner shall be corrected prior to further qualification of any operators;

(5) Records of audits shall be retained for 3 years and made available to the GDA upon request;

(6) A qualification under this option is non-portable and is valid for 5 years from date of issuance.

c. Option 3. Qualification by the U.S. Military. Operator is considered valid if he has a current operator qualification issued by the U.S. military for operation of the equipment. Qualification meets operator qualification requirements of this section for operation of equipment only within the jurisdiction of the government entity and is valid for the period stipulated but no longer than 5 years from issuance.

d. Option 4. Licensing by a Government Entity. An examiner that issues operator licenses for operating equipment is considered a government accredited crane/derrick operator examiner if the following criteria are met:

(1) The requirements for obtaining the license include an assessment by written and practical tests of the operator applicant regarding knowledge and skills, as applicable to the specific type of equipment the individual will operate.



(2) The testing meets industry recognized criteria for written testing materials, practical examinations, test administration, grading, facilities/equipment and personnel. Testing shall include:

(a) The controls and operational/performance characteristics;

(b) Responsibilities of operator, rigger, signalpersons, and lift supervisor;

(c) Knowledge of USACE crane safety requirements and the crane operator manual;

(d) Ability to determine the crane configuration, determine size and shape of loads, and the crane's applicable capacity using the load chart;

(e) Use and limitations of crane safety devices and operator aids;

(f) Inspection, testing, and maintenance requirements;

(g) Suitability of ground and surface to handle expected loads;

(h) Identification of site hazards and site access conditions;

(i) Outrigger and matting requirements (as applicable);

(j) Crane set-up, assembly, dismantling, and demobilization procedures;

(k) Requirements for clearance from power sources, procedures for preventing contact and responding to contact with said sources;

(l) Signaling and communication procedures;

(m) Factors that reduce rated capacity; and

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(n) Emergency control skills.

(3) The government authority that oversees the examiners has determined that the requirements for Option 4 licensing have been met.

(4) The examiner has testing procedures for recertification designed to ensure that the operator continues to meet the technical knowledge and skills requirements.

(5) A license issued by an examiner that meets the requirements of this Option:

(a) Meets operator qualification requirements of this section for operation of equipment only within the jurisdiction of the government entity.

(b) Is valid for the period stipulated but no longer than 5 years from issuance.

16.B.04 USACE Examiner Qualifications. It is recommended that each USACE Command select in-house crane examiners and that the individuals be designated in writing.

a. Examiners shall be trained and licensed or certified by a commercial qualifying/certifying organization.

b. Examiners will examine, qualify and certify the Command's crane operators based on criteria in this section.

c. For Commands with few crane operators, where an in-house examiner would not be cost effective, operators should be examined, qualified or certified by a commercial qualifying/certifying organization.

16.B.05 Operator Practical Examination Requirements. Crane operators shall pass a practical operational test that demonstrates the following:

- a. Ability to recognize, from visual and audible observation, the items listed in 16.D.08 for shift inspections;
- b. Ability to establish a stable foundation and leveling the crane;
- c. Operating skills - Raising, lowering, extending, retracting, and swinging the boom, raising and lowering the load line;
- d. Attaching the load, holding the load, and moving the load;
- e. Reading and applying load, boom angle, and other indicator devices;
- f. Maneuvering skills; and
- g. Applying safe shut-down and securing procedures.

16.B.06 Operator Physical Qualifications/Examination. All crane/derrick operators shall be physically qualified to operate the equipment. Physical examinations for operators are required to be conducted every 2 years and any time a condition is observed that may impact the safe operation of a crane. Written proof, signed by a physician stating that the crane operator has had a physical examination and meets the medical requirements set forth below shall be submitted to the GDA for acceptance prior to allowing an operator to operate a crane.

- a. Crane operators shall have a current physician's certification, dated within the past 2 years, that states the operator meets the following physical qualifications:
  - (1) Vision of at least 20/30 Snellen in one eye and 20/50 in the other, with or without corrective lenses;
  - (2) Normal depth perception and field of vision;
  - (3) Ability to distinguish colors, regardless of position;

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(4) Adequate hearing, with or without hearing aid, for the specific operation;

(5) Sufficient strength, endurance, agility, coordination, manual dexterity, and speed of reaction to meet the demands of equipment operation;

(6) No tendencies to dizziness or similar undesirable characteristics; and

(7) Has a negative result for substance abuse test.

b. Evidence of physical defects, emotional instability that could render a hazard to the operator, others, or safe operation of the crane, or evidence that the operator is subject to seizures or loss of physical control shall be sufficient reason for disqualification. In such cases, specialized medical tests may be required to evaluate these conditions and determine their impact.

c. All crane/derrick operators shall participate in a drug testing program and have a negative result for a substance abuse test. The level of testing will be in accordance with standard practices for industry or by the agencies random drug testing program. This test will be confirmed by a recognized laboratory service.

#### 16.B.07 Signal Person Qualifications

a. The employer shall insure that the signal person is qualified either by a third party qualified evaluator or the employer's qualified evaluator.

b. The qualification means that the evaluator has assessed the individual's capabilities and knowledge and has determined that the individual meets the following qualification requirements:

- (1) Know and understand the type of signals used (radio, cell, hand, etc). If hand signals are used, the signal person must know and understand the Standard Method for hand signals.
- (2) Be competent in the application of the type of signals used.
- (3) Have a basic understanding of crane operation and limitations, including crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads.
- (4) Demonstrate that he/she meets the requirements above through a practical test.

**16.C. CLASSIFICATION OF EQUIPMENT AND TRAINING OF OPERATORS (FOR USACE-OWNED AND -OPERATED CRANES AND HOISTS ONLY)**

16.C.01 Designated personnel must be qualified to operate a particular type of crane or hoist (i.e., mobile, tower, overhead, etc.) and the training provided shall be applicable to that type of crane or hoist. The three classifications of cranes and hoisting equipment and their associated training requirements are identified here. All exams shall meet the applicable parts of Option 4, based on type of equipment.

a. Class I: Class I cranes are mobile and locomotive cranes, hammerhead, portal, tower, derricks (post or stiff leg), floating or barge mounted cranes/derricks, overhead, gantry, bridge, underhung, monorail:

(1) Class I crane operators may perform critical lifts, preventive maintenance and inspections as required on specific equipment as trained:

(2) Training must be, as a minimum:

(a) Initial: 24-hour training with written and practical/operational examinations;

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(b) Annual: 8-hour refresher training, to include practical/operational examination.

b. Class II: Class II cranes are overhead, bridge and gantry cranes, underhung, monorail, pedestal and wall-mounted jib cranes, and similar.

(1) Class II crane operators may perform only routine lifts in the performance of their duties, preventive maintenance and inspection as required on specific equipment as trained. Class II crane operators may not perform critical lifts with this equipment.

(2) Class II training, must be, as a minimum:

(a) Initial: 8-hour training with written and practical/operational examinations;

(b) Annual: 1-hour refresher training, to include practical/operational examination.

c. Class IIIA Hoisting Equipment: greater than 10 tons (>10T rated capacity), and shop equipment used for lifting or lowering a freely suspended (unguided) loads.

(1) Class IIIA operators are qualified to operate, perform preventive maintenance and inspection of this equipment as required.

(2) Class IIIA training, must be on the specific type(s) of hoist operated and be, as a minimum:

(a) Initial: 4-hour training with written (as applicable, see 16.B.03.d) and practical/operational examinations;

(b) Annual: 1-hour refresher training, to include practical/operational examination.

d. Class IIIB Hoisting Equipment: up to and including 10 tons (</= 10T rated capacity), and shop equipment used for lifting or lowering a freely suspended (unguided) loads.

(1) Class IIIB operators are qualified to operate, perform preventive maintenance and inspection of this equipment as required.

(2) Class IIIB training must be on the safe operation and use of the hoist and be, as a minimum:

(a) Initial: 1-hour training with written (as applicable, see 16.B.03.d) and practical/operational examinations;

(b) Annual: 1-hour refresher training, to include practical/operational examination.

16.C.02 Prior to re-issuance of qualification, crane and hoisting equipment operators must have attended applicable training (initial and annual) and passed the written and operational examination requirements specified above.

16.C.03 Each USACE activity or operating project will maintain a current list of operators, complete crane and hoisting equipment training records for each operator, and a list of equipment that each operator is qualified to operate.

## **16.D INSPECTION CRITERIA for CRANES and HOISTING EQUIPMENT**

16.D.01 Inspections of cranes and hoisting equipment shall be in accordance with this section, applicable ASME standards, OSHA regulations and the manufacturer's recommendations.

16.D.02 Records of crane and hoisting equipment tests and inspections shall be maintained onsite. Contractors shall make these records readily available upon request and, when submitted, they shall become part of the official project file.

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16.D.03 Contractor shall provide the GDA 24-hours notice in advance of any crane or hoisting equipment entering the site (prior to inspection/tests) so that observation of the Contractor's inspection process and spot checks may be conducted.

16.D.04 Whenever any crane and/or hoisting equipment is found to be unsafe, or whenever a deficiency that affects the safe operation of a crane and/or hoisting equipment is observed, the affected equipment shall be immediately taken out of service and its use prohibited until unsafe conditions have been corrected.

16.D.05 Cranes and derricks in regular service. Inspection procedures for cranes/derricks in regular service are divided into three general classifications based on the intervals at which inspections shall be performed. The intervals depend on the nature of critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are Periodic, Start-up, and Frequent, with respect to intervals between inspections as defined.

16.D.06 Inspection Frequency. Required inspection frequency shall be as per Table 16-1.

16.D.07 Initial Inspections. Prior to use, all new, re-assembled, modified or altered cranes, derricks or hoisting equipment (as applicable) that have had modifications or additions which affect the safe operation of the equipment (i.e., involving a safety device, operator aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook or in-use operating mechanism) or capacity shall be inspected by a qualified person.

a. Any deficiencies shall be carefully examined and a determination made as to whether they constitute a hazard.

b. The inspection shall include functional testing.



16.D.08 Start-Up Inspections (Pre-Operational, Each shift). Before every crane or derrick operation (at beginning of each shift) or following a change of operator, a competent person shall visually inspect the items listed below. If any deficiency is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a safety hazard. If it does, the equipment shall be properly removed from service (i.e., a tag shall be placed in a conspicuous location on the crane or hoisting equipment indicating that it shall not be operated and that the tag shall remain in its attached location until it is demonstrated to the individual deadlining the crane or hoisting equipment that it is safe to operate. When required, lockout procedures shall be used as well. > **See Sections 8 and 12.** If any deficiency in safety device/operational aids is identified, the action identified in Section 16.E shall be taken prior to using the equipment.

- a. Control mechanisms for proper operation;
- b. Brake actions to ensure brakes are functioning normally and that there is no slippage, excessive play, or binding. Exercise brakes to assure they are dry;
- c. Control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter;
- d. Operator aids and other safety devices for proper functioning and accuracy of settings;
- e. Chords and lacing for damage, bent members, cracked welds, etc.;
- f. Hydraulic and pneumatic systems for deterioration or leakage - with particular emphasis given to those that flex during normal operation;
- g. Hooks and latches for deformation, chemical damage, cracks, and wear;

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- h. Rope for proper spooling onto the drum(s) and sheave(s) and rope reeving for compliance with crane or derrick manufacturer's specifications;
- i. Electrical apparatus for proper functioning, signs of excessive deterioration, dirt, and moisture accumulation;
- j. Tires (when in use) for recommended inflation pressure and condition;
- k. Ground conditions around the equipment for proper support, including ground settling under and around outriggers and supporting foundations, ground water accumulation, or similar conditions;
- l. Hydraulic system for proper fluid level;
- m. The equipment for level position, both shift and after each move and setup;
- n. Operator cab windows for significant cracks, breaks or other deficiencies that would hamper the operator's view;
- o. Safety devices and operational aids for proper operation;
- p. Wedges and supports for looseness or dislocation (climbing tower cranes);

**TABLE 16-1**

**CRANE & DERRICK INSPECTION FREQUENCY**

<b><u>When to inspect</u></b>	<b><u>Type of Inspection</u></b>
<u>Prior to initial use - all new cranes <sup>(a)</sup></u>	<u>Initial inspection</u>
<u>Prior to use - all altered cranes <sup>(b)</sup></u>	<u>Initial inspection</u>
<u>Prior to initial use on a USACE project <sup>(c)</sup></u>	<u>Periodic inspection</u>
<u>Monthly after initial use on a USACE project</u>	<u>Periodic inspection</u>
<u>Prior to every operation (shift)</u>	<u>Start-up inspection</u>
<u>Before using a crane that is not in use on a regular basis and that has been idle for more than 1 month, but less than 6 months <sup>(d)</sup></u>	<u>Frequent inspection</u>
<u>Before using a crane that is not in use on a regular basis and that has been idle for more than 6 months <sup>(d)</sup></u>	<u>Periodic inspection</u>
<u>Standby cranes, at least semi-annually <sup>(e)</sup></u>	<u>Frequent inspection</u>
<u>Standby cranes, prior to use <sup>(f)</sup></u>	<u>Frequent inspection</u>

**Notes:**

*(a) Performed by the manufacturer.*

*(b) "Altered" is defined as any change to the original manufacturer's design configuration, that is, replacement of weight handling equipment parts and components.*

*(c) Initial use refers to (1) the first time the USACE takes possession of and assembles a crane, or (2) whenever a Contractor brings a crane onto a job site and assembles the crane.*

*(d) This requirement is in addition to the requirement for a periodic inspection.*

*(e) Standby cranes are those cranes that are not used on a regular basis but are available - on a standby basis - for emergencies (e.g., emergency operations & maintenance (O&M) work); requirements for frequent inspections of standby cranes are in addition to the requirement for a periodic inspection.*

*(f) In addition to the semi-annual frequent inspection, a frequent inspection shall be conducted prior to use*

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q. Braces and guys supporting crane masts for safe condition and proper tension; anchor bolt base connections for tightness or retention of preload; wedges and supports of climbing cranes for tightness and proper positioning;

r. For derricks, inspect all chords and lacing, tension in guys, plump of the mast, and derrick mast fittings and connections for compliance with manufacturer's recommendations;

s. Barge or pontoon ballast compartments for proper ballast; deck loads for proper securing; chain lockers, storage, fuel compartments, and battening of hatches; firefighting and lifesaving equipment in place and functional; hull void compartments sounded for leakage (floating cranes and derricks); and

t. Wire rope per 16.D.12.

16.D.09 Frequent Inspections (Monthly intervals). Each month the equipment is in service, it shall be inspected according to the criteria in 16.D.08 for pre-operational/shift inspection.

a. The items checks, the results of the inspection, the name and signature of the person who conducted the inspection and the date shall all be documented. Documentation shall be retained for a minimum 3 months or the life of the contract.

b. Equipment shall not be used until an inspection performed under this paragraph demonstrates that no corrective action is required.

16.D.10 Periodic Inspections/Comprehensive (at least annually or as recommended by the manufacturer). This inspection shall include functional testing to determine that the equipment as configured in the inspection is functioning properly.

a. If any deficiency is identified, an immediate determination shall be made by the qualified person as to whether the

deficiency constitutes a safety hazard. If so, then the equipment shall be removed from service until it has been corrected. If not yet a safety hazard, the qualified person may determine that the employer shall monitor the deficiency in the monthly inspections.

b. The comprehensive inspection must be documents and shall include: items checked and results of inspection, name and signature of the person who conducted the inspection and the date and this documentation must be retained until at least the next annual/comprehensive inspection occurs, or 12 months, whichever is longer.

c. The following, in addition to those items required by a pre-operational inspection in 16.D.08 above, shall be inspected by a qualified person:

(1) Equipment structure – to include boom and, if equipped, the jib;

(2) Bolts, rivets, and other fasteners for tightness, corrosion;

(3) Welds for cracks;

(4) Proper tension (torque) of high strength (traction) bolts used in connections and at the slewing bearing;

(5) Power plants for performance and compliance with safety requirements;

(6) Drive components such as pins, bearings, wheels, shafts, gears, sheaves, drums, rollers, locking and clamping devices, sprockets, drive chains or belts, bumpers, and stops for absence of wearing, cracks, corrosion, or distortion;

(7) All crane function operating mechanisms for proper operation, proper adjustment, and the absence of unusual sounds;

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(8) Travel, steering, holding, braking, and locking mechanisms for proper functioning and absence of excessive wear or damage;

(9) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing for leaks, deformation or other signs of failure/impending failure, abrasion or scrubbing;

(10) Hydraulic and pneumatic pumps and motors for performance indicators (noises, vibration low operating speed, excessive heating of the fluid, low pressure, etc.), loose bolts or fasteners, seals and joints between pump sections for leaks, Tires for damage or excessive wear;

(11) Hydraulic and pneumatic valves (Spools – sticking, Leaks, Valve housing cracks, Relief valves – failure to reach correct pressure);

(12) Hydraulic and pneumatic cylinders for: drifting; rod seals and welded joints for leaks; cylinder rods for scores, nicks or dents; barrel for significant dents; rod eyes and connecting joints for looseness and deformity;

(13) Brake and clutch system parts, linings, pawls, and ratchets for excessive wear;

(14) Wire rope per 16.D.12;

(15) Sheaves and drums for cracks or significant wear;

(16) Crane operator aids and safety devices and indicating devices for proper operation, to include accuracy;

(17) A means to verify the proper setup of the boom stops and functioning of the boom hoist disengaging device. This test will be conducted before initiating the operational test required by 16.F;

(18) Motion limiting devices for proper operation with the crane unloaded (each motion should be inched into its limiting device to run in at slow speed with care exercised) and load limiting devices for proper operation and accuracy of settings;

(19) Safety and function labels for legibility and replacement;

(20) For floating plant, inspect ballast compartments for proper ballast; deck loads for proper securing; safety of chain lockers, storage, fuel compartments; battening of hatches; hull void compartments sounded for leakage; tie-downs for barge-mounted land cranes for wear, corrosion, and tightness; cleats, bitts, chocks, fenders, capstans, ladders, stanchions for corrosion, wear, deterioration, and deformation; take four corner draft readings;

(21) Outrigger pads/floats and slider pads for excessive wear and cracks;

(22) Electrical components and wiring for cracked or split insulation and loose or corroded terminations;

(23) Operator seat – missing or unusable;

(24) Originally equipped steps, ladders, handrails, guards – missing; OR

(25) Steps, ladders, handrails, guards in unusable or unsafe condition.

16.D.11 Inspection of cranes, derricks and other hoisting equipment not in regular use shall be inspected as follows:

(a) Frequent (Monthly) Inspection Criteria (see 16.D.09) – Cranes or hoisting equipment that have been idle for a period of one month or more, but less than one year;

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(b) Periodic (Annual/Comprehensive) Inspection Criteria (see 16.D.10) – Cranes or hoisting equipment that have been idle for a period of one year or more;

(c) Cranes or hoisting equipment that are exposed to adverse environmental conditions shall be inspected more frequently, as determined by a qualified person (of GDA or the Contractor) with the concurrence of GDA.

#### 16.D.12 Wire Rope Inspection, Maintenance and Replacement.

a. A competent person shall perform this inspection for each shift, visually inspecting all running ropes and counterweight ropes and load trolley ropes, if provided. Visual inspection shall concentrate on identifying apparent deficiencies in wire rope as categorized below. Opening of wire rope or booming down is not required as part of this inspection.

b. Category I. Apparent deficiencies in this category include the following:

(1) Distortion of wire rope structure such as kinking, crushing, unstranding, birdcaging, main strand displacement, core failure or protrusion between the outer strands;

(2) General corrosion;

(3) Electric arc (from a source other than power lines) or heat damage;

(4) Severely corroded or broken wires at end connections; severely corroded, cracked bent, worn, or improperly applied end connections.

c. Category II. Apparent deficiencies in this category include the following:



(1) Number, distribution and type of visible broken wires are as per Table 16-2;

(2) A diameter reduction of more than 5% from nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.

d. Category III. Apparent deficiencies in this category include the following:

(1) Core failure or protrusion in rotation resistant ropes;

(2) Electrical contact with a power line; OR

(3) A broken strand (care shall be taken when inspecting rotation resistant ropes because of their susceptibility to damage from misuse and potential for deterioration when used on equipment with limited design parameters).

e. Critical Review Items. Particular attention should be given to:

(1) Rotation resistant wire rope in use;

(2) Boom hoist ropes and sections of rope subject to rapid deterioration such as at flange points, crossover points, and repetitive pickup points on drums;

(3) Sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited;

(4) Sections of the rope at or near terminal ends where corroded or broken wires may protrude; AND

(5) Sections subject to reverse bends and sections normally hidden during routine visual inspections, such as parts passing over outer sheaves.

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f. Removal from Service.

(1) If a Category I deficiency is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a safety hazard. If so, operations involving the use of the wire rope in question shall be prohibited until:

(a) The wire rope is replaced; OR

(b) If the deficiency (other than power line contact) is localized and the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wore rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.

(2) If a Category II deficiency is identified, one of the following actions must occur:

(a) Employer shall consider the deficiency to constitute a safety hazard where it meets the wire rope manufacturer's established criterion for removal from service or meets a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope. If the deficiency is considered a safety hazard, operations involving use of the wire rope shall be prohibited until the wire rope is either replaced OR the damage is removed in accordance with 16.D.12.f(1)(b), OR

(b) Institute alternative measures. The wire rope may continue to be used if the employer ensures that the following measures are implemented:

(i) A qualified person assesses the deficiency in light of the load and other conditions of use and determines it is safe to continue to sue the wire rope as long as the conditions established under this paragraph are met;

(ii) A qualified person establishes the parameters for the use of the equipment with the deficiency, including a reduced maximum rated load;

(iii) A qualified person establishes a specific number of broken wires, strands or diameter reduction that, when reached, will require<sup>3</sup> the equipment to be taken out of service until the wire rope is replaced or the damage is removed in accordance with 16.D.12.f(1)(b);

(iv) a qualified person sets a time limit, not to exceed 30 days from the date the deficiency is first identified, by which the wire rope must be replaced, or the damage removed in accordance with 16.D.12.f(1)(b).

(3) If a Category III deficiency is identified, operations involving the use of the wire rope in question shall be prohibited until:

(a) The wire rope is replaced; OR

(b) 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. Joining lengths of wore rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.

**TABLE 16-2**

**Wire Rope Removal and Replacement Criteria**

		<u># OF BROKEN WIRES IN RUNNING ROPES</u>			<u># OF BROKEN WIRES IN STANDING ROPES</u>	
		<u>In one rope lay</u>	<u>In one strand</u>	<u>At end connection</u>	<u>In one rope lay</u>	<u>At end connection</u>
<u>Standard</u>	<u>Equipment</u>					
<u>ASME/B30.2</u>	<u>Overhead &amp; gantry cranes</u>		<u>12**</u>	<u>4</u>	<u>N/S</u>	<u>Not Specified</u>
<u>ASME/B30.4</u>	<u>Portal, tower, &amp; pillar cranes</u>		<u>6**</u>	<u>3</u>	<u>2</u>	<u>3</u> <u>2</u>
<u>ASME/B30.5</u>	<u>Mobile &amp; locomotive cranes</u>	<u>Running ropes</u>	<u>6**</u>	<u>3</u>	<u>2</u>	<u>3</u> <u>2</u>
		<u>Rotation-resistant ropes</u>	<u>2 randomly distributed broken wires in 6 rope dia. or 4 randomly distributed broken wires in 30 rope dia. **</u>			
<u>ASME/B30.6</u>	<u>Derricks</u>		<u>6**</u>	<u>3</u>	<u>2</u>	<u>3</u> <u>2</u>
<u>ASME/B30.7</u>	<u>Base-mount drum hoists</u>		<u>6**</u>	<u>3</u>	<u>2</u>	<u>3</u> <u>2</u>
<u>ASME/B30.8</u>	<u>Floating cranes and derricks</u>		<u>6**</u>	<u>3</u>	<u>2</u>	<u>3</u> <u>2</u>
<u>ASME/B30.16</u>	<u>Overhead hoists</u>		<u>12**</u>	<u>4</u>	<u>N/S</u>	<u>Not Specified</u>
<u>ANSI/A10.4</u>	<u>Personnel hoists</u>		<u>6**</u>	<u>3</u>	<u>2</u>	<u>2**</u> <u>2</u>
<u>ANSI/A10.5</u>	<u>Material hoists</u>		<u>6**</u>	<u>Not Specified</u>		<u>Not Specified</u>

**16.E SAFETY DEVICES AND OPERATIONAL AIDS.** Safety devices and operational aids shall not be used as a substitute for the exercise of professional judgment by the operator.

16.E.01 Safety Devices. The following safety devices are required on all cranes and derricks covered by Section 16 unless otherwise specified.

a. Crane level indicator.

(1) The equipment shall 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 shall be tagged-out or removed.

(3) This requirement does not apply to portal cranes, derricks, floating cranes/derricks and crane/derricks on barges, pontoons, vessels or other means of flotation.

b. Boom stops, except for derricks and hydraulic booms.

c. Jib stops (if jib is attached), except for derricks.

d. Equipment with foot pedal brakes shall have locks, except for portal floating cranes.

e. Hydraulic outrigger jacks shall have an integral holding device (check valve).

f. Equipment on rails shall have rail clamps and rail stops, except for portal cranes.

16.E.02 Proper Operation of Safety Devices. Operations shall not begin unless the safety devices listed above are in proper working order. If a safety device stops working properly during operations, the operator shall safely stop operations. Operations shall not

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resume until the device is again working properly. Alternative measures are not permitted to be used.

#### 16.E.03 Operational Aids.

a. The devices listed here as “operational aids” are required on all cranes and derricks covered by Section 16 unless otherwise specified.

b. Operations shall not begin unless the listed operational aids are in proper working order except where the employer meets the specified temporary alternative measures. More protective alternative measures specified by the crane/derrick manufacturer, if any, shall be followed.

c. If a listed operational aid stops working properly during operations, the operator shall safely stop operations until the temporary alternative measures are implemented or the device is again working properly. If a replacement part is not longer available, the use of a substitute device that performs the same type of function is permitted and is not considered a modification.

d. Category I operational aids and alternative measures. Operational aids listed in this paragraph that are not working properly shall be repaired not later than 7 days after the deficiency occurs. EXCEPTION: If the employer documents that it has ordered the necessary parts within 7 days of the occurrence of the deficiency, the repair shall be completed within 7 days of receipt of the parts.

(1) Boom hoist limiting device. TEMPORARY alternative measures (use at least one):

(a) Use a boom angle indicator;

(b) Clearly mark the boom hoist cable, in a visible location to the operator, at a point that will give the operator sufficient time to stop the hoist to keep the boom within the minimum allowable

radius. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark;

(c) Clearly mark the boom hoist cable, in a visible location to the spotter, at a point that will give the spotter sufficient time to signal the operator and have the operator stop the hoist to keep the boom within the minimum allowable radius.

(2) Luffing jib limiting device.

(a) Equipment with a luffing jib shall have a luffing jib limiting device.

(b) Temporary alternative measures are the same as in 16.E.03.d.(1)(a) except to limit the movement of the luffing jib.

(3) Anti two-blocking device (A2B). Anti-two blocking devices shall be installed at all points of two-blocking.

(a) All cranes and derricks shall be equipped with A2B/Hoist-limit device that will disengage the function that is causing the two-blocking or an A2B damage prevention feature (except as noted). They shall be tested and certified functional by a competent person prior to operating the crane.

(b) Lattice boom cranes. Lattice boom cranes shall be equipped with an A2B device to stop the load hoisting and boom-down functions before the load block or load contacts the boom tip.

**EXCEPTION 1 – Duty Cycle:** Lattice boom cranes that are used exclusively for duty cycle operations are exempt from A2B equipment requirements. When a lattice boom crane engaged in duty cycle work is required to make a non-duty cycle lift (for example, to lift a piece of equipment), it will be exempt from the A2B equipment requirements if the following procedures are implemented:

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- An international orange colored warning device (flag, tape or ball) is properly secured to the hoist line at a distance of 8 ft to 10 ft (2.4 m to 3m) above the rigging;

- The signal person acts as a spotter to alert the crane operator with a "STOP" signal when the warning device approaches the boom tip and the crane operator ceases hoisting functions when alerted of this;

- While the non-duty cycle lift is underway the signal person shall not stand under the load, shall have no duties other than as a signal person, and shall comply with the signaling requirements of this manual.

**EXCEPTION 2 – Lattice boom cranes with manually operated friction brakes:** Lattice boom crane and hoisting equipment with manually activated friction brakes, A2B warning devices may be used in lieu of A2B prevention devices.

(c) Telescopic boom cranes.

(i) Telescopic boom cranes shall be equipped with an A2B device to stop the load hoisting function before the load block or load contacts the boom tip and to prevent damage to the hoist rope or other machine components when extending the boom.

(ii) Telescopic boom cranes that are used exclusively for duty cycle operations shall be equipped with a two-blocking damage prevention feature or warning device to prevent damage to the hoist rope or other machine components when extending the boom.

(d) Floating cranes. Floating cranes may use an A2B alarm system in lieu of a disengaging device unless they are hoisting personnel.

(e) Other cranes used in duty cycle operations, to include clamshell (grapple), magnet, drop ball, container handling,



concrete bucket, pile driving and extracting operations, drilled shaft operations (except telescopic boom cranes, see 16.E.03.d(3)(c)(2)), are exempt from the requirements for A2B devices.

(f) Temporary alternative measure: clearly mark the cable (so that it can be easily 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 when extending the boom.

e. Category II operational aids and alternative measures. Operational aids listed in this paragraph that are not working properly shall be repaired not later than 30 days after the deficiency occurs. EXCEPTION: If the employer documents that it has ordered the necessary parts within 7 days of the occurrence of the deficiency, and the parts are not received in time to complete the repair in 30 days, the repair shall be completed within 7 days of receipt of the parts.

(1) Boom angle or radius indicator. The equipment (except articulating boom cranes) shall have a boom angle or radius indicator readable from the operator's station. Temporary alternative measures: radii or boom angle shall be determined by measuring the radii or boom angle with a measuring device. Calibration and testing of indicators will be performed in accordance with the manufacturer's recommendations.

(2) Jib angle indicator (if equipment has luffing jib). Temporary alternative measures: radii or jib angle shall be determined by ascertaining the main boom angle and then measuring the radii or jib angle with a measuring device.

(3) Boom length indicator if the equipment has a telescopic boom, except where the load rating is independent of the boom length. Temporary alternative measures: one of the following methods shall be used:

(a) Mark the boom with measured marks to calculate boom length;

(b) Calculate boom length from boom angle and radius measurements; OR

(c) Measure the boom with a measuring device.

(4) Load weighing and similar devices. Equipment, other than derricks, shall have at least one of the following: load weighing device, load moment indicator (LMI), rated capacity indicator or rated capacity limiter. Temporary alternative measures: The weight of the load shall be determined from a reliable source (i.e., load manufacturer), by a reliable calculation method (i.e., calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information shall be provided to the operator prior to the lift.

EXCEPTION: When cranes are used in duty cycle operations they are exempt from the requirements for load indicating devices and LMI devices.

(5) Hoist drum rotation indicator if the drum is not visible from the operator's station. Temporary alternative measures: mark the drum. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

(6) Outrigger position (horizontal beam extension) sensor/monitor if the equipment has outriggers (required on equipment manufactured after January 1, 2008). Temporary alternative measure: the operator shall verify that the position of the outriggers is correct (in accordance with manufacturer's procedures) before beginning operations requiring outrigger deployment.

## **16.F TESTING**

16.F.01 Written reports of tests, showing test procedures and confirming the adequacy of repairs or alterations, shall be

maintained with the crane and hoisting equipment or at the on-site project office.

16.F.02 Operational Testing.

a. A qualified person shall conduct operational tests in accordance with ANSI/ASME and the manufacturer's recommendations. If the manufacturer has no procedures, reference Appendix I for procedures. At the minimum, operational testing shall meet the requirements listed below.

(1) Before initial use of a crane or hoisting equipment after a load bearing or load controlling part or component, brake, travel component, or clutch (to include securing devices, skids and barges for floating cranes) has been altered, replaced, or repaired;

(2) Every time a crane or hoisting equipment(s) is reconfigured or re-assembled after disassembly (to include booms);

(3) Every time a crane and/or hoisting equipment is brought onto a USACE project; and

(4) Every year during periodic inspection.

b. Operational testing after the replacement of wire rope is not required.

16.F.03 Load Testing.

a. Load tests shall be performed in accordance with ANSI/ASME and the manufacturer's recommendations by, or under the direction of, a qualified person. If the manufacturer has no procedures, a Registered Professional Engineer familiar with the type of equipment involved must approve procedures and frequency of testing using as a minimum, Appendix I for procedures and taking into account age of equipment, history of use, testing and inspection, anticipated future use, and other such factors.

b. Test loads shall be made at 110% of the anticipated load for the specified configuration, not to exceed 100% of the manufacturer's load rating at the configuration of the test, except for manufacturer testing of new crane and hoisting equipment, which shall be conducted in accordance with the ANSI/ASME standards B30.1 through B30.17 as appropriate for the crane and hoisting equipment.

c. Load testing shall be performed:

(1) Before initial use of crane or hoisting equipment in which a load bearing or load controlling part or component, brake, travel component, or clutch has been altered, replaced, or repaired.

(2) Every time the crane or hoisting equipment is reconfigured or reassembled after disassembly (to include booms); and

(3) When the manufacturer requires load testing.

(a) The employer shall specifically research, identify and document manufacturer required load-testing frequency for each USACE-owned/operated and/or Contractor-owned/operated crane or hoisting equipment and maintain and/or provide this information to the GDA;

(b) Under conditions (1) and (2) above, a selective load test (testing only those components that have or may have been affected by the alteration, replacement, or repaired) may be performed;

(c) The replacement of the rope is specifically excluded from this requirement. However, a functional test of the crane or hoisting equipment under a normal operating load shall be made prior to putting the crane back in service.

d. The manufacturer's specifications and limitations applicable to the operation of any crane and hoisting equipment shall be followed. At no time shall a crane or hoisting equipment be

loaded in excess of the manufacturer's rating, except overhead and gantry cranes in accordance with ANSI/ASME B30.2. Loads shall not exceed 125% of the rated load for test purposes or planned engineered lifts for overhead and gantry cranes.  
**> See 16.H, Critical Lifts.**

(1) Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a registered engineer competent in this field, and such determinations will be documented and recorded.

(2) Attachments used with crane and hoisting equipment shall not exceed the capacity, rating, or scope recommended by the manufacturer.

e. Written reports that show test procedures and confirm the adequacy of repairs or alterations shall be maintained and provided upon request.

## **16.G OPERATION**

16.G.01 All cranes and hoisting equipment shall have the following documents with them (in the cab, if applicable) at all times they are to be operated:

a. A copy of the operating manual developed by the manufacturer for the specific make and model of the crane or hoist.

(1) When not available from a manufacturer, a qualified person shall establish the ratings and operating limitations (load charts), recommended operating speeds, special hazard warnings, instructions and operators manual, maintenance, testing, and inspection requirements that apply during the use.

(2) Where load capacities are available only in electronic form: in the event of a failure which makes the load capacities inaccessible, the operator must immediately cease operations

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or follow safe shut-down procedures until the load capacities (in electronic or other form) are available.

b. A copy of the load-rating chart (separate or included in the operating manual), shall include:

(1) The crane/hoist make and model, serial number, and year of manufacturer;

(2) Load ratings for all operating configurations, including optional equipment;

(3) Recommended reeving for the hoist line; and

(4) Operating limits in windy or cold weather conditions.

c. A durable load chart with legible letters and figures shall be fixed at a location visible to the operator while seated at the control station;

d. The crane log book shall be used to record operating hours and all crane inspections, tests, maintenance, and repair. The log shall be updated daily as the crane is used and shall be signed by the operator and supervisor. Service mechanics shall sign the log after conducting maintenance or repairs on the crane.

e. All inspections, test, maintenance and repairs for hoisting equipment shall be maintained in the log, the O&M records or equivalent for that piece of equipment.

16.G.02 No modifications or additions that affect the capacity or safe operation of cranes or hoisting equipment shall be made without the manufacturer's written approval.

a. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

b. In no case shall the original safety factor of the equipment be reduced.

16.G.03 Hoisting wire ropes shall be installed in accordance with ANSI/ASME standards and the equipment manufacturer's recommendations.

a. Overhead and gantry cranes shall have at least two full wraps of wire rope on the drums at all times.

b. All other cranes shall have at least three full wraps (not layers) of wire rope on the drums at all times.

c. The drum end of the wire rope shall be anchored to the drum by an arrangement specified by the crane manufacturer.

16.G.04 Responsibilities.

a. The responsibilities of the operator shall include, but are not limited to the following requirements:

(1) The operator shall not engage in any activity that will divert his attention while operating the equipment;

(2) The operator shall not leave the controls while a load is suspended;

(3) Before leaving the crane or hoisting equipment unattended, the operator shall:

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

(b) Disengage the master clutch;

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

(d) Put the controls in the "OFF" or neutral position;

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(e) Secure the equipment against accidental travel; and

(f) Stop the engine.

(g) Exception: When crane operation is frequently interrupted during a shift and the operator must leave the crane. Under these circumstances, the engine may remain running and the following conditions (including those in paragraphs (a) thru (e) above) shall apply:

(i) The operator shall remain adjacent to the equipment and is not engaged in any other duties;

(ii) The competent person determines that it is safe to do so and implements measures necessary to restrain the boom hoist and telescoping, load, swing and outrigger functions;

(iii) The crane shall be located within an area protected from unauthorized entry.

(4) The operator shall respond to signals from the person who is directing the lift or an appointed signal person. When a signal person is not used in the crane operation, the operator shall ensure he has full view of the load and the load travel paths at all times the load is rigged to the crane and hoisting equipment;

(5) Each operator is responsible for those operations under his direct control. Whenever there is a concern as to safety, the operator shall have the authority to stop and refuse to handle loads until a qualified person has determined that safety has been assured.

b. The operator, qualified lift supervisor and rigger shall jointly ensure that:

(1) The crane is level and, where necessary, blocked;



(2) The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches;

(3) The lift and swing path is clear of obstructions and adequate clearance is maintained from electrical sources per Table 16-3; and

(4) All persons are clear of the swing radius of the counterweight.

c. When two or more cranes (tandem lift is a critical lift) are used to lift one load, the lift supervisor shall be responsible for the following:

(1) Analyzing the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made;

(2) Making determinations as necessary to reduce crane ratings, load position, boom location, ground support, and speed of movement, which are required to safely make the lift;

(3) Ensuring that dedicated personnel are present and equipment is functioning properly. All personnel involved with the crane operation shall understand the communication systems and their responsibilities.

#### 16.G.05 Communications.

a. A standard signal system shall be used on all cranes and hoisting equipment (by hand, voice, audible or comparable signals). Manual (hand) signals may be used when the distance between the operator and signal person is not more than 100 ft (30.4 m). If using hand signals, Standard Method must be used per Figure 16-

(1) Radio, telephone, or a visual and audible electrically-operated system shall be used when the distance between

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operator and signal person is more than 100 ft or when they cannot see each other.

b. A signal person must be used in the following situations:

(1) When the point of operation, load travel, area near or at load placement, is not in full view of the operator;

(2) When the equipment is traveling and the view in the direction of travel is obstructed;

(3) Due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.

c. During crane operations requirement signals, the ability to transmit signals between the operator and signal person shall be maintained. If that ability is interrupted at any time, the operator shall safely stop operations requiring signals until it is reestablished and a proper signal is given and understood.

d. Only one person gives signals to a crane/derrick operator at a time unless an emergency stop signal is given (which may be given by anyone and must be obeyed by the operator).

16.G.06 Riding on loads, hooks, hammers, buckets, material hoists, or other hoisting equipment not meant for personnel handling is prohibited.

FIGURE 16-1

**CRANE HAND SIGNALS**

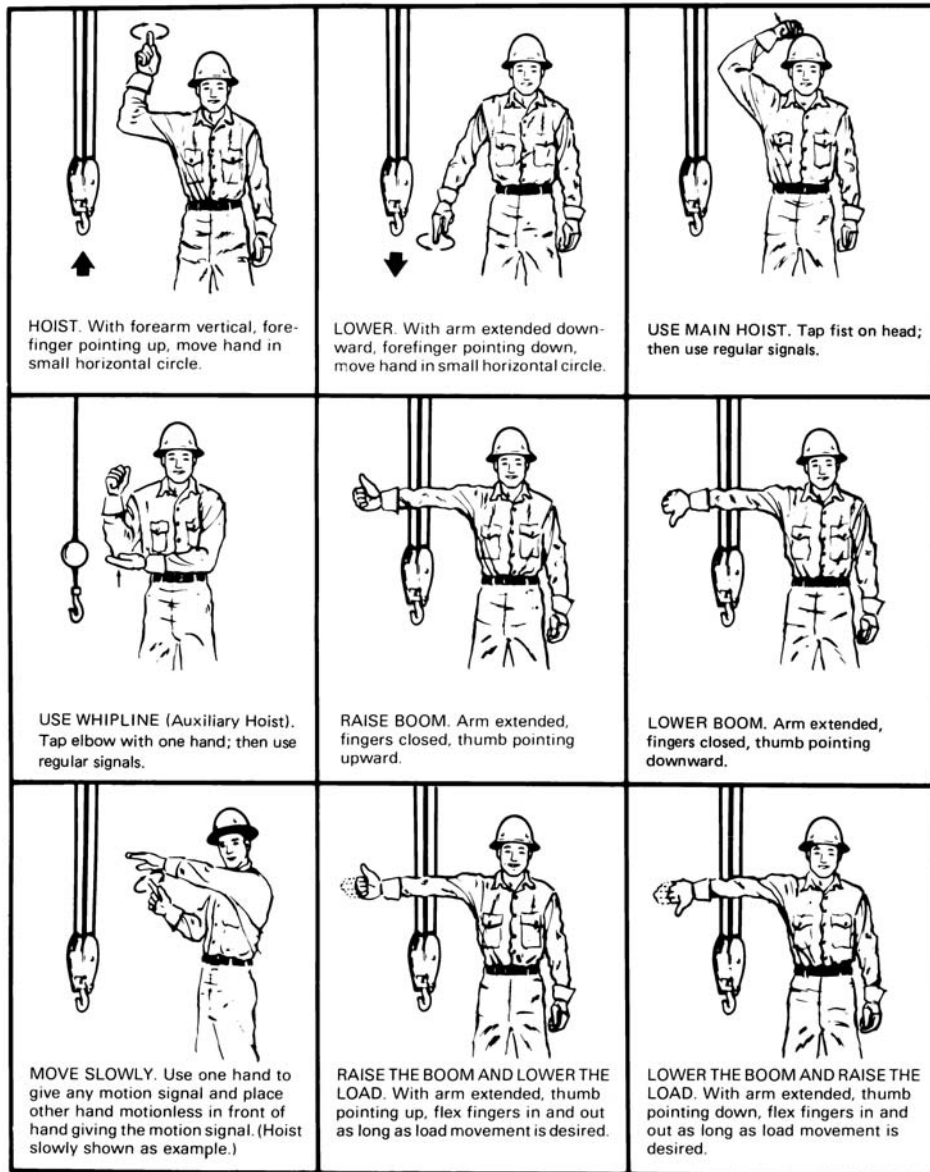
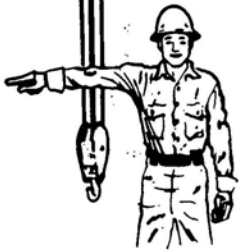


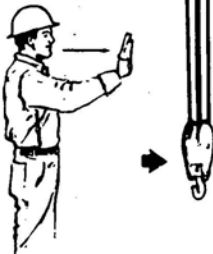







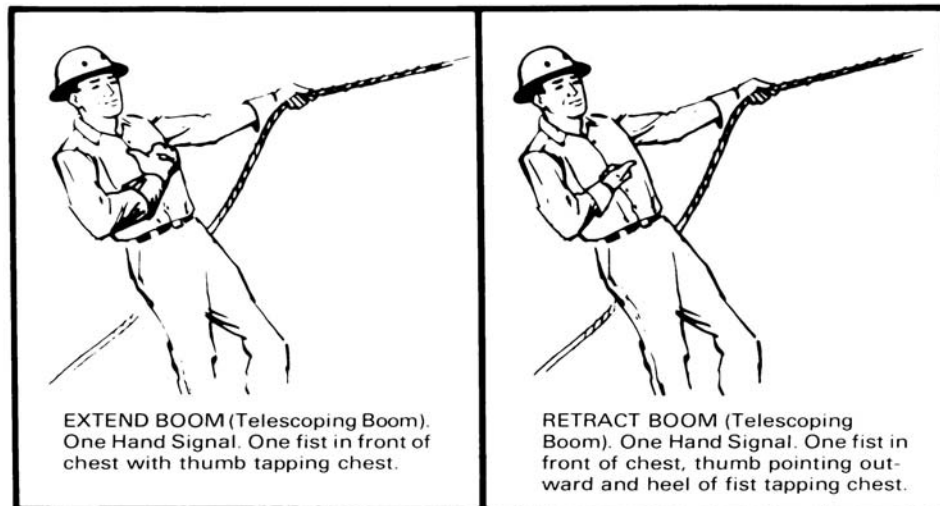
FIGURE 16-1 (Continued)

CRANE HAND SIGNALS

 <p>SWING. Arm extended, point with finger in direction of swing of boom.</p>	 <p>STOP. Arm extended, palm down, move arm back and forth horizontally.</p>	 <p>EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.</p>
 <p>TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.</p>	 <p>DOG EVERYTHING. Clasp hands in front of body.</p>	 <p>TRAVEL (Both Tracks). Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward. (For land cranes only.)</p>
 <p>TRAVEL. (One Track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For land cranes only.)</p>	 <p>EXTEND BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing outward.</p>	 <p>RETRACT BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.</p>

**FIGURE 16-1 (Continued)**

**CRANE HAND SIGNALS**



NOTE: Crane signals taken from ANSI/ASME B30 series standards with permission of ASME.

16.G.07 When practical and when their use does not create a hazard, tag lines shall be used to control loads.

16.G.08 Whenever a slack line condition occurs, the proper seating of the rope in the sheaves and on the drum shall be checked prior to further operations.

16.G.09 Clearances.

a. Power line clearance. The employer must identify the work zone for the crane in question (work zone is the area 360 degrees around the crane, up to the crane's maximum working radius). A determination shall be made if any part of the crane, load line or load (to include rigging and lifting accessories), if operated up to the crane's maximum working radius in the work

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zone, could get within 20 ft (6 m) of the power line. If possible, one of the following options must be met:

(1) De-energize and ground. Confirm from the utility owner/operator that the line has been de-energized and visibly grounded at the worksite;

(2) Table 16-3, Minimum approach distances. Determine the line's voltage and the minimum approach distance permitted by Table 16-3 and insure that no part of the crane, load line or load (including rigging and lifting accessories) while operating up to the crane's maximum working radius in the work zone, gets within the minimum approach distance;

(3) Permanently installed overhead and gantry cranes clearances shall be in accordance with NFPA 70;

(4) Operations below power lines. No part of a crane, 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 visibly grounded the power line at the work site;

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

b. Physical clearances.

(1) Adequate clearance shall be maintained between moving and rotating structures of the crane and hoisting equipment and fixed objects to allow the passage of employees without harm. The minimum adequate clearance is 24 in (61 cm).

(2) Accessible areas within the swing radius of the rear of the crane and hoisting equipment's rotating superstructure, either permanently or temporarily mounted, shall be barricaded to

prevent an employee from being struck or crushed by the crane and hoisting equipment.

(3) No employee shall be permitted to work under any suspended loads. Exception: Where workers are engaged in the initial connection of steel or employees are unhooking the load.

## **16.H CRITICAL LIFTS**

16.H.01 When using cranes or hoists, the following are identified as critical lifts requiring detailed planning and additional or unusual safety precautions. Critical lifts are defined as:

- a. Lifts involving hazardous materials (e.g., explosives, highly volatile substances);
- b. Hoisting personnel with a crane or hoist;
- c. Lifts made with more than one crane;
- d. Lifts where the center of gravity could change;

**TABLE 16-3**

**MINIMUM CLEARANCE FROM ENERGIZED OVERHEAD  
ELECTRIC LINES**

(All dimensions are distances from live part to employee)

<u>Voltage (nominal, kV, alternating current)</u>	<u>Minimum rated clearance</u>
Up to 50	10 ft (3 m)
51 – 200	15 ft (4.6 m)
201 – 350	20 ft (6 m)
351 to 500	25 ft (7.6 m)
501 - 650	30 ft (9.1 m)
651 – 800	35 ft (10.7 m)
801 – 950	40 ft (12.2 m)
951 – 1100	45 ft (13.7 m)
<u>Clearance values calculated using: (Initial kV-50kV) x (4 in/10 kV) x (1 ft/12 in) = increased distance (ft) over 10 ft. Add this value to 10 ft to yield minimum rated clearance</u>	

- e. Lifts the operator believes should be considered critical;
- f. Lifts made when the load weight is 75% of the rated capacity of the crane load chart or more (not applicable to gantry, overhead or bridge cranes);
- g. Lifts without the use of outriggers using rubber tire load charts;
- h. Lifts using more than one hoist on the same crane or trolleys;
- i. Lifts involving non-routine or technically difficult rigging arrangement (to include lifts involving Multiple Lift Rigging;



j. Lifts involving submerged loads (EXCEPTION: lifts that were engineered to travel in guided slots throughout the lift and have fixed rigging and/or lifting beams, i.e., intake gates, roller gates, tailgates/logs.);

k. Lifts out of the operator's view; **EXCEPTION: if hand signals via a signal person in view of the operator or radio communications are available and in use, load does not exceed two tons AND is determined a routine lift by the lift supervisor.**

16.H.02 Critical lift plans. Before making a critical lift, a critical lift plan shall be developed:

a. By a qualified person and shall include the crane operator, lift supervisor, and the rigger and signed by all involved personnel prior to the lift;

b. For a series of lifts on one project or job, as long as the cranes, personnel, type loads and configuration do not differ;

c. And documented with a copy provided to the GDA prior to the lift(s) being made;

d. And shall include, as a minimum:

(1) The specific make and model of the cranes, the line, boom, and swing speeds;

(2) The exact size and weight of the load to be lifted and all crane and rigging components that add to the weight. The manufacturer's maximum load limits for the entire range of the lift, as listed in the load charts, shall also be specified;

(3) The plan shall specify the lift geometry and procedures, including the crane position, height of the lift, the load radius, and the boom length and angle, for the entire range of the lift;

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(4) Site drawing shall be included to identify placement/location(s) of crane, adjacent equipment and/or facilities, etc.;

(5) The plan shall designate the crane operator, lift supervisor and rigger and include their qualifications;

(6) The plan will include a rigging plan that shows the lift points and describes rigging procedures and hardware requirements;

(7) The plan will describe the ground conditions, outrigger or crawler track requirements, and, if necessary, the design of mats, necessary to achieve a level, stable foundation of sufficient bearing capacity for the lift;

(8) For floating crane or derricks, the plan shall describe the operating base (platform) condition and any potential maximum list / trim;

(9) The plan will list environmental conditions under which lift operations are to be stopped;

(10) The plan will specify coordination and communication requirements for the lift operation;

(11) For tandem or tailing crane lifts, identify the requirements for an equalizer beam if applicable.

## **16.I ENVIRONMENTAL CONSIDERATIONS**

16.I.01 Projects shall have adequate means for monitoring local weather conditions, including a wind-indicating device

16.I.02 Cranes shall not be operated when wind speeds at the site attain the maximum wind velocity recommendations of the manufacturer. At winds greater than 20 mph (9 m/s), the operator, rigger, and lift supervisor shall cease all crane operations, evaluate conditions and determine if the lift shall proceed. The

determination to proceed or not shall be documented in the crane operator's logbook.

16.I.03 When a local storm warning has been issued, the competent person shall determine whether it is necessary to implement manufacturer recommendations for securing the equipment.

16.I.04 Operations performed during weather conditions that produce icing of the crane and hoisting equipment structure or reduced visibility shall be performed at reduced functional speeds and with signaling means appropriate to the situation.

16.I.05 When conditions are such that lightning is observed all crane and hoisting equipment operations shall cease. A period of 30 minutes between subsequent observations shall be observed prior to resuming work.

16.I.06 For night operations, lighting adequate to illuminate the working areas while not interfering with the operator's vision shall be provided. > See Section 7.

## **16.J LATTICE, HYDRAULIC, CRAWLER-, TRUCK-, WHEEL-, AND RINGER-MOUNTED CRANES**

16.J.01 For required operator aids and indicating devices, see Section 16.E.03.

16.J.02 Boom assembly and disassembly. This operation shall be covered in the AHA and Competent Person shall be identified.

a. The manufacturer's boom assembly and disassembly procedures shall be reviewed by the team before starting the assembly or disassembly. The Competent Person shall be present during assembly/disassembly operations.

b. When removing pins or bolts from a boom, workers shall stay out from under the boom. Sections shall be blocked or otherwise secured to prevent them from falling.

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16.J.03 Outriggers.

a. Anytime outriggers are required to be used, they shall be extended or deployed per the crane manufacturer's load/capacity chart specifications and set to remove the machine weight from the wheels at all settings, except for locomotive cranes.

b. When partially extended outriggers are used, the following requirements, shall be met:

(1) Crane operation with partially extended outriggers shall only be undertaken if approved by the crane manufacturer;

(2) Outriggers shall be set at equal positions that correspond to the load/capacity charts supplied by the manufacturer for those positions. Only the load chart(s) corresponding to the outrigger positions shall be used for operation;

(3) When situations arise where outriggers must be set at unequal positions that correspond to the load/capacity charts corresponding with the individual quadrants of operation. The manufacturer or qualified person shall be consulted to determine if the capacity reductions, special operating procedures, or limitations are required;

c. When outrigger floats are used, they shall be securely attached to the outriggers.

d. Blocking under outriggers floats shall meet the following requirements:

(1) Sufficient strength to prevent crushing, bending, or shear failure;

(2) Such thickness, width, and length as to completely support the float, transmit the load to the supporting surface, and

prevent shifting, toppling, or excessive settlement under load;  
and

(3) Use of blocking only under the outer bearing surface of the  
extended outrigger beam floats.

16.J.04 Unless the manufacturer has specified an on-rubber rating,  
mobile cranes shall not pick or swing loads over the side of the  
crane unless the outriggers are down and fully extended.

16.J.05 Unless recommended against by the manufacturer, crane  
booms shall be lowered to ground level or secured against  
displacement by wind loads or other outside forces when not in  
use. If the manufacturer recommends against this practice, the  
manufacturer's recommended practice shall be followed.

16.J.06 When pick and carry operations occur (Rough Terrain  
Crane's), the boom must be centered over the front of the crane,  
the mechanical swing lock engaged, and the load restrained from  
swinging.

## **16.K PORTAL, TOWER, AND PILLAR CRANES**

16.K.01 All load bearing foundations, supports, and rail tracks shall  
be constructed or installed as determined by a Registered  
Professional Engineer with knowledge in this area, in accordance  
with the crane manufacturer's recommendations.

16.K.02 Cranes shall be erected/dismantled in accordance with the  
manufacturer's recommendations, (or if manufacturer procedures  
are not available, in accordance with procedures developed by a  
Registered Professional Engineer with knowledge in this area).

a. When erected/dismantled, written instructions by the  
manufacturer and/or Registered Professional Engineer and a list  
of the weights of each component shall be kept at the site.

b. Erection and dismantling shall be performed under the  
supervision of a qualified person.

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c. An AHA shall be developed and procedures established before the erection/dismantling work commences to insure site-specific needs are considered. The analysis will include:

(1) The location of the crane in relation to other tower cranes, adjacent buildings or towers, overhead power and communication lines, underground utilities;

(2) Foundation design and construction requirements; and

(3) When the tower is erected within a structure, clearances between the tower and the structure and bracing and wedging requirements.

d. Wind velocity at the site at the time of erection/dismantling shall be a consideration as a limiting factor that could require suspending the erection/dismantling operation and shall be as determined by the manufacturer or if this data is not available, by a qualified person.

e. Before crane components are erected, they shall be visually inspected for damage. Dented, bent, torn, gouged or otherwise damaged members shall not be erected.

f. Initially and after each climb, the crane shall be plumbed and then held in the plumbed condition by wedges or other means. Cranes shall be plumbed to a tolerance of 1:500 (1 in:40 ft; 2.4 cm:12 m) unless the manufacturer specifies otherwise.

16.K.03 Pre-operation tests shall be performed when cranes are erected and after each climbing operation, before placing the crane in service. All functional motions, motion limiting devices and brakes shall be properly tested for operation in accordance with the manufacturer's recommended procedures and ANSI/ASME B30.3 or B30.4, as applicable:

a. Crane supports;

b. Brakes and clutches, limit and overload switches, and locking and safety devices; and

c. Load hoisting and lowering, boom hoisting and lowering, and swing motion mechanisms and procedures.

16.K.04 Climbing Procedures. Prior to and during, all climbing procedures (to include inside and top climbing), the employer shall:

a. Comply with all manufacturer prohibitions;

b. Have a registered professional engineer verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages and supporting floors;

c. Ensure that no part of the climbing procedure takes place when wind velocity at the crane superstructure exceeds the limit set by the manufacturer or a qualified person, or 20 mph (9 m/s) at the crane superstructure if no such limit has been set. The characteristics of the gusts should be considered for their effect on the climbing operation; and

d. The operator of a hammerhead tower crane shall be present during climbing or telescoping operations.

16.K.05 Safety devices and operational aids. Operations shall not begin unless the safety devices and operational aids are in place and in proper working order. In addition to those listed in 16.E.03, the following shall be provided:

a. Rail clamps, if used, shall have slack between the point of attachment to the rail and the end fastened to the crane. Rail clamps shall not be used as a means of restraining tipping of a crane display magnitude of load on the hook;

b. Hydraulic system pressure limiting device;

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c. The following brakes, which shall automatically set in the event of pressure loss or power failure, are required: hoist brake on all hoists, swing brake, trolley brake, rail travel brake;

d. Deadman control or forced neutral return control (hand) levers;

e. Emergency stop switch at the operator's station;

f. Trolley travel limiting device prevents trolley from running into the trolley end stops;

g. Ambient wind velocity device. This device shall be mounted at or near the top of the crane. A velocity readout shall be provided at the operator's station in the cab, and a visible or audible alarm shall be triggered in the cab and at remote control stations when a preset wind velocity has been exceeded;

h. Hoist line pull limiting device (limits lifted load).

16.K.06 Multiple tower crane jobsites. On jobsites where more than one fixed jib (hammerhead) tower crane is installed, the cranes shall be located such that no crane may come in contact with the structure of another crane. Cranes are permitted to pass over one another.

16.K.07 Weathervaning. Tower cranes required to weathervane when out-of-service shall be installed with clearance for boom (jib) and supersutstructure to swing through a full 360 degree arc without striking any fixed object or other weathervaning crane. The boom shall be taken in the attitude dictated by its wind area balance. Nonweathervaning boom (jibs) shall be taken in the least favorable attitude. Traveling cranes shall also resist design wind level induced sliding.



## **16.L FLOATING CRANES/DERRICKS, CRANE BARGES, AND AUXILIARY SHIPBOARD MOUNTED CRANES**

16.L.01 The requirements in this section are supplemental requirements for floating cranes/derricks, land cranes/derricks on barges, pontoons, vessels or other means of flotation and auxiliary shipboard mounted cranes, unless otherwise specified.

16.L.02 The load rating of a floating crane/derrick shall be the maximum working loads at various radii as determined by the manufacturer or qualified person considering list and trim for each installation. The load rating shall specifically reflect the: design standard; machine trim; machine list; and dynamic/environmental loadings anticipated for the operational envelope of the floating crane or auxiliary shipboard crane. A Naval Architectural Analysis shall be performed to determine these parameters that shall be used in generating the load rating.

- a. The load rating is dependent upon the structural competence of the crane, rope strength, hoist capacity, structural attachment to the floating platform, and stability and freeboard of the floating platform.
- b. When deck loads are to be carried while lifting, the situation shall be analyzed for modified ratings.
- c. When mounted on barges or pontoons, the rated loads and radii of land cranes shall be modified as recommended by the manufacturer or qualified person. The modification shall be evaluated by the qualified person specific to the flotation device/platform being used.
- d. Load charts shall be posted in the cab or at the operator's station (if no cab). All other procedures applicable to the operation of the equipment (instructions and operators manual, recommended operating speeds, etc.) shall be readily available on board.
- e. Load charts shall, at a minimum, identify the following:

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(1) Naval Architect Notes:

(a) Draft limits (with deck cargo considered):

(b) Vessel motion limits :

(c) Vessel and crane list/trim limits, and

(d) Vessel condition (e.g., dry bilges, watertight integrity, etc.).

(2) Crane manufacturer Notes, or reference to them.

(3) Safe Working Load Chart with:

(a) Mode of operation:

(b) Environmental limits;

(c) Capacity (net or gross):

(d) Load, boom elevation, radius (with list/trim considered), and

(e) Crane configuration, to include boom length, amount of counterweight, parts of wire, and block size.

16.L.03 Floating cranes/derricks. All floating cranes/ derricks intended for permanent attachment to a barge, pontoon or other means of flotation shall be designed in accordance with the requirements of 46 CFR 173.005 through 173.025.

a. Load Charts.

(1) The manufacturer load charts applicable to operations on water shall not be exceeded. When using these charts, the employer shall comply with all parameters and limitations (dynamic, environmental, etc.) applicable to the use of these charts.

(2) The load charts shall take into consideration a minimum wind speed of 40 mph (18 m/s).

b. Maximum Operating list or trim. Unless the crane manufacturer recommends a lesser value, maximum operating list or trim shall comply with requirements below:

(1) Cranes designed for marine use (barge or pontoon mounting) by permanent attachment, with a rated capacity of up to 25 tons (22,680 kg) shall have a maximum allowable list or trim of 5°;

(2) Cranes designed for marine use (barge or pontoon mounting) by permanent attachment, with a rated capacity of greater than 25 tons (22,680 kg) shall have a maximum allowable list or trim of 7°, although 5° is recommended;

(3) Derricks, designed for marine use (barge or pontoon mounting) by permanent attachment, of any capacity shall have a maximum allowable list or trim of 10°;

c. Stability. The equipment shall be made stable with the following maximum allowable freeboard requirements:

(1) Operated at rated capacity, 60 mph (100 kph) wind, 2 ft (0.6 m) minimum freeboard;

(2) Operated at rated capacity plus 25%, 60 mph (100 kph) wind, 1 ft (0.3 m) minimum freeboard;

(3) Operated at high boom, no load, 60 mph (100 kph) wind, 2 ft (0.6 m) minimum freeboard;

(4) For backward stability of the boom - high boom, no load, full back list (least stable condition), 90 mph (145.8 kph) wind.

d. If the equipment is employer-made, it shall not be used unless the employer has documents demonstrating that the load

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charts and applicable parameters for use meet the requirements of paragraphs 16.L.03.a, b and c. Such documents shall be signed by a marine engineer or a registered professional engineer who is a qualified person with respect to the design of this type of equipment (including the means of flotation).

16.L.04 Land cranes/derricks mounted on barges, pontoons or other means of flotation.

a. The rated capacity of the equipment (load charts) applicable for use on land shall be reduced by the equipment manufacturer, or a qualified person who has expertise with respect to both land crane/derrick capacity and the stability of vessels/flotation devices.

b. Load Charts. The rated capacity of the equipment for use on land shall be reduced to:

(1) Account for increased loading from list, trim, wave action and wind;

(2) Be applicable to a specified location(s) on the specific barge, pontoons, vessel or other means of flotation that will be used, under the expected environmental conditions;

(3) Insure that the maximum allowable list and trim for the land crane/derrick shall not exceed the amount specified by the crane/derrick manufacturer or if not specified, the amount specified by the qualified person;

(4) Maximum allowable list and trim for the barge, pontoon, or other means of flotation shall not exceed the amount necessary to ensure:

(a) All deck surfaces of the barge, pontoon or flotation device shall be above the water;

(b) The entire bottom area of the barge, pontoon or flotation device shall be submerged; AND

(c) The maximum allowable list or trim shall not exceed the least of the following: 5°, the maximum specified by the crane/derrick manufacturer or if not specified, the amount specified by the qualified person.

c. Physical attachment.

(1) Derricks shall be secured to the deck to transmit the loading to the barge or pontoon.

(2) Cranes shall be blocked or secured to prevent shifting.

(3) The crane shall be allowed to travel on the barge for repositioning only. If traveling is required while lifting the load, this lift shall be deemed a critical lift and a critical lift plan is required. It must include a Naval Architectural Analysis to determine these parameters. A marine engineer or registered professional engineer familiar with floating crane design shall perform this analysis. In addition, the manufacturer's recommendations shall be followed.

16.L.05 When loads approach the maximum rating of the crane or derrick, the person responsible for the job shall ascertain that the weight of the load has been determined within +/- 10% before it is lifted.

16.L.06 Safety devices and Operational Aids. In addition to those required by section 16.E.03, the following are required:

a. Pontoon, barge, vessel or flotation device list and trim device: Shall be located in the cab or at the operator's station (if there is no cab) as a means for the operator to visually determine the list and trim;

b. Wind speed and direction indicator: within clear view of the operator's station;

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c. Anti two-block device: only when hoisting personnel or hoisting over an occupied cofferdam or shaft.

16.L.07 Principal walking surfaces shall be of a skid-resistant type.

16.L.08 In addition to inspection of the crane/derrick per 16.D, inspection of the barge, pontoons, vessel or other means of flotation used to support a land crane/derrick by a competent person is required:

a. Each shift - the means used to secure/attach the equipment to the vessel/flotation device shall be inspected for proper condition, to include wear, corrosion, loose or missing fasteners, defective welds and (where applicable) insufficient tension.

b. Monthly. In addition to 16.L.08.a, The vessel/means of flotation used shall be inspected for the following:

(1) Taking on water;

(2) Deckload for proper securing;

3) Chain lockers, storage, fuel compartments and battening of hatches for serviceability as a water-tight appliance;

(4) Firefighting and lifesaving equipment in place and functional.

c. If any deficiency is identified, an immediate determination shall be made by a qualified person as to whether the deficiency constitutes a hazard. If so, the vessel/flotation device shall be removed from service until it has been corrected.

16.L.09 Operations.

a. Operators shall monitor the wire lead from the boom tip carefully to ensure that limits on off-lead and side-lead identified in the load chart are not exceeded.

b. Operators shall monitor environmental criteria for compliance with the criteria set forth in the load chart.

c. Operators should be aware that safety devices such as LLD(s) and LMI(s) do not offer protection against loads generated by relative motions between a floating crane and a fixed object to be lifted.

d. Whenever practical, crane use during buoy tending shall be limited to lifting the freely suspended buoy clear of the water onto the vessel.

e. Bilges shall be kept as dry as possible to eliminate the adverse effect of free surface (sloshing liquid).

16.L.10 All lifts must be planned to avoid procedures that could result in configurations where the operator cannot maintain safe control of the lift. (A plan, in this case, might be a quick discussion with the deck crew, and a verification of the proposed operation.) Lifts shall reflect floating operational parameters such as: anticipated values for wire leads, unknown load for extractions, and upper limits on crane force.

16.L.11 Mobile Auxiliary Cranes. For mobile auxiliary cranes used on deck of a floating crane/derrick, the requirement for physical attachment does not apply when the following can demonstrate the following requirements have been met:

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 shall be designed so that the requirements for safe location of equipment will be met despite the position, travel, operation, and lack of physical attachment of the mobile auxiliary crane.

c. The plan shall specify the areas of the deck where the mobile auxiliary crane is permitted to be positioned, travel and operate

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and the parameters or limitations of such movements and operation.

d. The deck shall be marked to identify the permitted areas for positioning, travel and operation.

e. The plan shall specify the dynamic and environmental conditions that must be present for the use of the plan.

f. If the dynamic and environmental conditions are exceeded, the mobile auxiliary crane shall be physically attached or corralled.

16.L.12 Anchor handling barge/vessel.

a. An anchor handling barge/vessel may be used for anchor handling, low lifting of loads such as anchor buoys/weights, dredge pipe, submerged pipeline, pontoons, and other loads provided they do not exceed the load rating of the anchor barge/vessel. If used for any other lifting application, the work platform will be considered a floating derrick and all other requirements of Section 16 apply. Anchor barge/vessels shall also comply with the following:

(1) All deck surfaces of the pontoon or barge shall be above the water;

(2) Means for limiting the applied load, such as mechanical means or marking the draft of the barge corresponding to the rated load, shall be provided. Calculations shall be available and the barge shall be tested to verify rated load;

(3) A ratchet and pawl shall be provided for releasing the load from the hoisting machinery brake;

(4) An operating manual/procedure shall be available for use by the operator. The operator shall be trained in the anchor handling barge systems operation.



b. If additional external load is superimposed above that which can be hoisted with the onboard hoisting machinery, then a chain stopper shall be used to remove the external load from the A-frame and hoist machinery.

## **16.M OVERHEAD AND GANTRY CRANES**

16.M.01 The requirements in this section are supplemental requirements for overhead and gantry cranes whether permanently installed in a facility or not and includes overhead/bridge cranes, semi gantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics whether it travels on tracks, wheels or other means (unless otherwise specified).

16.M.02 All load bearing foundations, anchorages, runways, and rail tracks shall be constructed or installed in accordance with the crane manufacturer's recommendations and ANSI/ASME B30.2 or B30.17, as applicable.

16.M.03 The rated load of the crane shall be plainly marked on each side of the crane.

a. If the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block.

b. Markings on the bridge, trolley, and load block shall be legible from the ground or floor.

16.M.04 Clearance shall be maintained between the crane, any structure or object, and any parallel running cranes and cranes operating at different elevations.

16.M.05 Contacts with runway stops or other cranes shall be made with extreme caution. The operator shall do so with particular care for the safety of persons on or below the crane, and only after making certain that any persons on the other cranes are aware of what is being done.

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16.M.06 Operators of outdoor cranes shall secure them when leaving.

16.M.07 When the wind-indicating alarm of a cab-operated outdoor crane sounds, crane operations shall be discontinued and the crane shall be prepared and stored for excessive wind conditions.

## **16.N MONORAILS AND UNDERHUNG CRANES**

16.N.01 Crane runways, monorail tracks, track supports, and track control devices shall be constructed or installed in accordance with the crane manufacturer's recommendations and ANSI/ASME B30.11.

16.N.02 The rated load of the crane shall be plainly marked on each side of the crane.

- a. If the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block.
- b. Markings on the bridge, trolley, and load block shall be legible from the ground or floor.

## **16.O DERRICKS**

16.O.01 For permanent fixed locations, the following load anchoring data shall be provided to the GDA. For non-permanent installations, this data shall be determined by a qualified person.

- a. Guy derricks.
  - (1) Maximum horizontal and vertical forces when handling rated loads with the particular guy slope and spacing stipulated for the application, and

(2) Maximum horizontal and vertical forces at the guy when handling rated loads with the particular guy slope and spacing stipulated for the application.

b. Stiffleg derricks.

(1) Maximum horizontal and vertical forces at the mast base when handling rated loads with the particular stiffleg slope and spacing stipulated for the application, and

(2) Maximum horizontal and vertical forces at the stifflegs when handling rated loads with the particular stiffleg arrangement stipulated for the application.

16.O.02 Derrick booms, load hoists, and swinger mechanisms shall be suitable for the derrick work intended and shall be anchored to prevent displacement from imposed loads.

16.O.03 When rotating a derrick, sudden starts and stops shall be avoided and rotational speed shall be such that the load does not swing out beyond the radius at which it can be controlled. A tagline shall be used.

16.O.04 Boom and hoisting rope systems shall not be twisted.

16.O.05 Ropes shall not be handled on a winch head without the knowledge of the operator. When a winch head is being used, the operator shall be within reach of the power unit controls.

16.O.06 When securing the boom, dogs or other positive holding mechanisms on the hoist shall be engaged.

16.O.07 When not in use the derrick boom shall be either:

a. Laid down;

b. Secured to a stationary member as nearly under the head as possible by attachment of a sling to the load block;

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- c. Lifted to a vertical position and secured to the mast (for guy derricks); or
- d. Secured against a stiffleg (for stiffleg derricks).

## **16.P HANDLING LOADS SUSPENDED FROM ROTORCRAFT**

16.P.01 Helicopter cranes shall comply with regulations of the Federal Aviation Administration (FAA).

16.P.02 Before each day's operation, a briefing shall be conducted to set forth the plan of operation for the pilot and ground personnel.

16.P.03 Loads shall be properly slung.

- a. Tag lines shall be of a length that will not permit their being drawn up into rotors.
- b. Pressed sleeve, swedged eyes, or equivalent means shall be used for all freely suspended loads to prevent hand splices from spinning open or wire clamps from loosening.

16.P.04 All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation.

- a. In addition, these cargo hooks shall be equipped with an emergency mechanical control for releasing the load.
- b. The hooks shall be tested prior to each day's operation to determine that the release functions properly, both electrically and mechanically.

16.P.05 PPE for employees receiving the load shall consist of eye protection and hard hats secured by chinstraps.

16.P.06 Loose-fitting clothing likely to flap in the downwash, and be snagged on the hoist line, shall not be worn.

16.P.07 Every practical precaution shall be taken to provide for the protection of the employees from flying objects in the rotor downwash. All loose gear within 100 ft (30.4 m) of the place of lifting or depositing the load, and all other areas susceptible to rotor downwash, shall be secured or removed.

16.P.08 The helicopter pilot shall be responsible for the size, weight, and manner in which loads are connected to the helicopter. If, for any reason, the helicopter pilot believes the lift cannot be made safely, the lift shall not be made.

16.P.09 When employees are required to work under hovering craft, safe access shall be provided for employees to reach the hoist line hook and engage or disengage cargo slings. Employees shall not work under hovering craft except to hook, unhook, or position loads.

16.P.10 Static charge on the suspended load shall be dissipated with a grounding device before ground personnel touch the suspended load, or protective rubber gloves shall be worn by all ground personnel touching the suspended load.

16.P.11 The weight of an external load shall not exceed the rated capacity.

16.P.12 Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel, shall not be attached to any fixed ground structure or be allowed to foul on any fixed structures.

16.P.13 When visibility is reduced by dust or other conditions, ground personnel shall exercise special caution to keep clear of main and stabilizing rotors. Precautions shall also be taken to eliminate reduced visibility.

16.P.14 No unauthorized person shall be allowed to approach within 50 ft (15.2 m) of the helicopter when the rotor blades are turning.

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16.P.15 Whenever approaching or leaving a helicopter with blades rotating, all employees shall remain in full view of the pilot and keep in a crouched position. Employees shall avoid the area from the cockpit or cabin rearward unless authorized by the helicopter pilot to work there.

16.P.16 There shall be constant reliable communication between the pilot and a designated employee of the ground crew who acts as a signal person during loading and unloading. This signal person shall be distinctly recognizable from other ground personnel. > See **Figure 16-2**

16.P.17 Good housekeeping shall be maintained in all helicopter loading and unloading areas.

#### **16.Q MATERIAL HOISTS**

16.Q.01 Material hoists shall be designed to raise and lower materials during construction, alteration, or demolition. It is not applicable to the temporary use of permanently installed elevators as material hoists. They shall be constructed and installed in accordance with the requirements of ANSI A10.5.

16.Q.02 Material hoist towers, masts, guy or braces, counterweights, drive machinery supports, sheave supports, platforms, supporting structures, and accessories shall be designed by a licensed engineer.

16.Q.03 Hoist towers shall be erected and dismantled only under the direct supervision of a qualified individual.

16.Q.04 A copy of the hoist operating manual shall be available at all times it is operated.

FIGURE 16-2

HELICOPTER HAND SIGNALS



Arms crossed in front of body and pointing down

Land



Right hand behind back, left hand pointing up

Takeoff



Hands above arm, palms out using a noticeable shoving motion

Move Rearward



Combination of arm and hand movement in a collecting motion pulling toward body

Move Forward



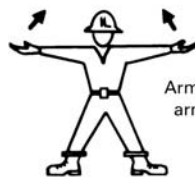
Right arm extended horizontally, left arm sweeps upward to position overhead

Move Left



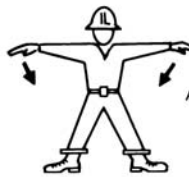
Left arm extended horizontally, right arm sweeps upward to position over head

Move Right



Arms extended, palms up, arms sweeping up

Move Upward



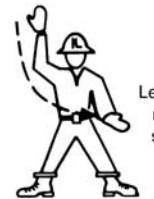
Arms extended, palms down, arms sweeping down

Move Downward



The signal "hold" is executed by placing arms over head with clenched fists

Hold - Hover



Left arm held down away from body, right arm cuts across left arm in a slashing movement from above

Release Sling Load

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16.Q.05 Material hoists and hoist tower systems shall be inspected in accordance with the manufacturer's recommendations.

a. Prior to initial use and each time after the tower is extended, all parts of the tower or mast, cage, bucket, boom, platform, hoisting machine, guy, and other equipment shall be inspected by a qualified person to ensure compliance with the manufacturer's inspection guidelines and ANSI A10.5.

b. Prior to initial use on a USACE project, and monthly thereafter, a periodic inspection shall be conducted by a qualified person. Periodic inspections shall cover those items specified by the manufacturer.

c. A GDA shall be notified at least 24 hours prior to any of the above inspections and may wish to accompany the contractor's inspector.

d. Pre-operational inspections (start-up procedures) shall be conducted by the operator prior to every operation (shift) of the hoist.

16.Q.06 Before a hoist is placed in service and every 4 months thereafter, a car-arresting-device test shall be performed.

a. For rope-supported cars, the test shall be conducted in the following manner:

(1) Pull a loop in the lifting rope and attach the test rope to each side of the loop above the bucket or platform;

(2) Raise the platform or bucket to allow the load to be supported by the test rope; and

(3) Cut the test rope to allow the load to fall and activate the car-arresting device.



b. For car suspension other than rope supported, the test shall be conducted by creating an over speed condition of the car.

c. Structural components shall be inspected for damage after the test and before the hoist is placed in operation again.

16.Q.07 Maintenance and repairs.

a. Replacement parts for load bearing or critical components shall be either obtained from or certified by the equipment manufacturer.

b. Maintenance and repairs shall be conducted in accordance with the manufacturer's procedures.

16.Q.08 Landings and runways.

a. Landing platforms and runways that connect the hoist way or tower to a structure shall be designed and constructed to sustain the maximum intended load without failure.

b. Floors or platforms that may become slippery shall have slip-resistant surfaces.

c. When workers may be exposed to falling objects, overhead protection, composed of 2-in (5-cm) planking or the equivalent, shall be provided.

d. A barricade shall be provided at the open ends of each landing. The barricade shall extend a minimum distance of 6 ft (1.8 m) laterally along the outer edge of the landing from each side of the hoist way, shall extend from the floor a distance of at least 3 ft (0.9 m), and shall be of #19 US gauge wire or the equivalent, with openings not exceeding 0.5 in (1.2 cm).

e. All hoist way entrances shall be protected by substantial gates or bars that shall guard the full width of the landing entrance. Gates shall be not less than 66 in (167.6 cm) in

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height, with a maximum under clearance of 2 in (5 cm), and shall be located not more than 4 in (10 cm) from the hoist way line. Gates of grille, lattice, or other open work shall have openings of not more than 2 in (5 cm).

f. Material shall not be stored on landing platforms or runways.

16.Q.09 Whenever a slack line condition occurs, the proper seating of the rope in the sheaves and on the drum shall be checked prior to further operations.

16.Q.10 Riding on material hoists or other hoisting equipment not meant for personnel handling is prohibited.

16.Q.11 While hoisting equipment is in operation, the operator shall not perform any other work and shall not leave his/her position at the controls until the load has been safely landed or returned to ground level.

16.Q.12 Not more than one cage or bucket shall be operated at the same time by any one hoisting machine or operator.

16.Q.13 Operating rules shall be established and posted at the operator's station of the hoist. Such rules shall include signal system and allowable line speed for various loads. Rules and notices shall be posted on the car frame or crosshead in a conspicuous location, including the statement "**NO RIDERS ALLOWED.**"

16.Q.14 Air-powered hoists shall be connected to an air supply of sufficient capacity and pressure to safely operate the hoist. Pneumatic hoses shall be secured by some positive means to prevent accidental disconnection.

## **16.R PILE DRIVERS**

16.R.01 Other cranes used in duty cycle operations, to include pile driving and extracting operations (except telescopic boom cranes),

are exempt from the requirements for A2B devices. > See  
16.E.03.d.(3)

16.R.02 Guy, outriggers, thrust outs, counter-balances, or rail  
clamps shall be provided to maintain stability of pile-driver rigs.

16.R.03 Pile-driver leads.

a. Swinging (hanging) leads.

(1) Swinging (hanging) leads shall have fixed ladders.

(2) Employees shall be prohibited from remaining on leads or  
ladders while pile is being driven.

b. Fixed leads.

(1) Fixed pile-driver leads shall be provided with decked  
landings having guard rails, intermediate rails, and toe boards.  
Fixed ladders or stairs shall be provided for access to landings  
and head blocks.

(2) Fixed leads shall be provided with rings or attachment  
points so that workers exposed to falls of 6 ft (1.8 m) or greater  
may attach their safety harnesses to the leads.

c. Landings or leads shall not be used for storage of any kind.

d. Pile-driver leads shall have stop blocks to prevent the  
hammer from being raised against the head block.

e. A blocking device, capable of supporting the weight of the  
hammer, shall be provided for placement in the leads under the  
hammer at all times while employees are working under the  
hammer.

f. Leads shall be free of projections or snags to minimize line  
damage and personnel safety hazards.

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16.R.04 Dogs, on pile-driver hoist drums, that automatically disengage when the load is relieved or the drum is rotated shall be prohibited.

16.R.05 Guards shall be provided across the top of the head block to prevent wire from jumping out of the sheaves.

16.R.06 All hose connections to pile-driver hammers, pile ejectors, or jet pipes shall be securely attached with an adequate length of at least ¼ in (0.6-cm) alloy steel chain, having 3,250 lb (1,500 kg) working load limit, or equal strength wire, to prevent whipping if the joint is broken.

16.R.07 Steam/hydraulic line controls shall consist of two shutoff valves, one of which shall be a quick-acting lever type within easy reach of the hammer operator.

16.R.08 Floating pile drivers.

a. The width of hulls of floating pile drivers shall not be less than 45% of the height of the lead above the water.

b. The operating deck of floating pile drivers shall be so guarded as to prevent piles that are being hoisted into driving position from swinging in over the deck.

16.R.09 Hoisting and moving pile.

a. All employees shall be kept clear when piling is being hoisted into the leads.

b. Hoisting of steel piling shall be done by use of a closed shackle or other positive attachment that will prevent accidental disengagement.

c. Taglines shall be used for controlling unguided piles and free hanging (flying) hammers.

d. Hammers shall be lowered to the bottom of the leads while the pile driver is being moved.

16.R.10 When driving jacked piles, all access pits shall be provided with ladders and bulk headed curbs to prevent material from falling into the pit.

16.R.11 When it is necessary to cut off the tops of driven piles, pile-driving operations shall be suspended except where the cutting operations are located at least twice the length of the longest pile from the driver.

16.R.12 Pile extraction.

a. If piling cannot be pulled without exceeding the load rating of equipment, a pile extractor shall be used.

b. When pulling piling, the crane shall be equipped with LID devices (unless the load can be calculated and is within the load rating chart of the crane) and the booms shall not be raised more than 60° above the horizontal. (This requirement does not apply to vibrating-type pulling devices.)

c. Piling shall not be pulled by tipping the crane, releasing the load brake momentarily, and catching the load before the crane has settled.

### **16.S HYDRAULIC EXCAVATORS, WHEEL/TRACK/BACKHOE LOADERS USED TO TRANSPORT OR HOIST LOADS WITH RIGGING**

16.S.01 Hydraulic excavating equipment shall not be used to hoist personnel. The riding of personnel on loads, hooks, hammers, buckets or any other hydraulic excavating equipment attachment is prohibited.

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16.S.02 Hydraulic excavating equipment may only be used to transport or hoist loads if allowed by the equipment manufacturer.  
**> See Figure 16-3**

16.S.03 When hydraulic excavating equipment is to be used to transport or hoist loads utilizing hooks, eyes, slings, chains, or other rigging the following requirements shall apply:

a. Operations involving the use of hydraulic excavating equipment and rigging to transport or hoist loads require different operator skills and considerations than the standard excavating operations routinely performed with hydraulic excavating equipment. An AHA specific to the transporting or hoisting operation shall be prepared. The AHA shall include, but not be limited to:

(1) Written proof of qualifications of equipment operators, riggers, and others involved in the transporting and hoisting operations;

(2) Performance of the operational test described in 16.F;

(3) Proper operating procedures in accordance with the equipment manufacturer's operating manual;

(4) Proper use and on site availability of manufacturer's load rating capacities or charts;

(5) Proper use of rigging, including positive latching devices to secure the load and rigging;

(6) Inspection of rigging;

(7) Use of tag lines to control the load;

(8) Adequate communications;

(9) Establishment of a sufficient swing radius (equipment, rigging and load) and

(10) Stability of surfaces beneath the hydraulic excavating equipment.

b. An operational test with the selected hydraulic excavating equipment will be performed in the presence of the GDA.

(1) The operational test shall consist of a demonstration that the test load and selected rigging can be safely lifted, maneuvered, controlled, stopped, and landed.

(2) The operational test shall be representative of the complete cycle of the proposed transporting or hoisting operation, including configuration, orientation and positioning of the excavating equipment and the use of identical rigging.

(3) The test load shall be equivalent to the maximum anticipated load, but shall not exceed 100% of the manufacturer's load rating capacity for the excavating equipment as configured. Written documentation of the performance of the operational test outlining test procedures and results shall be maintained at the on-site project office.

c. All rigging and rigging operations shall comply with the requirements of Section 15. Hooks, eyes, slings, chains or other rigging shall not be attached to or hung from the teeth of a bucket during the transporting or hoisting of a load by hydraulic excavating equipment.

d. After the completion and acceptance of an operational test described in 16.F, if repairs, major maintenance or reconfiguration are required to be performed on the hydraulic excavating equipment or attachments, another operational test as described in 16.F shall be performed to demonstrate that the completed repairs are satisfactory and that the test load and selected rigging can be safely lifted, maneuvered, controlled, stopped, and landed.

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16.S.04 Loads shall be lifted the minimum height necessary to clear the ground or other obstacles and carried as low as possible when the equipment is traveling.

16.S.05 Loads shall not be lifted over personnel.

16.S.06 Adequate clearances shall be maintained from electrical sources.

**FIGURE 16-3**

**HYDRAULIC EXCAVATING EQUIPMENT USED TO  
TRANSPORT OR HOIST LOADS**

**EXCAVATORS**



**EXCAVATORS – FRONT SHOVELS**



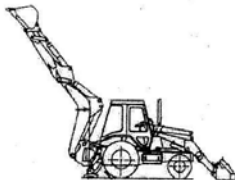
**WHEEL LOADERS**



**TRACK LOADERS**



**BACKHOE LOADERS**





## **16.T CRANE-SUPPORTED PERSONNEL (WORK) PLATFORMS**

16.T.01 Crane supported personnel platforms are prohibited, except when the erection, use, and dismantling of conventional means of reaching a work site, 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.

16.T.02 If a crane supported work platform is determined to be the only safe method of access, the operation shall be deemed a critical lift (per Section 16.H) and meet the following requirements:

- a. The person responsible for the lift shall perform an AHA and attest to the need for the operation in writing.
- b. The responsible person shall sign the AHA and submit it to the GDA for acceptance.
- c. Personnel shall not be hoisted until the GDA has accepted the AHA.
- d. Crane supported work platforms may be used for routine access of employees to underground construction via a shaft.

16.T.03. The work platform and suspension system shall be designed and certified by a Registered Professional Engineer with knowledge in this area.

- a. The work platform (excluding fall protection systems) shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load. Criteria for fall protection systems are contained in Sections 21 and 16.T.10.
- b. The suspension system shall be designed to minimize tipping of the platform due to movement of the employees on the work platform.

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c. The system used to connect the work platform to the equipment shall allow the platform to remain within 10 degrees of leel, regardless of boom angle.

d. All welding of the work platform and its components shall be performed by a Certified Welder familiar with the weld grades, types, and material specified in the platform design.

16.T.04 Crane supported work platforms shall meet the following requirements:

a. The scaffold shall be of metal or metal frame construction with a standard guardrail system and shall be enclosed at least from the toeboard to mid-rail with either solid construction material or expanded metal having openings no greater than ½ inch (1.2 cm).

b. A grab rail shall be installed inside the entire perimeter of the personnel platform.

c. Access gates, if installed, shall not swing outward and shall be equipped with a device to prevent accidental opening.

d. Headroom shall be provided which allows employees to stand upright in the platform.

e. In addition to the use of hardhats, employees shall be protected by overhead protection on the personnel platform when the employee(s) are exposed to falling objects.

f. The platform shall be conspicuously posted with a plate or other permanent marking that indicates the weight of the platform and its rated load capacity or maximum intended load.

16.T.05 Rigging.

a. When a wire rope bridle is used to connect the work platform to the load line, each bridle leg shall be connected to a master

link or shackle in such a manner to ensure that the load is evenly distributed among the bridle legs.

b. The hook connection to the platform rigging shall be of a type that can be closed and locked to eliminate the hook throat opening and shall be closed and locked when attached. Alternately, an alloy anchor type shackle with a bolt, nut, and retaining pin, in place OR of the screw type, with the screw pin secured from accidental removal may be used.

c. Wire rope and rigging hardware and hooks shall be capable of supporting, without failure, at least five times the maximum intended load.

d. Where rotation-resistant rope is used the slings shall be capable of supporting without failure at least ten times the maximum intended load.

e. Rope sling suspension systems with mechanically spliced flemish eyes, if used, shall be designed with thimbles in all eyes.

f. Bridles and associated rigging for attaching the platform to the hoist line shall be used only for the platform and the employees, their tools and the materials necessary to do the work and shall not be used for any other purpose when not hoisting personnel.

#### 16.T.06 Work Practices.

a. Before employees enter or exit a hoisted personnel platform that is not landed, the platform shall be secured to the structure, unless securing to the structure creates an unsafe condition.

b. The rated load capacity of the platform shall not be exceeded.

c. The number of employees occupying the work platform shall not exceed the number required for the work to be performed.

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d. Work platforms shall be used only for employees, their tools and the materials necessary to do their work. Work platforms shall not be used to hoist only materials or tools when not hoisting personnel.

e. Materials and tools for use during a personnel lift shall be secured to prevent displacement. They shall be evenly distributed within the confines of the platform while it is suspended.

f. No lifts shall be made on another of the crane's or derrick's loadlines while personnel are suspended on a platform.

g. Employees (except a designated signal personal) shall keep all parts of the body inside the platform during raising, lowering, and positioning.

h. A competent person shall observe the operations while personnel are working from the crane supported work platform.

i. Environmental conditions.

(1) Wind. When wind speed (sustained or gusts) exceeds 20 mph (9 m/s) at the work platform, a qualified person shall determine if, in light of the wind conditions, if it is safe to lift personnel. If not, the lifting operation shall be terminated.

(2) Other weather and environmental conditions. A qualified person shall determine if, in light of indications of dangerous weather conditions, or other impending or existing danger, it is safe to lift personnel. If not, the lifting operation shall be terminated.

j. Employees being hoisted shall remain in the continuous sight of, and in direct communication with, the crane operator or signal person. In situations where direct visual contact with the operator is not possible and the use of a signal person would create a greater hazard for that person, direct communication by

radio shall be maintained at all times. The crane operator shall bring all operations to an immediate stop if radio communications are lost.

k. Taglines shall be used to help control the work platform unless the competent person determines that their use creates an unsafe condition.

l. The crane or derrick operator shall remain at the controls at all times with the engine crane running whenever the platform is occupied.

m. Hoisting personnel within 20 ft (6 m) of a power line that is up to 350 kV and hoisting personnel within 50 ft (15.2 m) of a power line that is over 350 kV is prohibited, except for Power Transmission and Distribution Work.

#### 16.T.07 Operational Criteria

a. Hoisting of the personnel platform shall be in a slow, controlled, cautious manner with no sudden movements.

b. Load lines shall be capable of supporting, without failure, at least 7 times the maximum intended load, except where rotation resistant rope is used the lines shall be capable of supporting, without failure, at least 10 times the maximum intended load. The required design factor is achieved by taking the current safety factor of 3.5 and applying the 50% de-rating of the crane capacity.

c. The crane shall be uniformly level within 1% of level grade and located on firm footing. Cranes equipped with outriggers shall have them all fully deployed to load chart criteria following manufacturer's specifications, as applicable, when hoisting personnel.

d. The total weight of the loaded personnel platform and related rigging shall not exceed 50% of the rated capacity for the radius and configuration of the crane or derrick.

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e. Only cranes with power-operated up and down boom hoists and load lines shall be used to support work platforms. The use of machines having live booms is prohibited. Platforms shall be lowered under power and not by the brake.

f. Only cranes with an A2B device that prevents contact between the load block or overhaul ball and the boom tip, or a system that deactivates the hoisting action before damage occurs shall be used.

g. Cranes with variable angle booms shall be equipped with a boom angle indicator readily visible to the operator.

h. Cranes with telescoping booms shall 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 shall be made prior to hoisting personnel.

i. The load line hoist drum shall have a system or device on the power train, other than the load hoist brake, that regulates the lowering rate of speed of the hoist mechanism (controlled lowering). Free fall is prohibited.

#### 16.T.08 Trial Meeting, Lift and Inspection.

a. Prior to every trial lift, the crane or derrick operator, signal person, employees to be lifted, and the competent person shall attend a pre-lift meeting to review the applicable parts of this manual, the AHA, and the details of this particular lift.

b. A trial lift with the unoccupied work platform loaded at least to the anticipated lift weight shall be made from the ground level, or any other location where employees will enter the platform, to each location at which the work platform is to be hoisted and positioned.

c. The trial lift shall be made immediately prior to placing personnel on the platform and shall be repeated prior to hoisting employees after the crane is moved and set up at new location or returned to a previously used location, and when the lift route is changed unless the competent person determines that the route change is not significant.

d. The operator shall determine that all systems, controls, and safety devices are activated and functioning properly; that no interferences exist; and that all configurations necessary to reach those work locations will allow the operator to remain under the 50% limit of the crane's rated capacity.

e. Materials and tools to be used during the actual lift may be loaded in the platform (evenly distributed and secured) for the trial lift.

f. After the trial lift and just prior to hoisting employees, the platform shall be hoisted a few inches and inspected to ensure that it is secure and properly balanced.

g. A visual inspection of the crane, derrick, rigging, work platform, and the crane or derrick support base shall be conducted by a competent 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.

h. Any defects found during inspection which create a safety hazard shall be corrected before hoisting personnel.

i. If the load rope goes slack, the hoisting system shall be re-inspected to ensure that all ropes are properly seated on drums and sheaves.

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#### 16.T.09 Proof Testing

a. At each job site, prior to hoisting employees on the work platform, and after any report or modification, the platform and rigging shall be proof tested to 125% of the platform's rated capacity by holding it in a suspended position for 5 minutes with the proof test load evenly distributed on the platform (this may be done concurrently with the trial lift).

b. After proof testing, a competent person shall inspect the platform and rigging. Personnel hoisting shall not be conducted until the proof testing requirements are satisfied.

#### 16.T.10 Personnel Fall Protection.

a. For work over water, see section 21.N for fall protection and PFD requirements. Lifesaving equipment and safety skiffs meeting the requirements of this manual shall be available.

b. When NOT working over water, all employees occupying the work platform shall use a properly anchored personal fall protection (arrest or restraint) system. The system shall be attached to a structural member within the platform.

(1) The attachment points to which personal fall arrest or restraint systems are attached on the platform must meet the anchorage requirements in Section 21.

(2) Depending on the type of work to be done and the height of the work platform above a lower surface, all workers shall wear a full-body harness as part of a fall arrest or fall restraint system. The competent person for fall protection on-site will assess each situation and determine which system would best fit the current work requirement and be in accordance with the crane manufacturer's instructions and recommendations. Particular attention should be paid to anchor points and capacities.



(3) Workers working from the platform suspended from a crane are permitted to be tied off to the lower load block or overhaul ball. An AHA shall be developed to details on how work will be safely performed. AHA must be submitted to the GDA for acceptance.

16.T.11 Employees shall not be hoisted unless the following conditions are determined to exist:

- a. The load test and proof test requirements are satisfied;
- b. Hoist ropes are free of kinks;
- c. Multiple part lines are not twisted around one another,
- d. The primary attachment is centered over the platform, and
- e. The hoisting system is inspected if the load rope is slack to ensure all ropes are properly seated on drums and in sheaves.

16.T.12 Traveling.

a. Hoisting of personnel while the crane is traveling is prohibited, except for:

(1) Portal, tower, and locomotive cranes; or

(2) Where it is demonstrated and documented that there is no less hazardous way to perform the work.

b. If the requirements above (16.T.12.a) are satisfied, the following safeguards shall be implemented while cranes travel with hoisted personnel:

(1) Crane travel shall be restricted to a fixed track or runway;

(2) Travel shall be limited to the load radius of the boom used during the lift;

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(3) The boom must be parallel to the direction of travel;

(4) A completed trial run shall be performed to test the route of travel before employees are allowed to occupy the platform (this trial run may be performed when the trial lift required by this manual is performed).