



Department of

*Environmental  
Safety*

DIVISION OF ADMINISTRATIVE AFFAIRS

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**CRANE &  
HOIST  
PROGRAM**

Approved as UM Policy – December 2012

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# Policy on Crane and Hoist Safety Precautions

## **I. Purpose.**

Many types of cranes, hoists, and rigging devices are used for lifting and moving materials by various departments at the University of Maryland, College Park, and the Maryland Fire and Rescue Institute. The mission of the Department of Environmental Safety is to maintain a safe and healthful environment for faculty, researchers, staff, students and visitors; therefore, it cannot be overemphasized that only qualified and competent individuals shall be designated operate these devices.

## **II. Application.**

The crane, hoist, and rigging safety program applies to all operations that involve the use of cranes, hoists and/or rigging installed in or attached to buildings. Mobile equipment and temporary construction cranes are not included in this procedure. It applies to all campus employees, including: faculty, researchers, staff, students, visitors, supplemental labor, and subcontractor personnel who use such devices. In addition to the roles and responsibilities established in other safety directives and procedures, this program establishes crane-specific safety responsibilities. Each affected Department/Division Head, or designee, shall ensure that designated operators are trained in hoist and crane safety aspects by having completed the DES on-line safety training class.

## **III. Responsibilities.**

### **A. Department of Environmental Safety shall:**

- (1) Develop, administer and update the UM Crane and Hoist safety program;
- (2) Develop and update an on-line safety training course in crane and hoist safety; and
- (3) Provide assistance and advice to University departments on fixed crane and hoist safety.

### **B. Department/Division Heads shall:**

- (1) Performing annual maintenance and inspection of all cranes and hoists that are not covered by an individual maintenance agreement;
- (2) Conducting periodic and special load tests of cranes and hoists, as required;
- (3) Maintaining written records of inspections and tests;
- (4) Inspect and load testing cranes and hoists following modification or extensive repairs (e.g., a replaced cable or hook, or structural modification.);
- (5) Schedule a non-destructive test and inspection for crane and hoist hooks at the time of the periodic load test, and testing and inspecting before use new replacement hooks and other hooks suspected of having been overloaded. The evaluation, inspection, and testing may include, but are not limited to visual, dye penetrant, and magnetic particle techniques referenced in ASME B30.10 (Hooks, Inspection and Testing.);
- (6) Maintaining all manuals, testing results, and lists of authorized operators for cranes and hoists in a central file for on-site reference;
- (7) Conducting on-the-job training for all crane and hoist operators in proper use, maintenance, servicing, and control of the equipment. In addition, assure all crane and hoist operators have taken and completed the DES on-line course in crane and hoist safety; and
- (8) Identify those individuals qualified to use the equipment (For fixed location equipment, a current list of designated operators may be maintained on-site.)

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- C. Supervisors of crane and hoist operators shall:
- (1) Ensuring that employees under their supervision receive the required training and are qualified to operate the cranes and hoists in their areas;
  - (2) Assure new crane and hoist operators are knowledgeable in the proper use, maintenance, servicing, and control of the equipment and have completed the DES on-line crane and hoist safety training course;
  - (3) Ensure that hoisting equipment is inspected daily (on each day used), inspected and tested monthly by a responsible, designated individual; and insure that rigging equipment is inspected annually, and that inspection results are documented on-site; and
  - (4) Remove from service any cranes, hoists, slings or other gear that is found to be broken or defective. Assure that electrical power to broken or defective cranes and hoists is terminated until repairs are completed.
- G. Employees shall:
- (1) Receive training in the proper use, maintenance, servicing, and control of the equipment, and complete the DES on-line crane and hoist safety training course;
  - (2) Operate hoisting equipment safely;
  - (3) Conduct functional tests prior to using the equipment; and
  - (4) Not use the equipment unless listed by the department as being qualified to operate the specific cranes or hoists.

#### **IV. Information**

Assistance will be provided by the Department of Environmental Safety to any Department requesting guidance or training to satisfy implementation of this policy.

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## Glossary of Terms

The following terms used in this Crane and Hoist Program are defined as follows:

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

**Bridge Crane** - crane with bridge mounted on tracks, which enables three-dimensional handling

**Bridge travel** - crane movement in a direction parallel to the crane runway

**Crane** - defined by OSHA as a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an essential part of the machine. Cranes whether fixed or mobile are driven manually or by power.

**Designated Person** - selected or assigned by the Department/Division Head, or designated representative, as being qualified to perform specific duties

**Drum** - is the cylindrical member around which the ropes are wound for raising or lowering the load

**Floor-Operated Crane** - means a crane which is pendant or nonconductive rope controlled by an operator on the floor or an independent platform.

**Frequent Inspection** - an inspection of the equipment conducted in daily to monthly intervals

**Gantry Crane** - means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.

**Hand-Held Hoist** - lever operated roller chain hoist

**Hoist** - an apparatus, which may be part of a crane, exerting a force for lifting or lowering

**Load** – the total superimposed weight on the load block or hook

**Overhead crane** - means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

**Pawl** – a device used to hold machinery against undesired rotation by engaging a ratchet

**Pendant** – controls suspended from an electric hoist.

**Periodic inspection** - an inspection of the equipment conducted during 1 to 12 month intervals

**Power-Operated Crane** - means a crane whose mechanism is driven by electric, air, hydraulic, or internal combustion means.

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

**Semigantry Crane** - is a gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway

**Sheave** – a grooved wheel or pulley used with a rope or chain to change direction and point of application of the pulling force.

**Slip clutch** – is a clutch that will slip when the torque is too great

**Stop** - is a device to limit travel of a trolley or crane bridge. This device normally is attached to a fixed structure and normally does not have energy absorbing ability

**Trolley** - is the unit which travels on the bridge rails and carries the hoisting mechanism

**Trolley travel** - defined as the trolley movement at right angles to the crane runway

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**Unattended** - a condition in which the operator of a hoist is not at the operating control devices (pendant station or hand chain). However, if the control devices are within an unobstructed distance of 26 ft. (8.0 m) and within sight of the operator, the hoist should be considered attended

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## Safe Operating Requirements

All workers who use any crane or hoist shall have approval by their Department/Division to operate such equipment. The Department/Division Head issues approval for authorized employees who have been specifically trained in crane and hoist operations and equipment safety. (A current list of designated operators may be maintained on-site.)



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# Crane and Hoist Safety Design Requirements

The following are the design requirements for cranes and hoists and their components:

The design of all commercial cranes and hoists shall comply with the requirements of ASME/ANSI B30 standards and Crane Manufacturer's Association of America standards (CMAA-70 and CMAA-74).

All crane and hoist hooks shall have safety latches.

Hooks shall not be painted (or re-painted) if the paint previously applied by the manufacturer is worn.

Crane pendants shall have an electrical disconnect switch or button to open the main-line control circuit.

Cranes and hoists shall have a main electrical disconnect switch. This switch shall be in a separate box that is labeled with lockout capability.

Crane bridges and hoist monorails shall be labeled on both sides with the maximum capacity.

Each hoist-hook block shall be labeled with the maximum hook capacity.

Directional signs indicating N-W-S-E shall be displayed on the bridge underside, and a corresponding directional label shall be placed on the pendant.

A device such as an upper-limit switch or slip clutch shall be installed on all building cranes and hoists. A lower-limit switch may be required when there is insufficient hoist rope on the drum to reach the lowest point.

All newly installed cranes and hoists, or those that have been extensively repaired or rebuilt structurally, shall be load tested at 125% capacity prior to being placed into service.

If an overload device is installed, a load test to the adjusted setting is required.

Personnel baskets and platforms suspended from any crane shall be designed in accordance with the specifications in 29 CFR 1926.550(g) and COMAR 09.12.38.

All cranes used for personnel lifting, shall have anti-two blocking devices installed and operational.

Cranes taken out of service, for extended periods, shall be clearly tagged/labeled "Out of Service;" OOS labels shall be signed and dated. Cranes that are out of service shall have the power physically disconnected or locked out.

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## General Safety Rules

Operators shall comply with the following rules while operating the cranes and hoists:

Do not engage in any practice that will divert your attention while operating the crane.

Respond to signals only from the person who is directing the lift, or an appointed signal person.

Obey a stop signal at all times, no matter who gives it.

Do not move a load over people. People shall not be placed in jeopardy by being under a suspended load. Also, do not work under a suspended load, unless the load is supported by blocks, jacks, or a solid footing that will safely support the entire weight. Have a crane or hoist operator remain at the controls or lock open and tag the main electrical disconnect switch.

Ensure that the rated load capacity of a crane's bridge, individual hoist, or any sling or fitting is not exceeded. Know the weight of the object being lifted or use a dynamometer or load cell to determine the weight.

Check that all controls are in the OFF position before closing the main-line disconnect switch.

If spring-loaded reels are provided to lift pendants clear off the work area, ease the pendant up into the stop to prevent damaging the wire.

Avoid side pulls and/or load swinging. These can cause the hoist rope to slip out of the drum groove, damaging the rope or destabilizing the crane or hoist.

To prevent shock loading, avoid sudden stops or starts. Shock loading can occur when a suspended load is accelerated or decelerated, and can overload the crane or hoist. When completing an upward or downward motion, ease the load slowly to a stop.

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# Crane & Hoist Operation Rules

## 1. Pre-operational Test

At the start of each work shift (on a day when the crane and/or hoist will be used), operators shall do the following steps before making lifts with any crane or hoist:

- (a) Test the upper-limit switch. Slowly raise the unloaded hook block until the limit switch trips.
- (b) Visually inspect the hook, load lines, trolley, and bridge as much as possible from the operator's station; in most instances, this will be the floor of the building.
- (c) If provided, test the lower-limit switch.
- (d) Test all direction and speed controls for both bridge and trolley travel.
- (e) Test all bridge and trolley limit switches, where provided, if operation will bring the equipment in close proximity to the limit switches.
- (f) Test the pendant emergency stop.
- (g) Test the hoist brake to verify there is no drift without a load.
- (h) If provided, test the bridge movement alarm.
- (i) Lock out and tag for repair any crane or hoist that fails any of the above tests. Do not return to service until necessary maintenance is completed.

## 2. Moving a Load

- (a) Center the hook over the load to keep the cables from slipping out of the drum grooves and overlapping, and to prevent the load from swinging when it is lifted. Inspect the drum to verify that the cable is in the grooves.
- (b) Use a tag line when loads must traverse long distances or must otherwise be controlled. Manila rope may be used for tag lines.
- (c) Plan and check the travel path to avoid personnel and obstructions.
- (d) Lift the load only high enough to clear the tallest obstruction in the travel path.
- (e) Start and stop slowly.
- (f) Land the load when the move is finished. Choose a safe landing.
- (g) *Never* leave suspended loads unattended. In an emergency where the crane or hoist has become inoperative, if a load must be left suspended, barricade and post signs in the surrounding area, under the load, and on all four sides. Lock open and tag the crane or hoist's main electrical disconnect switch.

## 3. Parking a Crane or Hoist

- (a) Remove all slings and accessories from the hook. Return the rigging device to the designated storage racks.
- (b) Raise the hook at least 2.1 m (7 ft) above the floor.
- (c) Store the pendant away from aisles and work areas, or raise it at least 2.1 m (7 ft) above the floor.
- (d) Place the emergency stop switch (or push button) in the OFF position.

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# General Rigging Safety Requirements

Use only select rigging equipment that is in good condition. All rigging equipment shall be inspected at least annually. Defective equipment shall be removed from service and destroyed to prevent inadvertent reuse. The load capacity limits shall be stamped or affixed to all rigging components. Prudent practice requires a minimum safety factor of 5 to be maintained for wire rope slings.

## 1. The following types of slings shall be rejected or destroyed:

### Nylon slings with

- (a) Abnormal wear.
- (b) Torn stitching.
- (c) Broken or cut fibers.
- (d) Discoloration or deterioration.

### Wire-rope slings with

- (a) Kinking, crushing, bird-caging, or other distortions.
- (b) Evidence of heat damage.
- (c) Cracks, deformation, or worn end attachments.
- (d) Six randomly broken wires in a single rope lay.
- (e) Three broken wires in one strand of rope.
- (f) Hooks opened more than 15% at the throat.
- (g) Hooks twisted sideways more than 10 degrees from the plane of the unbent hook.

### Alloy steel chain slings with

- (a) Cracked, bent, or elongated links or components.
- (b) Cracked hooks.

### Shackles, eye bolts, turnbuckles, or other components that are damaged or deformed.

## 2. Rigging a Load

Operators shall do the following when rigging a load:

- (a) Determine the weight of the load. Do not guess.
- (b) Determine the proper size for slings and components.
- (c) Do not use manila rope for rigging.
- (d) Make sure that shackle pins and shouldered eye bolts are installed in accordance with the manufacturer's recommendations.
- (e) Make sure that ordinary (shoulderless) eye bolts are threaded in at least 1.5 times the bolt diameter. (Grade 8 preferred.)
- (f) Use safety hoist rings (swivel eyes) as a preferred substitute for eye bolts wherever possible.
- (g) Pad sharp edges to protect slings. Remember that machinery foundations or angle-iron edges may not feel sharp to the touch but will cut into rigging when under several tons of load. Wood, tire rubber, or other pliable materials may be suitable for padding.
- (h) Do not use slings, eye bolts, shackles, or hooks that have been cut, welded, brazed, or otherwise altered.
- (i) Install wire-rope clips with the base only on the live end and the U-bolt only on the dead end. Follow the manufacturer's recommendations for the spacing for each specific wire size.
- (j) Determine the center of gravity and balance the load before moving it.

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- (k) Initially lift the load only a few inches to test the rigging and balance.

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## Crane Overloading

Cranes or hoists shall not be loaded beyond their rated load for normal operations. Any crane or hoist suspected of having been overloaded shall be removed from service by locking open and tagging the main disconnect switch. Additionally, overloaded cranes shall be inspected, repaired, load tested, and approved for use before being returned to service.

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## Working at Heights on Cranes or Hoists

Anyone conducting maintenance or repair on cranes or hoists at heights greater than 1.8 m (6 ft) shall use fall protection. Fall protection should also be considered for heights less than 1.8 m. Fall protection includes safety harnesses that are fitted with a lifeline and securely attached to a structural member of the crane or building or properly secured safety nets. Belts are not permitted for fall protection.

Use of a crane as a work platform should only be considered when conventional means of reaching an elevated worksite are hazardous or not possible. Workers shall not ride a moving bridge crane without a formal approval from the Department/Division Head, or designee; which shall specify the following as a minimum:

- (a) Personnel shall not board any bridge crane unless the main disconnect switch is locked and tagged open.
- (b) Personnel shall not use bridge cranes without a permanent platform (catwalk) as work platforms. Bridge catwalks shall have a permanent ladder access.
- (c) Personnel shall ride seated on the floor of a permanent platform with approved safety handrails, wear safety harnesses attached to designated anchors, and be in clear view of the crane operator at all times.
- (d) Operators shall lock and tag open the main (or power) disconnect switch when the crane is parked.

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## Hand Signals

Signals to the operator shall be in accordance with standard hand signals unless voice communications equipment (telephone, radio, or equivalent) is used. Signals shall be discernible or audible at all times. Some special operations may require addition to or modification of the basic signals. For all such cases, these special signals shall be agreed upon and thoroughly understood by both the person giving the signals and the operator, and shall not be in conflict with the standard signals.



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# Inspection, Maintenance and Testing

All tests and inspections shall be conducted in accordance with the manufacturer's recommendations.

## 1. Monthly In-House Tests and Inspections

- (a) All in-service cranes and hoists shall be inspected monthly and the results documented.
- (b) The Department/Division Head shall designate an appropriate individual to conduct and document in-house crane, hoist and rigging inspections.
- (c) Defective cranes and hoists shall be locked and tagged "out of service" until all defects are corrected. The inspector shall initiate corrective action by notifying the.

## 2. Required Preventive Maintenance Inspections

The Department/Division Head, or designee, shall schedule and supervise (or perform) annual preventive maintenance (PM) and annual inspections of all cranes and hoists. Annual PM inspections shall be conducted by a designated crane inspector for frequent use cranes; or, at least every three years for infrequently used cranes.

The annual PM inspection shall cover at least:

- (a) Hoisting and lowering mechanisms.
- (b) Trolley travel or monorail travel.
- (c) Bridge travel.
- (d) Limit switches and locking and safety devices.
- (e) Structural members.
- (f) Bolts or rivets.
- (g) Sheaves and drums.
- (h) Parts such as pins, bearings, shafts, gears, rollers, locking devices, and clamping devices.
- (i) Brake system parts, linings, pawls, and ratchets.
- (j) Load, wind, and other indicators over their full range.
- (k) Gasoline, diesel, electric, or other power plants.
- (l) Chain-drive sprockets.
- (m) Crane and hoist hooks.
- (n) Electrical apparatus such as controller contractors, limit switches, and push button stations.
- (o) Wire rope.
- (p) Hoist chains.

## 3. Load Testing

- (a) Newly installed cranes and hoists shall be load tested at 125% of the rated load by designated personnel.
- (b) Slings shall have appropriate test data when purchased. It is the responsibility of the purchaser to ensure that the appropriate test data are obtained and maintained.
- (c) Re-rated cranes and hoists shall be load tested to 125% of the new capacity if the new rating is greater than the previous rated load.
- (d) Fixed cranes or hoists that have had major modifications or repair shall be load tested to 125% of the rated load.
- (e) Cranes and hoists that have been overloaded shall be inspected prior to being returned to service.
- (f) Personnel platforms, baskets, and rigging suspended from a crane or hoist hook shall be

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load tested initially, then re-tested annually thereafter, or at each new job site.

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## Records

The Department/Division Head, or designee, shall maintain records for all cranes, hoist and rigging equipment in the affected workplace.

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## Non-Standard, Crane-Like Lifting Devices

Non-standard devices and equipment for lifting personnel and/or materials shall be received operational and preventive maintenance inspections, as required for cranes and hoists. Each such device shall be evaluated for suitability on a case-by-case basis, based on documented engineering design and performance data. The Department/Division Head, or designee, shall justify the presence and use of such devices.

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## References

- ASME/ANSI B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)."
- ASME/ANSI B30.9, "Slings."
- ASME/ANSI B30.10, "Hooks."
- ASME/ANSI B30.11, "Monorails and Underhung Cranes."
- ASME/ANSI B30.16, "Overhead Hoists (Underhung)."
- ASME/ANSI B30.17, "Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)."
- ASME/ANSI B30.20, "Below-the-Hook Lifting Devices."
- ASME/ANSI B30.21, "Manually Lever Operated Hoists."
- Code of Federal Regulation*, Title 29, Part 1910.179, "Overhead and Gantry Cranes."
- Code of Federal Regulation*, Title 29, Part 1910.184, "Slings."
- COMAR 09.12.38, "General Industry Standard for Personnel Platforms Suspended from Cranes, Derricks, and Hoists."