

## Guideline for Cranes, Hoists & Rigging Safety

### A. Purpose

Many types of cranes, hoists, and rigging devices are used for lifting and moving materials in the College of Engineering and the Texas Engineering Experiment Station of the Texas A&M University System. The mission of the Engineering Safety Program 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.

### B. Application

The crane, hoist, and rigging safety program applies to all operations of the TAMUS Engineering Program that involve the use of cranes, hoists and/or rigging installed in or attached to buildings, and to mobile equipment. It applies to all Engineering 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 the Engineering Safety Policy, this program establishes crane-specific safety responsibilities. Each affected Department/Division Head, Center Director, or designee, shall ensure that designated operators are trained and that records of such training are documented and maintained for at least the individuals' duration of employment plus five years.

### C. Crane-Specific Responsibilities

#### Supervisors are responsible for:

- Ensuring that employees under their supervision receive the required training and are certified and licensed to operate the cranes and hoists in their areas.
- Providing training for prospective crane and hoist operators.
- Evaluating crane and hoist trainees using the Crane Safety Checklist and submitting a Qualification Request Form to the Engineering Department/Division Head, Center director, or designee to obtain the operator's license.
- Ensuring that hoisting equipment is inspected and tested monthly by a responsible, designated individual, that rigging equipment is inspected annually, and that inspection results are documented on-site.

#### Crane and Hoist Operators are responsible for:

- Operating hoisting equipment safely.
- Conducting functional tests prior to using the equipment.
- Selecting and using rigging equipment appropriately.
- Having a valid operator's license on their person while operating cranes or hoists.
- Participating in a medical certification program, if required.

**Engineering Department/Division Head, Center Director, or designee, is responsible for:**

- Performing annual maintenance and inspection of all cranes and hoists that are not covered by an individual maintenance agreement.
- Conducting periodic and special load tests of cranes and hoists.
- Maintaining written records of inspections and tests, and providing copies of all inspections and test results to Engineering administrators and TAMU officials.
- Inspecting and load testing cranes and hoists following modification or extensive repairs (e.g., a replaced cable or hook, or structural modification.)
- Scheduling 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.)
- Maintaining all manuals for cranes and hoists in a central file for on-site reference.
- Conducting training for all Crane & Hoist Operators
- Issuing licenses to Crane and Hoist Operators (For fixed location equipment, a current list of designated operators may be maintained on-site.)

**Engineering Safety Office is responsible for**

- Periodically verifying monthly test and inspection reports.
- Interpreting crane and hoist safety rules and standards.
- Providing management planning and technical assistance.

**D. Safe Operating Requirements**

All workers who use any crane or hoist shall have an operator's license. The Department/Division Head or Center director issues licenses for authorized employees who have been specifically trained in crane and hoist operations and equipment safety. (For fixed location equipment, a current list of designated operators may be maintained on-site.)

**E. Crane and Hoist Operators**

To be qualified as a Crane and Hoist Operator, the candidate shall have received hands-on training from a qualified crane and hoist operator designated by the Department/Division Head, Center Director, or designee. Upon successful completion of training, the crane and hoist operator and the candidate's supervisor will fill out and sign the Qualification Request Form and Crane Safety Checklist and send them to the Department/Division Head or Center Director, for approval. The candidate will be issued a license upon approval by the Department/Division Head or or Center Director. Crane and Hoist Operators must renew their license every three years by satisfying the requirements described above.

**F. Crane and Hoist Safety Design Requirements**

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). Employee or student-fabricated lifting equipment shall comply with the requirements in Chapter 2.2 (Lifting Equipment) of Mechanical Engineering *Design Safety Standards* (latest edition).
- 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 cab and remotely operated bridge cranes shall have a motion alarm to signal bridge movement.
- 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).
- 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.

#### **G. 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.

#### **H. Crane & Hoist Operation Rules**

##### **1. Pre-operational Test**

At the start of each work shift, operators shall do the following steps before making lifts with any crane or hoist:

1. Test the upper-limit switch. Slowly raise the unloaded hook block until the limit switch trips.
2. 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.

3. If provided, test the lower-limit switch.
4. Test all direction and speed controls for both bridge and trolley travel.
5. Test all bridge and trolley limit switches, where provided, if operation will bring the equipment in close proximity to the limit switches.
6. Test the pendant emergency stop.
7. Test the hoist brake to verify there is no drift without a load.
8. If provided, test the bridge movement alarm.
9. 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

- 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.
- Use a tag line when loads must traverse long distances or must otherwise be controlled. Manila rope may be used for tag lines.
- Plan and check the travel path to avoid personnel and obstructions.
- Lift the load only high enough to clear the tallest obstruction in the travel path.
- Start and stop slowly.
- Land the load when the move is finished. Choose a safe landing.
- *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

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

## H. 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

- Abnormal wear.
- Torn stitching.
- Broken or cut fibers.
- Discoloration or deterioration.

#### Wire-rope slings with

- Kinking, crushing, bird-caging, or other distortions.
- Evidence of heat damage.

- Cracks, deformation, or worn end attachments.
- Six randomly broken wires in a single rope lay.
- Three broken wires in one strand of rope.
- Hooks opened more than 15% at the throat.
- Hooks twisted sideways more than 10 degrees from the plane of the unbent hook.

**Alloy steel chain slings with**

- Cracked, bent, or elongated links or components.
- 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:

- Determine the weight of the load. Do not guess.
- Determine the proper size for slings and components.
- Do not use manila rope for rigging.
- Make sure that shackle pins and shouldered eye bolts are installed in accordance with the manufacturer's recommendations.
- Make sure that ordinary (shoulderless) eye bolts are threaded in at least 1.5 times the bolt diameter. (Grade 8 preferred.)
- Use safety hoist rings (swivel eyes) as a preferred substitute for eye bolts wherever possible.
- 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.
- Do not use slings, eye bolts, shackles, or hooks that have been cut, welded, brazed, or otherwise altered.
- 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.
- Determine the center of gravity and balance the load before moving it.
- Initially lift the load only a few inches to test the rigging and balance.

**I. Crane Overloading**

Cranes or hoists shall not be loaded beyond their rated capacity 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.

**J. 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 or Division Head, or designee; which shall specify the following as a minimum:

- Personnel shall not board any bridge crane unless the main disconnect switch is locked and tagged open.

- Personnel shall not use bridge cranes without a permanent platform (catwalk) as work platforms. Bridge catwalks shall have a permanent ladder access.
- 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.
- Operators shall lock and tag open the main (or power) disconnect switch when the crane is parked.

#### **K. 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.

#### **L. Inspection, Maintenance, and Testing**

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

#### **M. Monthly In-House Tests and Inspections**

- All in-service cranes and hoists shall be inspected monthly and the results documented.
- The Department/Division Head or Center Director shall designate an appropriate individual to conduct and document in-house crane, hoist and rigging inspections.
- 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.

#### **N. Required Preventive Maintenance Inspections**

The Department/Division Head, Center Director, 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:

- Hoisting and lowering mechanisms.
- Trolley travel or monorail travel.
- Bridge travel.
- Limit switches and locking and safety devices.
- Structural members.
- Bolts or rivets.
- Sheaves and drums.
- Parts such as pins, bearings, shafts, gears, rollers, locking devices, and clamping devices.
- Brake system parts, linings, pawls, and ratchets.
- Load, wind, and other indicators over their full range.
- Gasoline, diesel, electric, or other power plants.
- Chain-drive sprockets.

- Crane and hoist hooks.
- Electrical apparatus such as controller contractors, limit switches, and push button stations.
- Wire rope.
- Hoist chains.

**O. Load Testing**

- Newly installed cranes and hoists shall be load tested at 125% of the rated capacity by designated personnel.
- 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.
- 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 capacity.
- Fixed cranes or hoists that have had major modifications or repair shall be load tested to 125% of the rated capacity.
- Cranes and hoists that have been overloaded shall be inspected prior to being returned to service.
- Personnel platforms, baskets, and rigging suspended from a crane or hoist hook shall be load tested initially, then re-tested annually thereafter, or at each new job site.
- All mobile cranes & hoists shall be load tested at least annually.

**P. Records**

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

**Q. Non-standard, Crane-Like Lifting Devices**

Non-standard devices and equipment for lifting personnel and/or materials shall be receive 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, Center Director, or designee, shall justify the presence and use of such devices.

**R. 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."

*Code of Federal Regulation*, Title 29, Part 1926.550, "Cranes and Derricks."

Mechanical Engineering Department *Design Safety Standards*, Chapter 2.2, "Lifting equipment."

CMAA Specification No. 70, *Specifications for Electric Overhead Traveling Cranes*.

CMAA Specification No. 74, *Specifications for Top-Running and Under-Running Single-Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist.*

NFPA 70, Article 610, *Cranes and Hoists.*