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## **13.0 OVERHEAD AND GANTRY CRANES**

### **13.1 SCOPE**

This section applies to overhead and gantry cranes, including semigantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics. These cranes may be top-running, under-running, single- or double-girder (see Attachment 13.1, "Crane Types"). Hoist units and trolleys are most commonly electric powered, but can be air powered or hand chain operated. These cranes may be cab operated, pulpit operated, floor operated, or remotely operated. Such cranes are grouped together because all have trolleys and similar travel characteristics and are governed by Occupational Safety and Health Administration (OSHA) regulation, 29 CFR 1910.179.

### **13.2 OPERATOR QUALIFICATIONS**

#### **13.2.1 Operators of Overhead and Gantry Cranes**

1. Cranes shall be operated only by the following qualified personnel:
  - a. Qualified operators (see Section 4.2, "General")
  - b. Trainees under the direct supervision of a designated person
  - c. Maintenance, inspection, and test personnel, when it is necessary in the performance of their duties.
2. No one other than personnel specified above shall enter a crane cab or pulpit, with the exception of persons such as oilers and supervisors, whose duties require them to do so, and then only with the knowledge of the crane operator.

### **13.3 CONDUCT OF OPERATORS**

1. While actually engaged in operating the crane, the operator shall not engage in any practice that will divert his attention.
2. When physically or otherwise unfit, an operator shall not engage in the operation of equipment.
3. The operator shall respond to signals from the person who is directing the lift or from an appointed signal person. When a signal person or crane follower is not required as part of the crane operation, the operator then is responsible for the lifts. However, the operator shall obey a stop signal at all times, no matter who gives it.
4. Each operator shall be responsible for those operations under the operator's direct control. Whenever there is doubt as to safety, the operator shall consult with responsible management before handling the loads.
5. If a warning device is furnished, it shall be activated each time before traveling and intermittently when approaching work persons.

6. Before leaving a crane unattended, the operator shall place controllers in the “off” position and ensure that the main line disconnect device of the crane is open.
7. The operator shall not close the main line disconnect device until certain that no worker is on or adjacent to the crane. If there is a tag, sign, or lock on the device, it shall not be energized until the tag, sign, or lock is removed by the person who placed it there or by an authorized person. Facility-specific lock and tag procedures shall be strictly followed.
8. Before closing the main line disconnect device, the operator shall see to it that all controls are in the “off” position.
9. If power goes off during operation, the operator shall immediately place all controls in the “off” position. Before reusing the crane, operating motions shall be checked for proper direction.
10. The operator shall be familiar with the equipment and its proper care. If adjustments or repairs are necessary, or any defects are known, the operator shall report the same promptly to an appointed person responsible for the operation and maintenance repairs of the crane. The operator shall also notify the next operator of any remaining uncorrected defects at shift change.
11. 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 ensuring that any persons on the other cranes are aware of what is being done.
12. Operators of outdoor cranes shall secure them when leaving.
13. When the wind-indicating alarm is given, the bridge or gantry on an outside crane shall be anchored.
14. Before the operator performs any maintenance work on the crane, the operator shall ensure the main switch is locked and tagged in the deenergized position. **Facility-specific lock and tag procedures shall be strictly followed.**

**NOTE:** It is recognized that selected maintenance work must be performed with the power on; however, such maintenance work should be performed by maintenance personnel, not by the operator.

15. Controls shall be tested by the operator before beginning a new shift\*. If any controls do not operate properly, they should be adjusted or repaired before operations are begun.  
  
**\*NOTE:** If a lift is in progress during a shift change, this testing requirement is considered to have been satisfied for the completion of that lift. However, test the upper limit switch before the next lift.
16. Persons boarding or leaving overhead cranes should do so only at authorized boarding entrances.
17. Operators shall be familiar with the operation and care of fire extinguishers provided.

### 13.4 LOAD WEIGHT

1. No crane shall be loaded beyond its rated load except for test purposes as provided in paragraph 13.9.3.4, "Rated Load Test" and for special overrated load lifts as provided in paragraph 13.4, item 2.
2. Provisions for special overrated load lifts (also called engineered lifts) are outlined in ASME B30 standards. However, no such lift shall be made without the authorization of the U.S. Department of Energy, Hoisting & Rigging Program Manager.

### 13.5 ATTACHING THE LOAD

1. The hoist rope shall be free from kinks or twists and shall not be wrapped around the load.
2. The load shall be attached to the load block hook by means of slings or other approved devices.
3. Care shall be taken to ensure that the sling clears all obstacles.

### 13.6 MOVING THE LOAD

1. The appointed person directing the lift shall ensure the following:
  - a. The load, sling, or lifting device is seated in the bowl of the hook.<sup>1</sup>
  - b. The load is well secured and balanced in the sling or lifting device before it is lifted more than a few inches.
  - c. The hoist rope is not kinked.
  - d. Multiple-part lines are not twisted around each other.
  - e. The hook is brought over the load in such a manner as to minimize swinging.
  - f. The rope is seated in the drum grooves and in the sheaves.

**CAUTION:** If there are or have been slack rope conditions, the rope may not be properly seated in drum grooves.

2. During lifting, the following will be carefully avoided:
  - a. A sudden acceleration or deceleration of the moving load

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<sup>1</sup> Duplex (sister) hooks shall be loaded equally on both sides unless the hook is specifically designed for single loading. If the duplex (sister) hook is loaded at that pin hole instead of at the two saddles, the load applied shall not exceed the rated load that would normally be shared by the two saddles or the rated load of the supporting equipment. When using an articulated duplex (sister) hook, care should be taken because articulation of the hook may cause instability in the slung load.

- b. Contact with any obstruction.
3. Cranes shall not be used for side pulls except when specifically authorized by a qualified person who has determined the following:
  - a. The various parts of the crane will not be overstressed.
  - b. The hoist rope shall not bear or rub against other members of the crane, such as girders or trolley frame, except when members are specifically designed for such contact.
  - c. Such side pulls will not cause the hoist rope to be pulled out of the sheaves or across drum grooves.
  - d. Such side pulls will not result in excessive swinging of the load block or load.
4. The operator shall not cause the crane to lift, lower, or travel while anyone is on the load or hook.
5. The operator shall avoid carrying loads over people.

**Caution:** Working on or under a suspended load is prohibited, except when the load can be supported by blocking or cribbing, can be securely braced, or can be supported substantially by some other means that would prevent the load from moving. Loads being lifted and set in place may require special handling control measures that may require personnel to position their hands or other body parts under the load when inspecting, landing, setting, or controlling the load. To ensure that appropriate controls are implemented to control unwanted movement of the load, issues concerning “hands-on” work under suspended loads, guiding or controlling suspended loads, and fine load control shall be discussed and resolved during prelift planning.

6. The operator of a crane having a lifting magnet should beware the hazard of possible falling metal.
7. The load shall not be lowered below the point where two wraps of rope remain on each anchorage of the hoisting drum.
8. When two or more cranes are used to lift a load, one qualified person shall be in charge of the operation. This person shall analyze the operation and instruct other personnel involved in the proper positioning and rigging of the load and movements to be made.
9. The operator shall not leave the controls while the load is suspended over an area accessible to people. The operator shall not leave a suspended load unattended unless situation-specific precautions have been instituted and are in place (e.g., the load is lowered as low as the operation permits; the area is barricaded and signs are posted to prevent unauthorized personnel access).

## 13.7 GENERAL CONSTRUCTION AND INSTALLATION

### 13.7.1 Rated Load Marking

1. The rated load of the crane shall be marked on each side of the crane.

2. If the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block.
3. Load blocks should be painted to contrast with the bridge and trolley to facilitate quick visual identification.
4. Marking on the bridge, trolley, and load block shall be legible from the ground or floor.

### 13.7.2 Hand Signal Posting

Figures demonstrating standard hand signals for controlling crane operations shall be posted conspicuously at the job site (see Attachment 13.2, "Hand Signals").

### 13.7.3 Crane Egress

A means of egress from cab-operated cranes shall be provided to permit departure under emergency conditions. The best means of emergency egress should be evaluated for each specific installation.

### 13.7.4 Crane Toolbox

If tools, lubricants, or maintenance materials are stowed on the crane, a metal box securely fastened to the crane or walkway shall be used.

### 13.7.5 Cab-Operated Crane Fire Extinguisher

As a minimum, a 10BC portable fire extinguisher shall be installed in the cab and maintained in a serviceable condition.

### 13.7.6 Crane Footwalks and Ladders

**13.7.6.1 Walking Surface** Footwalks shall have a well-maintained, slip-resistant walking surface. Wooden footwalks may meet this requirement; however, use caution to ensure that the wood has an adequate level of slip-resistance. Wood may be prohibited because of considerations unique to the crane's location, such as fire hazard.

**13.7.6.2 Toeboards and Handrails** Footwalks shall have toeboards and handrails. Toeboards and handrails shall meet the requirements of ANSI A12.1, "Safety Code for Floor and Wall Openings, Railings, and Toeboards."

**13.7.6.3 Ladders** Ladders shall be permanently and securely fastened in place and shall be constructed in compliance with 29 CFR 1910.27. Hands shall be free from encumbrances while using ladders.

### 13.7.7 Rails

Rails shall be level, straight, joined, and spaced to the crane span compatible with the design of the crane. When curves or grades are required, special design is necessary. Tolerances shall be in accordance with the crane specification. In lieu of crane specification tolerances, Crane Manufacturers Association of America (CMAA) Specification 70, Table 1.4.2-1, or CMAA Specification 74, Table 1.4.1-1, may be used as a guideline.

### 13.7.8 Crane Stops, Bumpers, Rail Sweeps, and Guards

#### 13.7.8.1 Bumpers/Stops –Top-Running Bridge and Gantry Cranes.

1. **Trolley Stops.** The trolley shall be provided with stops at the limits of travel. A stop engaging the tread of the wheel shall be of a height at least equal to the radius of the wheel.
2. **Bridge Bumpers.** The bridge shall be provided with bumpers or other automatic means providing equivalent effect unless the crane has a fast deceleration rate caused by the use of sleeve bearings; the crane is not operated near the ends of bridge travel; or the crane is restricted to a limited distance and there is no hazard of striking any object in this limited distance.
3. **Trolley Bumpers.** Trolley bumpers or other automatic means of equivalent effect shall be provided, unless the trolley is not operated near the ends of trolley travel, or is restricted to a limited distance of the bridge girder and there is no hazard of striking any object in this limited distance, or is used in similar operating conditions.

**13.7.8.2 Bridges and Trolleys on Common Runways.** When more than one bridge or trolley is mounted on the same runway, bumpers shall be provided between adjacent bridge ends or trolleys.

**13.7.8.3 Rail Sweeps for Top-Running Bridge Cranes and Gantry Cranes.** Bridge trucks shall have rail sweeps that extend below the rail top and are adjacent to and outboard of the leading wheels with respect to any direction of travel.

**13.7.8.4 Guards for Moving Parts.** Exposed moving parts, such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components, that constitute a hazard under normal operating conditions, shall be fitted with guards.

### 13.7.9 Wheel and Truck Frames

**13.7.9.1 Overhead and Gantry Cranes, Top-Running Hoist.** For overhead and gantry cranes, top-running bridge, single or multiple girder, with a top-running trolley hoist (ASME B30.2), means should be provided to limit the drop of trolley and bridge truck frames to 1 inch (2.54 centimeters) in case of wheel or axle breakage.

**13.7.9.2 Underhung Cranes.** For underhung cranes (ASME B30.11), lugs or other means shall be provided to limit the drop of a bridge-end truck frame to 1 inch (2.54 centimeters) in case of wheel, axle, or load bar failure and shall be located on both sides of the track to provide central loading of the track about the vertical axis if failure occurs.

**13.7.9.3 Overhead and Gantry Cranes, Underhung Hoist.** For overhead and gantry cranes, with top-running bridge, single girder, underhung hoist (ASME B30.17), means shall be provided to limit the drop of bridge truck frames to 1 inch (2.54 centimeters) in case of wheel or axle breakage.

### 13.7.10 Brakes

**13.7.10.1 Holding Brake, Power Hoisting Unit.** Each independently powered hoisting unit shall be equipped with at least one holding brake applied directly to the motor shaft or some part of the drive train. The holding brake shall be applied automatically when power to the brake or crane is removed. The wearing surface of all holding-brake drums or discs shall be smooth.



**13.7.10.2 Load Brake, Hand Hoist.** A hand-operated hoist shall be so designed that when the actuating force is removed, it will automatically stop and hold a test load up to 125 percent of the rated load.

**13.7.10.3 Control Brake, Power Hoisting Unit.** Each independently powered hoisting unit greater than 1 ton (except worm-gear hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction) shall, in addition to a holding brake, be equipped with a control braking means to control lowering speeds.

#### **13.7.10.4 Brakes for Trolleys and Bridges.**

1. Brakes shall be provided with a means for adjustment to compensate for wear. The wearing surface of all brake drums or discs shall be smooth.
2. Any combination of service, emergency, and parking functions may be provided by a single friction brake if it can be applied without having power available.
3. If holding brakes are provided on the bridge or trolleys, they shall not prohibit the use of a drift point in the control circuit.
4. Foot brake pedals shall be clean and properly maintained so that the operator's foot will not easily slip off the pedal.

#### **13.7.11 Electrical Equipment**

**13.7.11.1 National Electrical Code Compliance.** Wiring and equipment shall comply with the National Electrical Code, NFPA 70, Article 610, "Cranes and Hoists."

#### **13.7.11.2 Controllers.**

1. **Control Motor Disconnect Device.** Lever-operated controllers shall be provided with a notch or latch that in the "off" position prevents the handle from being inadvertently moved to the "on" position. An "off" detent or spring return arrangement is acceptable. For floor-operated cranes, the control or controls, if rope operated, shall automatically return to the "off" position when released by the operator. Cranes not equipped with spring-return controllers, spring-return master switches, or momentary-contact pushbuttons shall be provided with a device that will disconnect all motors from the line in the event of a power failure. This disconnect device shall not permit any motor to be restarted until the control or master switch handle is brought to the "off" position, or a reset switch or power-on button is operated.
2. **Resultant Motion.** As far as practicable, the movement of each control handle shall be in the same general direction as the resultant movements of the load.
3. **Remotely Operated Cranes.** Remotely operated cranes shall function so that if the control signal for any motion becomes ineffective, that motion shall stop. In addition, signals received from any source other than the operating station (transmitter) shall not result in operation of any motion.

4. **Control Circuit Voltage-** The control circuit voltage shall not exceed 600 volts alternating current (AC) or direct current (DC). The voltage at pendant push buttons shall not exceed 150 volts AC and 300 volts DC.

#### 13.7.11.3 Pendant Control Station Requirements.

1. **Push-Button Station.** A pendant push-button station shall be supported so that the electrical conductors are protected from strain.
2. **Pendant Construction.** Makeshift field-fabricated pendants shall not be used. Pendant control boxes shall be constructed to prevent electrical shock.
3. **Spring-Return and Marked Push Buttons.** Push buttons (except on/off buttons) shall spring-return to the "off" position when the operator releases pressure. Buttons shall be clearly marked to identify their function. To minimize operator fatigue, return-spring force shall be the minimum necessary for positive return.
4. **Resultant Motion.** To the extent possible, each crane control shall be marked to indicate the direction of resultant motion.

#### 13.7.11.4 Runway Conductors and Switches.

1. **Power Supply, Runway Conductors.** The power supply to the runway conductors shall be controlled by a switch or circuit breaker located on a fixed structure. The switch shall be easily accessible and visible from the floor and arranged so that it can be locked in the open position.
2. **Operator-Controlled Switch, Runway Conductors.** On cab-operated cranes, a switch or enclosed-type circuit breaker with a provision for locking in the open position shall be provided in the leads from the runway conductors. A means of opening this device shall be located within the reach of the operator. When the operator opens this switch or circuit breaker, the holding brake(s) shall set.
3. **Pendant-, Remote-, or Pulpit-Operated Cranes.** Unless the crane is the only load on a lockable switch or circuit breaker accessible from the floor, a lockable switch, or enclosed-type circuit breaker in the leads from the runway conductors shall be mounted on the bridge or footwalk near the runway collectors. In either the floor or bridge/footwalk mount, a means to open the switch with a magnetic contactor controlled from the operator's station shall be provided. This provides for emergency shutdown of all power to the crane.
4. **Runway Conductor Guards.** Open-type runway conductors mounted on the crane runway beams or overhead shall be positioned or fitted with guards so that persons cannot inadvertently come into contact with them. Securely fastened guards shall be provided to prevent contact between bridge conductors and hoist ropes if hoist ropes could come into contact with conductors.
5. **Lifting Magnets.** A crane using a lifting magnet shall have a magnet circuit switch (enclosed type) with provision for locking in the open position. Means for discharging the inductive load of the magnet shall be provided.
6. **Service Receptacle.** If a service receptacle is provided in the cab or on the bridge, it shall be a grounded three-prong permanent receptacle not exceeding 300 volts.

### 13.7.12 Hoisting Equipment

#### 13.7.12.1 Sheaves.

1. **Sheave Guards.** Sheaves carrying ropes that can be momentarily unloaded, shall be provided with close-fitting guards, or other devices, to guide the rope back into the groove when the load is reapplied.
2. **Sheave Guards On Load Block.** Sheaves in the load block shall be equipped with close-fitting guards that will minimize the possibility of ropes becoming fouled when the load block is lying down with the ropes loose.
3. **Sheave Grooves.** Sheave grooves shall be smooth and free from surface defects that could cause rope damage.
4. **Running Sheaves.** Running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed, and/or shielded bearings meet this requirement.

#### 13.7.12.2 Hoist Overtravel Protection.

1. **Underhung, Hand-Chain Operated Hoists.** Before the load chain can be completely run out of the hoist, it shall be restrained in its fully extended position. The restraint shall be such that the unloaded hoist can withstand a lowering hand-chain force equivalent to twice the pull required to lift the rated load, or with the rated load on the hoist, a hand-chain force equivalent to the pull required to lift the rated load.
2. **Underhung, Electric- Or Air-Powered Hoists.** The hoist shall be so designed and constructed that the load hook, either loaded or empty, shall not exceed the upper limit of travel.<sup>2</sup>
3. **Top-Running Trolley, Electric- Or Air-Powered Hoist.** An overtravel limit switch in the hoisting direction shall be provided to stop hoisting motion. The actuating mechanism of the upper limit device shall trip the device under all conditions in sufficient time to prevent contact of the load block with any part of the crane. Cranes meeting current design standards that handle critical loads will have two separate overhoist limit switch systems. The first upper hoist limit shall be a control circuit device such as a gear-type, weight-operated, or paddle-operated switch. Actuation of this switch shall result in the removal of power from the motor and setting the hoist brakes. The operator may lower or back out of this tripped switch without further assistance. The second (final) hoisting limit switch shall interrupt all power to the hoist motor and the hoist brakes directly without relying on the sequencing of any devices. Actuation of this limit switch shall prevent further hoisting or lowering pending action by a person knowledgeable in the hoist control system.
4. **Load Block Travel Versus Rope Length.** Cranes with electric- or air-powered rope hoists shall not be installed where, during normal operating conditions, the hook can be lowered to a point that leaves less than two wraps of rope on the drum.

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<sup>2</sup> In lieu of a limit switch, a mechanism such as a slip clutch may be used for underhung hoists.

5. **Lower Travel Limit Switches.** Lower travel limit switches should be provided for hoists where the load block enters pits or hatchways in the floor. (Keep two wraps on the drum at the lower limit.)

**13.7.12.3 Load Chain Bucket.** If a slack load chain presents a potential hazard to either personnel or equipment below the hoist, a device shall be installed to contain the slack load chain as it emerges from the hoist.

**13.7.12.4 Hook Mousing and Throat Latches.** Latch-equipped hooks shall be used for all hoisting and rigging (H&R) operations unless the application makes latch use impractical, unnecessary, or unsafe. The absence of a hook throat latch is not indiscriminately allowed (see paragraph 5.3, "Throatlatches").

### 13.7.13 Warning Devices

**13.7.13.1.1 Travel Warning Devices.** Except for floor-operated cranes, a gong, bell, horn, flashing light or other effective warning device shall be provided for each crane with a power traveling mechanism. A warning device is recommended for floor-operated cranes with a power traveling mechanism.

**13.7.13.1.2 Runway Conductors Warning Devices.** A warning light visible from the operating floor, crane bridge, and runways should be provided. The warning light, if provided, shall be activated at all times when the runway conductors are energized.

**13.7.13.1.3 High-Wind Speed Warning Devices.** For outdoor, overhead, and gantry crane operations with a top-running trolley, a wind-indicating device shall be provided. The device shall give a visible and audible alarm to the crane operator at a predetermined wind velocity.

### 13.7.14 Clearance From Obstructions

**13.7.14.1 Overhead Clearance.** A 3-inch- (7 centimeter-) minimum vertical clearance shall be provided and maintained between crane and obstructions.

**13.7.14.2 Lateral Clearance.** A 2-inch-(5 centimeter-) minimum lateral clearance shall be provided and maintained between crane and obstructions.

**13.7.14.3 Cab Clearance.** The cab shall have a 3-inch- (7 centimeter-) minimum clearance from obstructions within its possible movement.

## 13.8 MODIFICATIONS

Cranes may be modified or re-rated provided such modifications and the supporting structure are analyzed thoroughly by a qualified person or crane manufacturer. A re-rated crane or one whose load-supporting components have been modified shall be subjected to a rated load test (see paragraph 13.9.3.4, "Rated Load Test"). The new rated load shall be displayed in accordance with paragraph 13.7.1, "Rated Load Marking." Documentation supporting crane re-rating shall be contained in, or retrievable by reference from, the crane maintenance file.

## 13.9 INSPECTION, MAINTENANCE, AND TESTING

### 13.9.1 Inspection

Inspection requirements shall be derived from information provided by the crane manufacturer. Unless there is justification to do otherwise, the manufacturer's recommendations shall be followed. Inspection procedures should state the acceptance criteria for inspections and tests and shall be specific for the applicable make and model of crane.

**13.9.1.1 Initial Inspection.** Before initial use, new, reinstalled, altered, modified, or extensively repaired cranes shall be inspected in accordance with a written procedure. This inspection shall include the following functions: (1) hoisting and lowering, (2) trolley travel, (3) bridge travel, and (4) limit switches and locking and safety devices.

**13.9.1.2 Pre-use and Daily Inspection.** The crane custodian shall be notified and deficiencies shall be carefully examined and a determination made as to whether they constitute a hazard.

**13.9.1.2.1 Pre-use Inspection.** On each shift, before operating the crane, the operator shall perform the following operations:

1. **Test All Controls.** If any controls do not operate properly, they should be adjusted or repaired before operations are begun.
2. **Verify Operation of the Primary Upper-Limit Device.** The trip-setting of primary upper-limit switches shall be checked under no-load conditions by inching the block into the limit (running at slow speed).
3. **Visually Inspect Ropes and Load Chains.** These visual observations should be concerned with discovering gross damage that may be a hazard.
4. Ensure inspections (wire rope, chains, and crane) are current via inspection sticker, other documentation, or verbal confirmation from equipment custodian.

**13.9.1.2.2 Daily Inspection.** Each day of use the operator shall carefully scan the crane for deficiencies that may occur between regular inspections:

1. Check that motions are smooth and regular with no hesitations, vibration, binding, weaving, unusual noise, or other irregularity.
2. Check for deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems.

### 13.9.1.3 Frequent Inspection.

1. Cranes In Regular Service, Inspection Interval--Cranes that are in use shall have visual

2. inspection by the operator or other designated personnel with records not required<sup>3</sup> as follows:
  - a. Normal service—monthly
  - b. Heavy service—weekly to monthly
  - c. Severe service—daily to weekly.

**NOTE:** For service definitions see Appendix A, “Definitions and Acronyms,” **crane service**.

3. **Cranes Not In Regular Service.** A crane that is used in infrequent service that has been idle for 1 month or more, but less than 6 months, shall receive a frequent inspection before being placed in service.
4. **Instructions.** The equipment custodian shall ensure that frequent inspection instructions are readily available.<sup>4</sup> The frequent inspection instructions or an attachment thereto, shall state how deficiencies shall be reported.
5. **Frequent Inspection Steps.** The operator or other designated personnel shall perform the following.<sup>5</sup>
  - a. Check that motions are smooth and regular for all speed steps, with no hesitations, vibration, binding, weaving, unusual noise, or other irregularity.
  - b. Ensure that hooks and hook throat latches, if installed, show no noticeable damage, wear, or deformation.
  - c. Ensure that brakes operate smoothly.
  - d. Visually ensure that hoisting ropes<sup>6</sup> and/or chains are in good condition. The hoist chain shall feed smoothly into and away from sprockets. Inspect the chain for excessive wear, twist, distorted links interfering with proper function, or stretch. Inspect hoist ropes for proper spooling onto the drums and sheaves.
  - e. Ensure that there is no visible leakage of lubricant.
  - f. Check the trip-setting of primary upper-limit switches under no-load conditions by inching the block into the limit (running at slow speed).

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<sup>3</sup> Frequent inspection records are not required, but a checklist, located on or near the crane, is recommended to demonstrate that the inspection has been performed.

<sup>4</sup> Inspection instructions provided by the manufacturer may be sufficient. For complex equipment or equipment in a hostile environment, a frequent inspection procedure prepared onsite may be needed.

<sup>5</sup> For reference, sample inspection checklists are included in Attachment 13.3, “Sample Inspection Checklist.”

<sup>6</sup> See Section 8.0 for rope-inspection details.

- g. If the crane is equipped with a lower-limit switch, check the lower-limit switch by slowly moving the block into the switch (no load on hook). The drum should be observed during this operation to ensure that at least two full wraps of wire rope remain on the drum at the lower limit.
- h. For a cab-operated crane, check for a charged 10BC (or larger) fire extinguisher and ensure that the extinguisher inspection tag is current.
- i. Complete any other inspections that are specific for the crane.

#### 13.9.1.4 Periodic Inspection.

1. **Cranes In Regular Service, Inspection Interval**--Cranes that are in use shall be visually inspected by a qualified inspector who will document apparent external conditions. These documents will provide the basis for a continuing evaluation, as follows:
  - a. Normal service—yearly
  - b. Heavy service—yearly
  - c. Severe service—quarterly.

**NOTE:** For service definitions see Appendix A, “Definitions and Acronyms,” **crane service**.

2. **Cranes Not In Regular Service.** A crane that is used infrequently and has been idle for a period of 6 months or more shall receive a periodic inspection before being placed in service.
3. **Qualified Inspector.** A qualified inspector shall perform periodic inspections. (See Section 4.0, “Personnel Qualifications and Training Requirements.”)
4. **Requirements of Periodic Inspection Procedure.** A periodic inspection procedure shall provide specific inspection requirements and methods. Inspection acceptance criteria shall be provided with the inspection procedure or by reference to another document that is available to the inspector. The procedure shall be based on the requirements and recommendations of the manufacturer (or qualified engineer in the absence of manufacturer recommendations), and the activity, operating environment, severity of service, and equipment history. A periodic inspection checklist follows:
  - a. Include pre-inspection safety requirements (e.g., lock and tag requirements) and ensure that the crane is in the proper location for inspection.
  - b. Include inspections recommended by the manufacturer or a qualified engineer.
  - c. Require a check of all limit devices, including hoist limit switches and bridge and trolley travel limit switches.
  - d. Require a check of functional operating mechanisms.
  - e. Require a check of control systems, if applicable, to include electrical apparatus for signs of pitting or any deterioration of visible controller contacts.
  - f. Require a check for leakage in lines, tanks, valves, pumps, and other parts of air or hydraulic systems.

- g. Require a visual inspection of hooks for cracks, increased throat opening, twists, damage to hook retaining nuts, collars, or pins, and welds or rivets used to secure the retaining members. (See Section 5.0, "Hooks.")
- h. Require inspection for deformed, cracked, or corroded members.
- i. Require an inspection for loose bolts or rivets.
- j. Require an inspection for cracked or worn sheaves, drums, and load or idler sprockets.
- k. Require an inspection of running ropes and/or load chain, including end connections.
- l. Require an inspection for worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.
- m. Require a check of brake systems parts, lining, pawls, and ratchets.
- n. Require a check of rail alignment and rail condition.
- o. Require a check of load, wind, and other indicators over their full range, for any significant inaccuracies.
- p. Require a check of gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements.
- q. Provide a document on which to record measurements, tests, or examinations.
- r. State the acceptance criteria for measurements, tests, and examinations.
- s. Provide specific "how-to"-type instructions for any inspection activity that is not "common sense" to qualified inspection personnel.

**NOTE:** See paragraph 13.9.1.6, "Wire Rope Inspection," regarding wire rope periodic inspection requirements. See paragraphs 13.9.1.7, "Monthly Chain Inspection," and 13.9.1.8, "Load Chain Inspection," regarding load chain periodic inspection.

**13.9.1.5 Predictive Maintenance.** The responsible engineering or maintenance organization should use predictive maintenance examinations or tests as necessary to diagnose problems and predict maintenance requirements (e.g., chemical/microscopic tests of used lubricants and vibration analysis of rotating equipment).

#### **13.9.1.6 Wire Rope Inspection.**

1. **Monthly Wire Rope Certification.** For in-service cranes (overhead traveling cranes and gantry cranes), a monthly documented rope inspection is required. Cranes not in regular use that have been idle for 1 month or more, but less than 6 months shall have an inspection in accordance with paragraph 8.3.2, "Monthly Inspection" before returning to service. Cranes that have been out of service for more than 6 months shall have a periodic wire rope inspection before returning to service. Monthly inspection shall be performed in accordance with paragraph 8.3.2, "Monthly Inspection."
2. **Periodic Wire Rope Inspection.** Periodic wire rope inspection is required. Periodic inspection, more thorough than the monthly rope inspection, should be performed in



conjunction with and on the same schedule with the crane periodic inspection as required by paragraph 13.9.1.4, "Periodic Inspection." See paragraph 8.3.3, "Periodic Wire Rope Inspection (Active Cranes and Hoists)," for rope inspection details.

#### **13.9.1.7 Monthly Chain Inspection (Welded Link and Roller Type).**

1. **Monthly Chain Inspection.** For overhead and gantry cranes that are in service, load chains shall be inspected monthly. Cranes not in regular use that have been idle for 1 month or more, but less than 6 months, shall have a chain inspection, equal to a monthly chain inspection, before returning to service. This inspection shall include end connections and the hoist chain to check for excessive worn, twisted, or distorted links interfering with proper function, or stretching beyond manufacturer's recommendations. This inspection shall be documented with a certification record that includes the date of inspection, the signature of the person who performed the inspection, and an identifier of the chain that was inspected. A checklist near the operator's station is recommended. Cranes (with load chain) that have been out of service for more than 6 months shall have a periodic load chain inspection before returning to service.

#### **13.9.1.8 Load Chain Inspection (Welded Link and Roller Type).**

##### **13.9.1.8.1 Periodic Load Chain Inspection, Welded Link.**

1. **Periodic Load Chain Inspection.** Periodic load chain inspection should be performed in conjunction with the overall crane periodic inspection (see paragraph 13.9.1.4, "Periodic Inspection"). Periodic load chain inspection, more thorough than the monthly inspection, shall include a careful link-by-link inspection of load chain as follows.
  - a. Check for link wear to less than 90 percent of the original bar diameter.
  - b. Check for nicking, cracking, or corrosion of a link that, when ground out to a smooth surface, leaves less than 90 percent of the original bar diameter.
  - c. Check for stiffening or poor hinging of linkage.
  - d. Check for distortion by bending or kinking of 15 percent of any overall link dimension.
  - e. Check for evidence of heat damage.
  - f. Check for elongation in excess of the manufacturer's recommended allowable.
  - g. Check for worn, nicked, or corroded fittings.

**NOTE:** See paragraph 13.9.2.6, "Hoist Rope and Load Chain Replacement," item 2, regarding welded link-type load chain replacement.

##### **13.9.1.8.2 Periodic Load Chain Inspection, Roller Type.**

1. Test the hoist under load in lifting and lowering directions and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.

2. If the chain binds, jumps, or is noisy, first see that it is clean and properly lubricated. If the trouble persists, inspect the chain in accordance with the following:
  - a. Roller chain should first be inspected while it is in the hoist space. With the hoist suspended in normal position, apply a light load of approximately 100 pounds.
    - (1). Check for elongation following the hoist manufacturer's instructions. In absence of specific instructions, the chain can be checked by determining the normal pitch and measuring a 12-inch (30.5 centimeter) section of chain that normally travels over the load sprocket. Using a caliper-type gage, check the dimension from the edge of one chain pin to the corresponding edge of another pin for the number of pitches per foot. If elongation exceeds 0.25 inch (6.3 millimeters) in 12 inches (30.5 centimeters) the chain shall be replaced. For example, a 0.75-inch pitch chain should measure 12 inches over 16 pitches. Chain shall be rejected if measurement over 16 pitches exceeds 12.25 inches.
    - (2). Check chain for twist. The chain shall be replaced if the twist in any 5 feet (1.52 meters) section exceeds 15 degrees.
    - (3). Check for straightness in plane perpendicular to plane of rollers. A chain that has a bow exceeding 0.25 inch (6.3 millimeters) in any 5-foot (1.52 meter) section shall be replaced.
  - b. Additional inspection of the chain should be made by removing chain from hoist and cleaning it thoroughly in an acid-free solvent. A check should then be made for any of the following deficiencies:
    - (1). Pins turned from their original position
    - (2). Rollers that do not run freely with light finger pressure
    - (3). Points that cannot be flexed by easy hand pressure
    - (4). Side plates that are spread open (a visual check of the pin head extension at the damaged area, as compared to the pin extension at a free end of the chain, can determine the amount of spread and the condition of the chain)
    - (5). Corrosion, pitting, or discoloration of chain (generally indicative of serious impairment)
    - (6). Gouges, nicks, or weld splatter.

**NOTE:** See paragraph 13.9.2.6, "Hoist Rope and Load Chain Replacement," item 3, regarding roller-type load chain replacement.

**13.9.1.9 Inspection of Cranes Not In Regular Use.** Cranes that are out of service shall be inspected before being returned to service.<sup>7</sup> The following identifies inspection requirements for returning cranes to service.

1. **Idle Greater Than 1 Month.** A crane that has been idle more than 1 month, but less than 6 months, shall be given a frequent inspection and a documented monthly hook, rope, or load chain inspection.
2. **Idle Greater Than 6 Months.** A crane that has been idle more than 6 months shall have a periodic inspection, including a documented hook, rope, or load-chain inspection.
3. **Standby.** Standby cranes shall have a frequent inspection and a documented (equivalent to monthly) hook, rope, or chain inspection every 6 months.

**NOTE:** Cranes that are out of service AND are exempt from inspections shall be tagged out of service in accordance with the facility-specific lock and tag procedure. Standby cranes are not out of service.

**13.9.1.10 Hooks.** Hooks shall be inspected in conjunction with the frequent and periodic crane inspection. Monthly documented hook inspection is required. See Section 5.0 "Hooks," for hook inspection details.

**13.9.1.11 Third-Party Inspection.** A third-party crane inspection program is optional at the discretion of the Hanford Site contractor.

**13.9.1.12 Inspection Records.** Inspection records shall be kept throughout the life of the crane.

1. **Pre-Use and Frequent Inspection.** No records retention is required. A frequent inspection verification checklist is recommended.
2. **Monthly Hook, Wire Rope, and Load Chain Inspection.** The most recent records, dated and signed by a qualified inspector, shall be retained in the crane maintenance file.
3. **Periodic Inspection.** The most recent records, dated and signed by a qualified inspector, shall be retained in the crane maintenance file.

## 13.9.2 Maintenance

**13.9.2.1 Preventive Maintenance.** A preventive maintenance program based on the crane manufacturer's recommendations shall be established. If the manufacturer's recommendations are not available or complete, a preventive maintenance program shall be developed by the responsible maintenance or engineering organization.

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<sup>7</sup> See paragraph 13.9.3.2 regarding tests.

**13.9.2.2 Preventive Maintenance Procedure.** Preventive maintenance shall be performed in accordance with written procedures. Procedures shall state specific precautions, such as lock and tag requirements, to be taken before beginning maintenance. A copy of the preventive maintenance procedures shall be retained in the crane history file.

**13.9.2.3 Maintenance Records.** The most recent copy of dated records that document maintenance of critical items such as hoisting machinery, sheaves, hooks, chains, ropes, and other lifting devices shall be retained in a maintenance file. Maintenance records shall be retained in the crane history file, or an electronic recordkeeping system may be used. If a computer system is used, and maintenance records are not retained in the crane history file, the crane history file shall state where the electronic maintenance records are available.

**13.9.2.4 Maintenance Procedure.**

1. **Precautions Before Maintenance.** Before adjustments or repairs are started, the following precautions shall be taken, as applicable.
  - a. The crane to be repaired shall be moved to a location where it will cause the least interference with other equipment and operations in the area.
  - b. Controllers shall be set in the off condition.
  - c. The main switch (crane disconnect) shall be deenergized and locked, tagged, or flagged in the deenergized position.

**NOTE:** Facility-specific lock and tag procedures shall be strictly followed. While maintenance is under way, “warning” or “out of order” signs shall be placed on the crane. If personnel have access to the floor beneath the crane, place warning signs that are visible from the floor. Lock and tag procedures shall be followed.

- d. Effective markings and barriers shall be used when maintenance work creates a hazardous area on the floor beneath the crane or crane runway.
  - e. Where other cranes are in operation on the same runway, rail stops or other means shall be provided to prevent interference with the idle crane or work area.
  - f. Where temporary protective rail stops or other means are not available or practical, a signal person shall be placed at a visual vantage point for observing the approach of an active crane and warning its operator when reaching the limit of safe distance from the idle crane or work area.
  - g. Only trained personnel shall work on energized equipment when adjustments and tests are required.
2. After maintenance work is completed and before restoring the crane to normal operation, the following activities shall be completed:
    - a. Guards shall be reinstalled.
    - b. Safety devices shall be reactivated.
    - c. Replaced parts and loose material shall be removed.
    - d. Maintenance equipment shall be removed.

### 13.9.2.5 Adjustments and Repairs.

1. Any hazardous conditions disclosed by inspection or during operation shall be corrected before normal operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.
2. Adjustments shall be maintained to ensure correct functioning of components. The following are examples:
  - a. All functional operating mechanisms
  - b. Limit devices
  - c. Control systems
  - d. Brakes.
3. Repairs or replacements shall be made as needed. The following are examples:
  - a. Crane hooks showing indications described in paragraph 5.4.4, "Frequent Inspection," shall be repaired or replaced.
  - b. All critical parts that are cracked, broken, bent, or excessively worn shall be replaced.
  - c. Pitted or burned electrical contacts should be corrected only by replacement and in sets. Control parts should be lubricated as recommended by the manufacturer.
  - d. Function labels on pendant control stations shall be kept legible.
  - e. If repairs of load-sustaining members are made by welding, identification of materials shall be made and appropriate welding procedures shall be assigned by a qualified welding engineer. The welds shall be made by a qualified welding operator.

### 13.9.2.6 Hoist Rope and Load Chain Replacement.

1. **Replacement Rope.** The end of the rope shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer. For wire rope requirements, see paragraph 8.4.1, "Wire Rope Replacement Criteria—Overhead and Gantry Cranes, Monorail Cranes and Hoists, Overhead Hoists."
2. **Replacement Load Chain (Welded Link Type).** The replacement welded link chain shall be the same size, grade, and construction as the original furnished by the crane or hoist manufacturer, unless use of a different type is justified. Repairing welded link chain by welding or heating shall not be attempted.
  - a. If for any reason a chain that is different from the original is used, or the original chain is unknown and the manufacturer is not available to specify the proper replacement, a qualified engineer shall approve the specification of the replacement chain.
3. **Roller Chain Replacement.** The roller chain shall be replaced if any of the conditions exist as stated in paragraph 13.9.1.8, "Load Chain Inspection (Welded Link and Roller Type)." Repairing of roller chain by welding or heating shall not be attempted.
  - a. The replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer unless otherwise recommended by the

manufacturer because of actual working conditions.

- b. When the chain is replaced, disassemble and inspect the mating parts (sprockets, guides, and stripper) for wear: replace, if necessary.
  - c. When the chain is replaced, it should be reeved in the recommended manner and should operate freely over all load and idler sprockets. All connecting links and chain end fasteners should be inspected and properly secured. The hoist manufacturer's recommendations should be followed on the selection and installation of connecting links.
  - d. The roller chains, discarded or new, shall not be used for slings.
4. **After Load Chain Replacement.** After chain (roller type or welded link type) replacement and before the initial load, do the following:
- a. Ensure that the proper chain is used.
  - b. Ensure that chain limit overtravel restraint requirements are met to prevent the chain from running off the hoist.
    - 1) For hand-operated hoists, before the load chain can be completely run out of the hoist, it shall be restrained in the fully extended position.
    - 2) An electric- or air-powered hoist shall not be installed where the load hook can be lowered beyond rated hook travel under normal operating conditions unless the hoist is equipped with a lower limit device.
5. Whenever a load chain (welded link type or roller type) is replaced, the following most recent documentation shall be retained in the crane maintenance file:
- a. Date replacement was completed
  - b. Purchase order (PO) number and PO item number, if known
  - c. Chain manufacturer
  - d. Size, grade, construction, and manufacturer's certification of the breaking strength.

**13.9.2.7 Preoperational Check After Maintenance or Repair.** A preoperational check shall be performed to verify the proper function of activities such as crane motion controls and interlocks. Special attention shall be given to those areas likely to have been affected by maintenance or repair.

**13.9.2.8 Lubrication.** A closely controlled lubrication plan is required to prevent over- or under-lubrication. The lubrication frequency shall be specified by the responsible engineering or maintenance organization and should be based on the manufacturer's recommendations. If inspection finds over- or under-lubrication, the lubrication method or frequency shall be adjusted. Lubricant types used on motors, bearings, gear boxes, and other lubrication points shall be specified by the responsible engineering or maintenance organization and should be as recommended by the crane manufacturer. Lubricants used on wire rope and chain should be as recommended by the manufacturer and shall be as specified by the responsible engineering or maintenance organization or qualified inspector.

#### 1. Sheave-Bearing Lubrication.

- a. **Normal Operation.** Sheave bearings, including equalizer sheaves, shall be individually

lubricated on a regular schedule.

- b. **Load Blocks in Water.** Load blocks that are immersed in water shall have special provisions to prevent lubricant loss to the water. In this case, lubrication frequency and lubricant type should be carefully evaluated.
2. **Hoist Rope Lubrication.** Hoist ropes, except for stainless steel rope (consult manufacturer), shall be lubricated. When ropes are immersed in water, the type of lubricant shall be selected to reduce the loss of lubricant to water.
3. **Motor Lubrication.** For those motors that require lubrication, a closely controlled lubrication plan is required.

### 13.9.3 Testing

**13.9.3.1 Periodic Load-Test.** Scheduled load-tests are not routinely required. Overhead and gantry cranes may be load-tested up to 100 percent of rated capacity when (if) specified in a critical lift procedure. For cranes that frequently make critical lifts, especially if the lifts are at or near rated capacity, responsible management may implement a periodic load-test program. Such periodic load-tests shall not exceed the rated capacity. Responsible management shall set the load-test frequency. (A 5-year frequency is recommended.)

**13.9.3.2 Cranes Removed from Service.** At the discretion of facility management, a crane that has been out of service may be load-tested before returning to service. Consider the following when determining whether a load-test shall be required: (1) Will the crane make critical lifts? (2) What is the general condition and age of the crane? (3) What is the previous load-test and maintenance history of the crane? This load test shall be done only after a return-to-service inspection is completed and should not exceed the rated capacity.

**13.9.3.3 Operational Tests.** Before initial use, new, reinstalled, altered, repaired, or modified cranes shall be tested by a designated person to ensure that the crane is in good operating condition, including the following functions:

1. Lifting and lowering
2. Trolley travel
3. Bridge travel
4. Limit devices
  - a. Check the hoist limit device(s), primary and secondary if so equipped, by slowly moving the block into the switch (no load on hook). Then check the hoist limit device(s) at increasing speeds up to the maximum speed. (See paragraph 13.7.12.2, "Hoist Overtravel Protection," and 13.9.1.2, "Pre-Use and Daily Inspection," for direction regarding trip setting of hoist limit devices.)
  - b. The actuating mechanism of the upper-limit device shall be located or adjusted so that it will trip the device in sufficient time to prevent contact of the load block or load with any part of the trolley or bridge;
  - c. Travel-limiting devices; and

- d. Locking and indicating devices, if provided.

NOTE: Operational testing of altered, repaired and modified cranes may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person.

#### 13.9.3.4 Rated Load-Test.

1. New, reinstalled, altered, repaired, and modified cranes should be load-tested prior to initial use, as determined by a qualified person.
2. Load-testing of altered, repaired and modified cranes may be limited to the functions affected by the alteration, repair, or modification, as determined by a qualified person. To resolve questions, the crane manufacturer should be consulted.
3. The replacement of load chain and rope is specifically excluded from load-test requirements; however, an operational test of the hoist shall be made in accordance with paragraph 13.9.3.3, "Operational Tests," before returning the crane to service.
4. When rope clips or wedge socket end connections are used on a load line, the hoist should be cycled several times with a load no less than the maximum operational load (normally 100 percent of the rated capacity). Next, if rope clips are used, check and retighten nuts to the recommended torque. If a wedge socket is used, verify that the rope is properly seated.
5. If a load-test is conducted, the load shall be not less than 100 percent of the rated load of the crane or hoists, whichever governs; or more than 125 percent of the rated load of the crane or hoists, whichever governs; unless otherwise recommended by the manufacturer or a qualified person.
6. If a load-test is conducted, it shall be conducted in accordance with paragraph 13.9.3.7, "Load-Test Procedure," and documented in accordance with paragraph 13.9.3.8, "Load-Test Report."

**13.9.3.5 Load-Test Weight.** The load-test weight should be within a tolerance of (+0 percent, -5 percent) and shall be traceable to a recognized standard or verified by engineering calculations. Any one of the following options will meet this requirement:

1. Use a calibrated (+0 percent, -5 percent) load-measuring device during the load test.
2. Determine the test load with a calibrated load-measuring device before the test.
3. Calculate the test load based on known unit weights and dimensions of the test fixture. Dimensions and calculations must be checked (signed and dated) by a qualified engineer and determined to be accurate within tolerance (+0 percent, -5 percent).

**13.9.3.6 Prerequisite to Load Test.** Load tests shall be performed only after inspection and maintenance of the crane are confirmed as current and any outstanding discrepancies have been addressed.

**13.9.3.7 Load-Test Procedure.** If a load-test is conducted, it shall be performed as follows or as modified by a qualified person.

1. Hoist the test load a distance to ensure the load is supported by the crane and held by the hoist



- brakes.
2. Transport the test load by means of the trolley for the full length of the bridge.
  3. With the trolley as close as practical to one end of the crane, transport the test load by means of the bridge for the full length of the runway in one direction and in the other direction with the trolley as close as practical to the other end of the crane.
  4. Lower the load, and stop and hold the load with the brakes.

**13.9.3.8 Load-Test Report.** After the test is completed, the load-test report shall be signed and dated by the person in charge of conducting the load test. The person in charge shall ensure that the test is placed in the crane maintenance file.

**13.9.3.9 Hook Nondestructive Testing.** Hook nondestructive examination (NDE) is not routinely required before a load test. If the crane hooks are to have NDE (see paragraph 5.4.5), the NDE should be done after the load test.

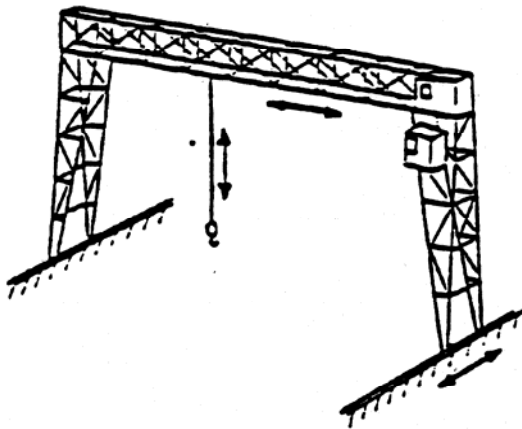
## 13.10 CRANE MAINTENANCE FILES

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

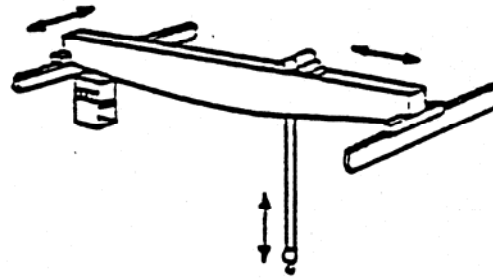
The crane maintenance file shall contain, as a minimum, the required current dated periodic inspection records and other documentation to provide the user with evidence of a safe and reliable maintenance program. Inspection records should be retained in a format and location that provides for ease in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

ATTACHMENT 13.1 CRANE TYPES

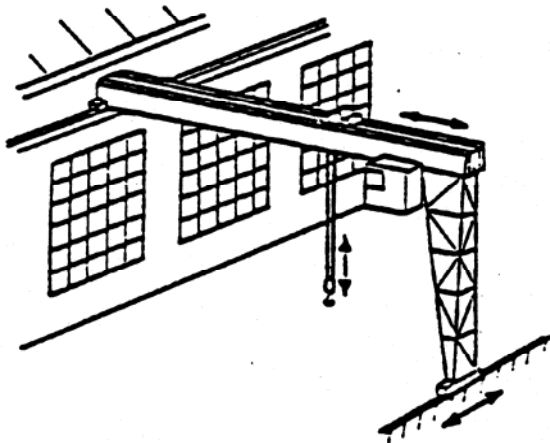
Attachment 13.1-1. Top-Running Single-Girder Bridge with Underhung Trolley Hoist.



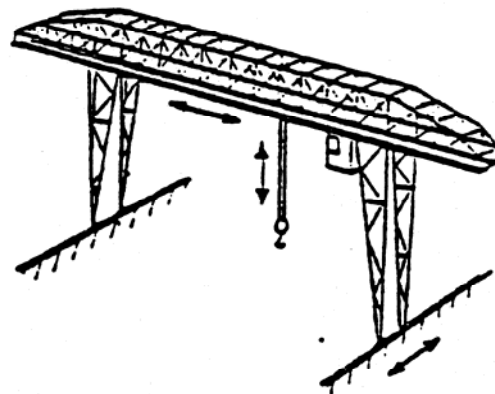
Gantry Crane



Overhead Traveling Crane

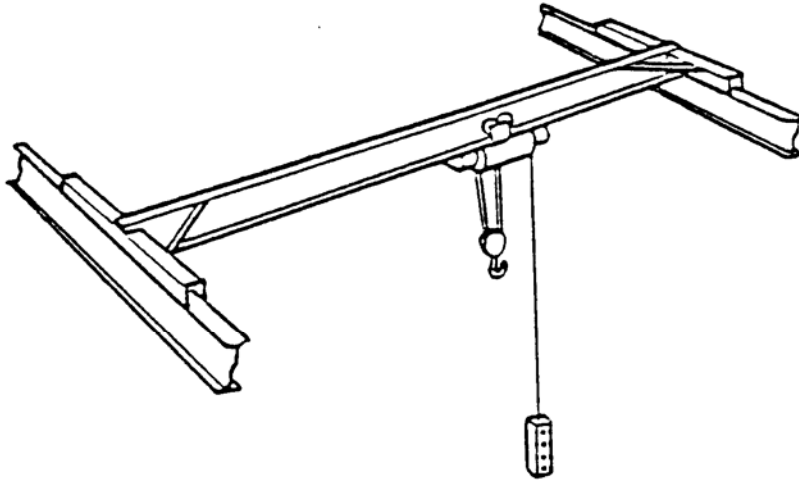


Semi-Gantry Crane

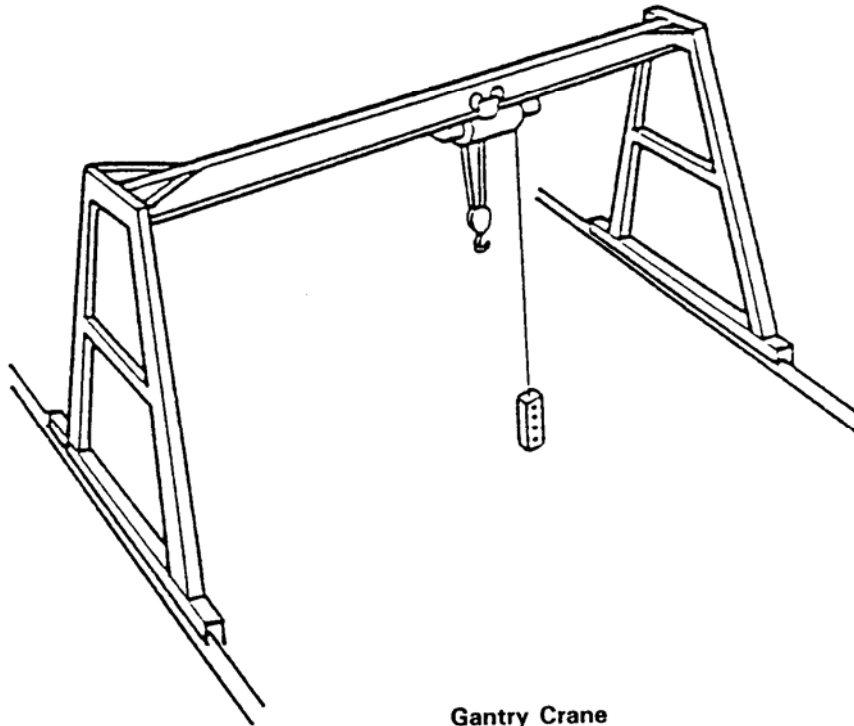


Cantilever Gantry Crane

Attachment 13.1-2. Overhead Floor Operated Crane



Overhead Floor-Operated Crane

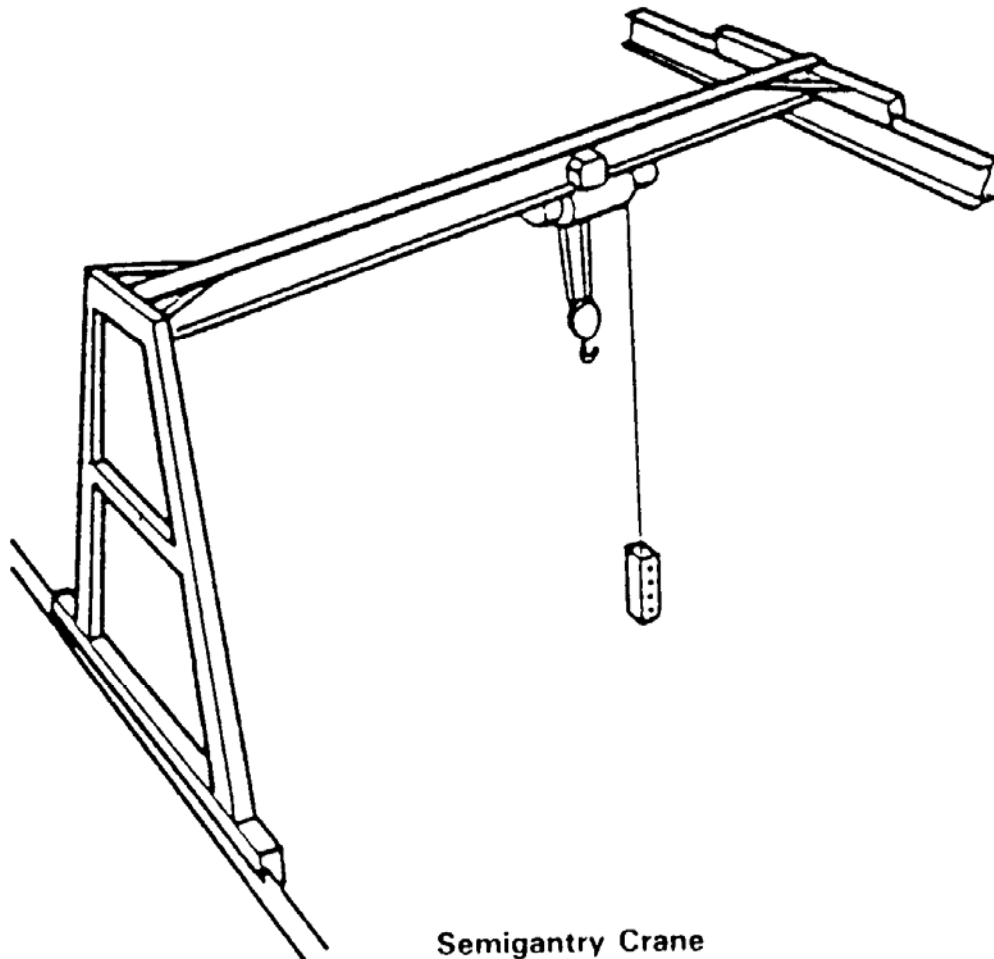


Gantry Crane

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Attachment 13.1-3. Gantry Crane

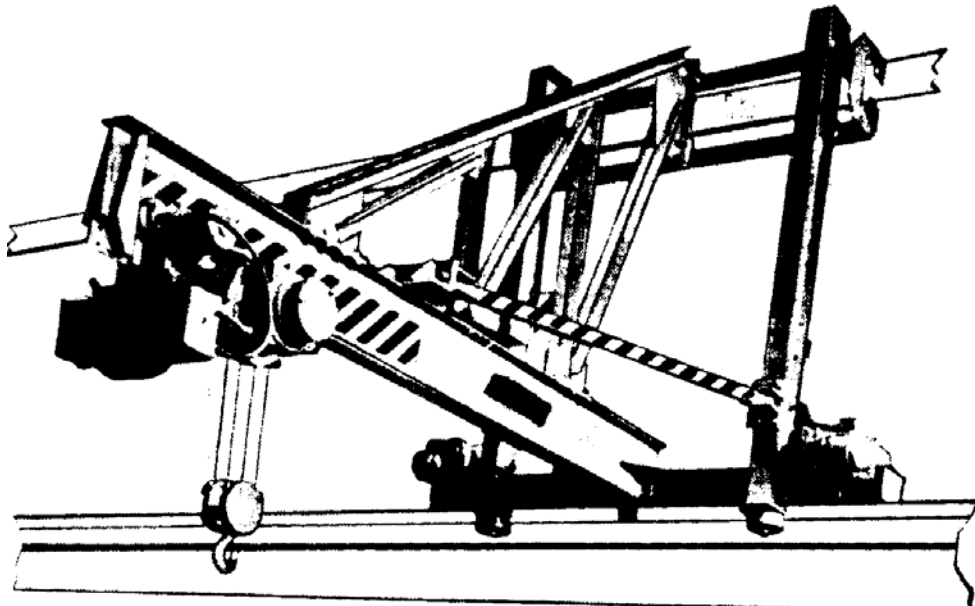
Attachment 13.1-4 Semigantry Crane



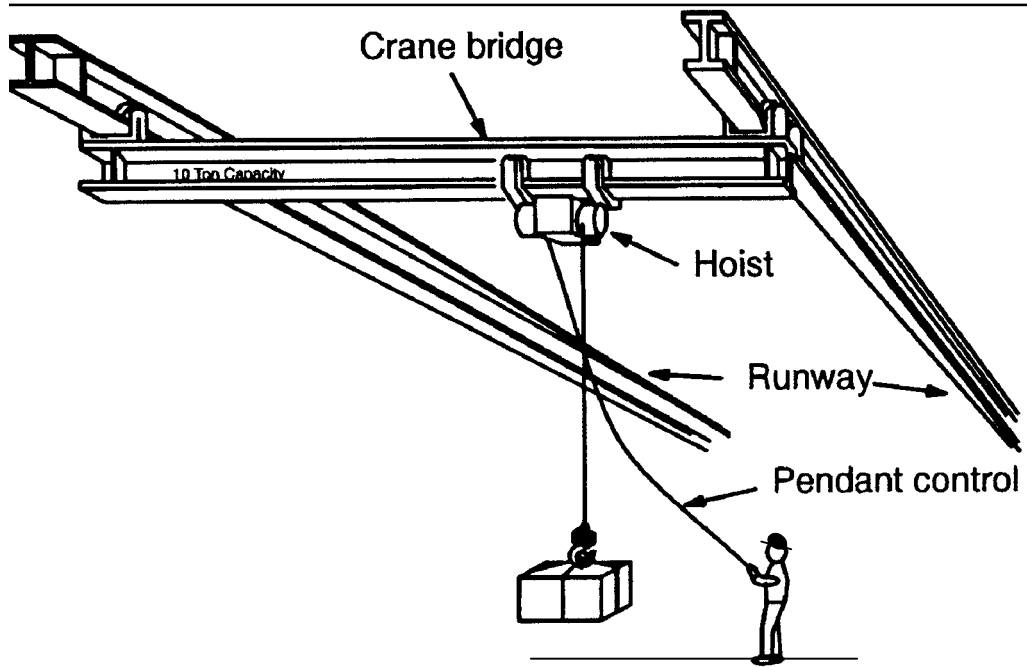
Semigantry Crane

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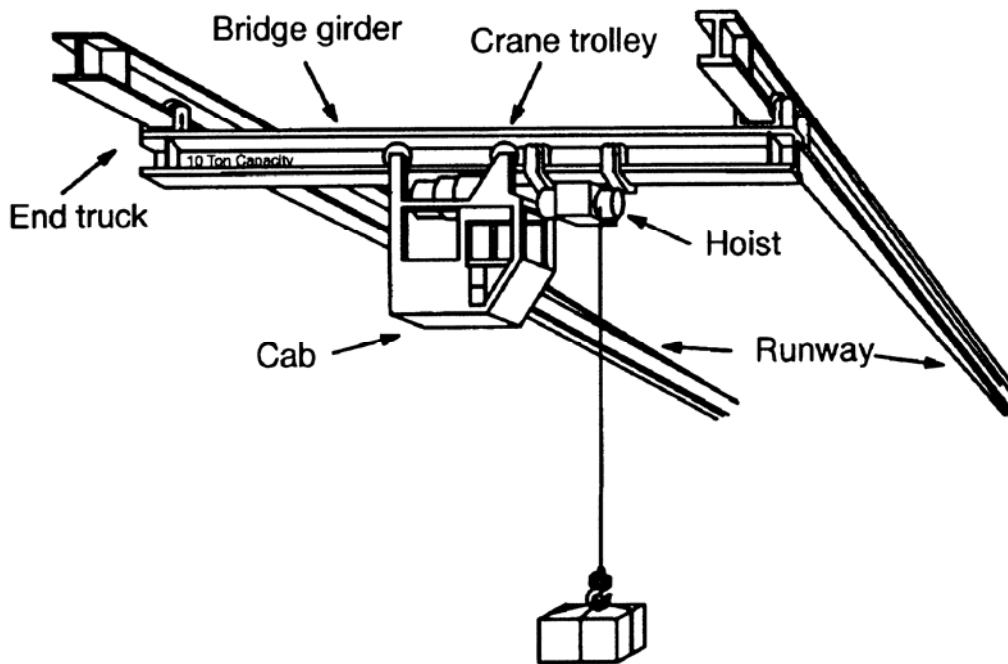
Attachment 13.1-5. Wall Crane.



Attachment 13.1-6. Underhung Cranes

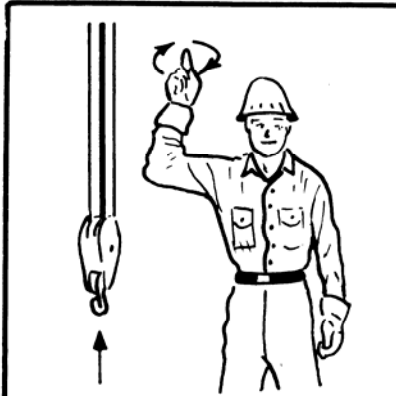


Underhung Floor-Operated Crane

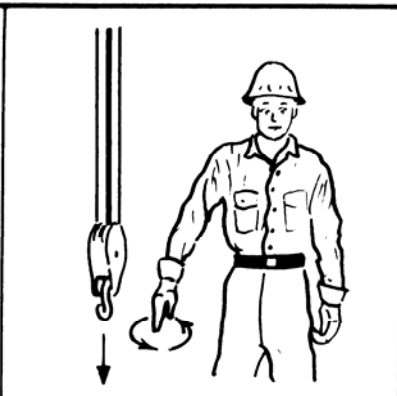


Underhung Cab-Operated Crane

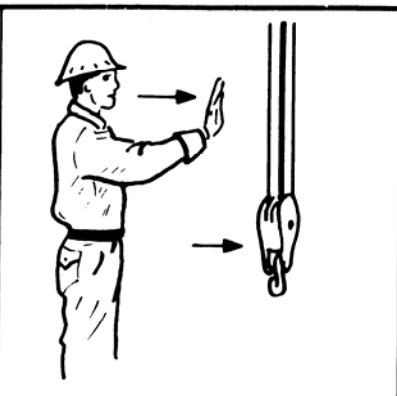
ATTACHMENT 13.2 HAND SIGNALS



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



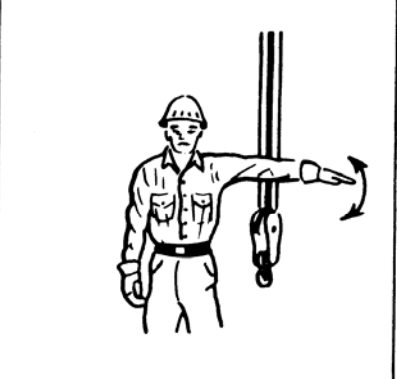
**LOWER.** With arm extended downward, forefinger pointing down, move hand in small horizontal circles.



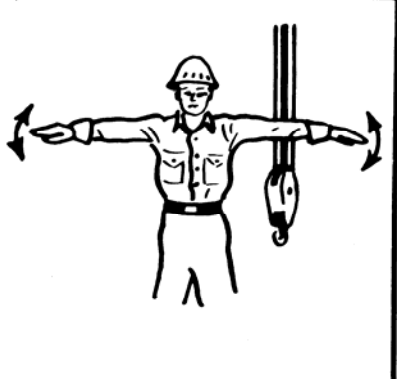
**BRIDGE TRAVEL.** Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



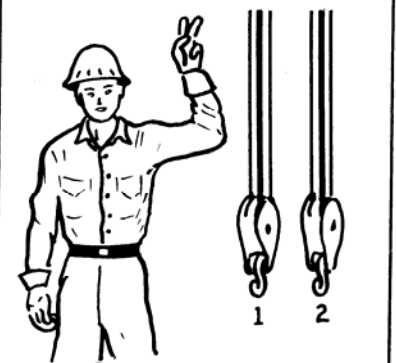
**TROLLEY TRAVEL.** Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.



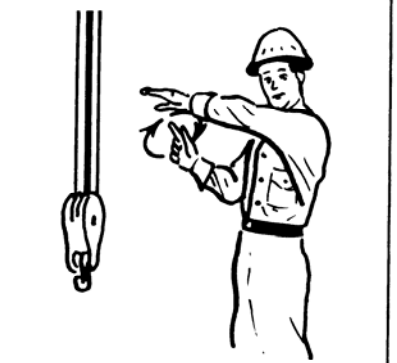
**STOP.** Arm extended, palm down, move arm back and forth horizontally.



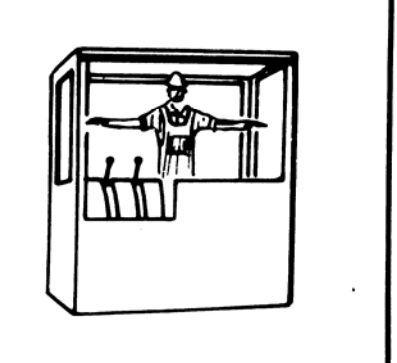
**EMERGENCY STOP.** Both arms extended, palms down, move arms back and forth horizontally.



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



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



**MAGNET IS DISCONNECTED.** Crane operator spreads both hands apart — palms up.

**ATTACHMENT 13.3 - SAMPLE OVERHEAD CRANE DAILY INSPECTION CHECKLISTS**

**BLDG:** \_\_\_\_\_ **LOCATION:** \_\_\_\_\_ **CRANE #:** \_\_\_\_\_ **DATE:** / / **BY:** \_\_\_\_\_

COMPONENT	N/A	OK	FAULTY	COMMENTS
<b>Main Hoist</b>				
Controls				
Push Buttons				
Sounds Normal				
Movement Smooth				
Brakes Positive				
Upper Limit				
Lower Limit				
Upper and Lower Blocks				
Sheaves				
Rope and Connections				
Proper Drum Spooling				
Hooks				
<b>Auxiliary Hoist</b>				
Controls				
Pushbuttons				
Sounds Normal				
Movement Smooth				
Brakes Positive				
Upper Limit				
Lower Limit				
Upper and Lower Blocks				
Sheaves				
Rope and Connections				
Proper Drum Spooling				
Hooks				
<b>Trolley</b>				
Controls/Pushbutton				
Travels Smooth				
Sounds Normal				
Brakes Positive				
<b>Trolley and Bridge Obstruction</b>				
<b>Housekeeping</b>				
<b>Ladders and Landings</b>				
<b>Oil Leaks</b>				
<b>Operation of Brakes</b>				
<b>Loose Parts</b>				
<b>Keepers in Place</b>				
<b>Lubrication Requirements</b>				
<b>Fire Extinguisher Locations</b>				
<b>Retaining Latch(es) in Place</b>				
<b>Hooks Swivel Freely</b>				
<b>Obvious Hook Deformations</b>				
<b>Bridge</b>				
Controls/Pushbuttons				
Travels Smooth				
Sounds Normal				
Brakes Positive				
Limits Working				
Alarms				
Lights				
Rigging Capacity				