University of Nevada, Reno

CRANE & HOIST SAFETY PROGRAM

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# CRANE & HOIST SAFETY PROGRAM
UNIVERSITY OF NEVADA, RENO

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 - INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>1.1 Policy</td>
<td>4</td>
</tr>
<tr>
<td>1.2 Purpose</td>
<td>4</td>
</tr>
<tr>
<td>1.3 Scope</td>
<td>4</td>
</tr>
<tr>
<td>2.0 - RESPONSIBILITY</td>
<td>5</td>
</tr>
<tr>
<td>2.1 Department Director</td>
<td>5</td>
</tr>
<tr>
<td>2.2 Supervisor</td>
<td>5</td>
</tr>
<tr>
<td>2.3 Crane &amp; Hoist Operators</td>
<td>5</td>
</tr>
<tr>
<td>2.4 Department of Environmental Health and Safety (EH&amp;S)</td>
<td>6</td>
</tr>
<tr>
<td>3.0 - CORE REQUIREMENTS</td>
<td>7</td>
</tr>
<tr>
<td>3.1 General Requirements</td>
<td>7</td>
</tr>
<tr>
<td>4.0 - SAFE OPERATING REQUIREMENTS</td>
<td>9</td>
</tr>
<tr>
<td>4.1 Operator Training</td>
<td>9</td>
</tr>
<tr>
<td>4.2 General Safety Tips</td>
<td>9</td>
</tr>
<tr>
<td>4.3 Rigging Safety Tips</td>
<td>10</td>
</tr>
<tr>
<td>4.4 Rope must be secured to drum</td>
<td>10</td>
</tr>
<tr>
<td>5.0 - HANDLING THE LOAD</td>
<td>11</td>
</tr>
<tr>
<td>6.0 - INSPECTION, TESTING, AND MAINTENANCE</td>
<td>13</td>
</tr>
<tr>
<td>6.1 General Inspection Guidelines</td>
<td>13</td>
</tr>
<tr>
<td>6.2 Daily Inspection</td>
<td>13</td>
</tr>
<tr>
<td>6.3 Monthly Inspection</td>
<td>13</td>
</tr>
<tr>
<td>6.4 Annual Inspection</td>
<td>14</td>
</tr>
<tr>
<td>6.5 Cranes Not In Regular Use</td>
<td>14</td>
</tr>
<tr>
<td>6.6 Sling Inspection</td>
<td>15</td>
</tr>
<tr>
<td>6.7 Rope Inspection</td>
<td>15</td>
</tr>
<tr>
<td>7.0 - TESTING</td>
<td>17</td>
</tr>
<tr>
<td>7.1 Operational Test</td>
<td>17</td>
</tr>
<tr>
<td>7.2 Rated Load Test</td>
<td>17</td>
</tr>
<tr>
<td>7.3 Maintenance</td>
<td>17</td>
</tr>
<tr>
<td>7.4 Adjustments and Repairs</td>
<td>18</td>
</tr>
<tr>
<td>7.5 Required Inspections</td>
<td>18</td>
</tr>
<tr>
<td>8.0 - TRAINING</td>
<td>20</td>
</tr>
<tr>
<td>8.1 Handling the Load</td>
<td>20</td>
</tr>
<tr>
<td>8.2 Moving the Load – Overhead and Gantry Cranes</td>
<td>20</td>
</tr>
<tr>
<td>8.3 Moving the Load – Crawler &amp; Wheel Mounted Cranes</td>
<td>21</td>
</tr>
<tr>
<td>8.4 Hoist Limit Switch</td>
<td>22</td>
</tr>
<tr>
<td>8.5 Holding the Load – Crawler &amp; Wheel Mounted Cranes</td>
<td>23</td>
</tr>
<tr>
<td>8.6 Other Training Content</td>
<td>23</td>
</tr>
<tr>
<td>9.0 - RECORDKEEPING</td>
<td>24</td>
</tr>
<tr>
<td>10.0 - GLOSSARY</td>
<td>25</td>
</tr>
<tr>
<td>11.0 - APPENDIX</td>
<td>27</td>
</tr>
<tr>
<td>Appendix A – Daily Crane Inspection Checklist</td>
<td>27</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

1.1 Policy

It is the policy of the University of Nevada, Reno (UNR) to ensure safe and healthy learning, research, work, entertainment and student living environments for faculty, staff, students and visitors. Implicit in this policy is a requirement to provide all individuals with pertinent information about crane and hoist safety.

1.2 Purpose

The purpose of this Crane & Hoist Safety Program is to communicate information regarding hazards associated with the operation of cranes, hoists and rigging devices. Therefore, in accordance with OSHA 29 CFR 1910.179, only qualified individuals shall be allowed to operate these types of equipments.

Manufacturer recommendations must be reviewed prior to installation/set-up and use of a crane. Furthermore, all manufacturer recommendations must be complied with.

All new overhead and gantry cranes must meet the design specifications of the American National Standard Safety Code for Overhead and Gantry cranes, ANSI B30.2.0.

1.3 Scope

This program provides guidelines that apply to all operations at the University of Nevada, Reno that involve the use of cranes, hoists or rigging devices installed inside or attached to UNR buildings and to all employees, supplemental labor, and subcontractor personnel who use such devices.

Industrial cranes raise, shift, and lower loads with a projected, swinging arm or a hoisting apparatus supported on an overhead track.

Industrial hoists are lifting and pulling devices that use a cable, rope, or chain to move or lift a load. Hoists are primarily used for vertical lifting, and usually have a feature for ceiling mounting such as a hook or trolley mount.

Note: Most hoists found on UNR campus are considered to be cranes - A “crane” is defined by OSHA (29 CFR § 1910.179) as a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes whether fixed or mobile are driven manually or by power.
2.0 RESPONSIBILITIES

2.1 Department Director

- Ensures that each supervisor and employee adheres to procedures
- Responsible for ensuring faculty, instructors, and managers maintain training requirements for this program
- Promotes faculty, instructors and managers to implement all guidelines within the Crane & Hoist Safety Program into their curriculum and training of new students and new employees

2.2 Supervisors are responsible for:

- Ensuring employees under their supervision receive the required training, certification, and license to operate the cranes and hoists specific to their areas
- Ensuring that training is given in accordance with this program
- Ensuring adequate documentation and tracking of all training within their group
- Ensuring only “qualified individuals” operate facility cranes
- Evaluating crane and hoist trainees using the Crane Safety Checklist in Appendix A
- Ensuring employees are not assigned to tasks requiring the use of a crane/hoist until they have been properly trained to operate the crane and hoist specific to that task
- Ensuring that crane and hoist equipment within their department is inspected and tested monthly by a responsible, designated individual, that rigging equipment is inspected annually, and that the inspection results are documented on-site
- Ensuring that work using a crane or hoist is performed in accordance with accepted safe practices of the job
- Ensuring that employees follow established safety procedures
- Adequately informing any non-University personnel sharing the same work area of the hazardous substances to which their employees may be exposed while performing their work
- Maintaining a copy of this written program in the workplace

2.3 Crane & Hoist Operators are responsible for:

- Knowing the hazards and precautionary procedures for their work area
- Reporting any unsafe conditions or breach of procedural requirements to their immediate supervisor and/or to the EH&S Department
Complying with procedures and information provided in training and in the Crane & Hoist Safety Program

Asking supervisor for assistance or clarification to maintain safe operations of cranes & hoists when necessary

Operating hoisting equipment safely

Conducting functional tests prior to using the equipment

Being classified as a “qualified operator” for the type of crane or hoist being operated

**DO NOT OPERATE EQUIPMENT IF YOU ARE NOT A QUALIFIED OPERATOR**

Testing at the beginning of each operator's shift, the upper limit switch of each hoist under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the switch does not operate properly, the appointed person shall be immediately notified

Attending required training

Planning and conducting operations in accordance with established procedures and good safety practices

**2.4 Department of Environmental Health and Safety (EH&S)**

Providing resources (i.e. reference materials) and technical support to ensure employees are protected from hazardous substances. Specific responsibilities include:

- Developing, implementing and evaluating the University’s Crane & Hoist Safety Program
- Assisting supervisors with employee training
- Recommending appropriate engineering controls, administrative controls and personal protective equipment
- Responsible for periodically verifying monthly test and inspection reports
- Interpreting crane and hoist safety rules and standards
3.0 CORE REQUIREMENTS

This section applies to overhead and gantry cranes, including semi-gantry, cantilever gantry, wall
cranes, storage bridge cranes and others having the same fundamental characteristics, and
crawler/wheel mounted cranes.

3.1 General Requirements

1. Installation/set-up must meet manufacturer recommendations, and current ANSI B30,
and OSHA 29 CFR 1910.179 requirements.

2. New and altered cranes must be tested to insure proper hoisting and lowering, trolley
travel, bridge travel, and proper function of limit switches, locking and safety devices. A
rated load test must also be performed. The testing must be performed in accordance
with OSHA 29 CFR § 1910.179(k)(1) & (2) and OSHA 29 CFR § 1910.180(e)(1) & (2).

3. Modifications are only allowed if the manufacturer has approved the modification and the
approval is documented in written form, a qualified engineer has checked the new rated
load, and the new rating is posted on the crane and supporting structure.

4. The rated load of a crane must be plainly marked on each side of the crane, and if the
crane has more than one hoisting unit, each hoist must have its rated load marked on it or
its load block and the marking must be clearly legible from the ground or floor.

5. Overhead and Gantry Cranes – A minimum clearance of 3-inches overhead and 2 inches
laterally must be provided and maintained between the crane and obstructions. Where
passageways or walkways are provided, obstructions must not be placed so that safety or
personnel will be jeopardized by movements of the crane. If runways of two cranes are
parallel, and there are no intervening walls or structure, there must be adequate clearance
provided and maintained between the two bridges.

6. Crawler and Wheel Mounted Cranes – Persons must stay outside the swing radius of the
boom when the crane engine is in operation.

7. Except for floor operated cranes a gong or other effective warning signal must be
provided for each crane equipped with a power traveling mechanism.

8. All hooks must be equipped with a safety latch to prevent loads from bouncing off of the
hook.

9. If a load is supported by more than one part of rope, the tension in the parts must be
equalized.

10. Rope clips attached with U-bolts must have the U-bolts on the dead or short end of the
rope (“never saddle a dead horse”). Spacing and number of all types of clips must be in
accordance with the clip manufacturer’s recommendations. Clips must be drop-forged
steel in all sizes manufactured commercially.

11. Swaged or compressed rope fittings must be applied as recommended by the rope or
crane manufacturer.
12. Rope socketing must be done in the manner specified by the manufacturer of the assembly.

13. Wherever exposed to temperatures, at which fiber cores would be damaged, rope having an independent wire-rope or wire-strand core or other temperature-damage resistant core must be used.

14. Wherever exposed to temperatures, at which fiber cores would be damaged, rope having an independent wire-rope or wire-strand core or other temperature-damage resistant core must be used.

15. When two or more cranes are used to lift a load, one qualified responsible person must be in charge of the operation. This person must analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.

16. Replacement rope must be the same size, grade and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a wire rope manufacturer due to actual working condition requirements.

17. When a newly installed rope has been in operation for an hour, all nuts on the clip bolts must be retightened.

18. When climbing ladders, hands must remain free from encumbrances and articles that are too large to be carried in pockets or belts must be lifted and lowered by hand line.

19. Loads must be attached to hooks by means of slings or other approved devices.

20. All operations near overhead lines must be done in accordance with 29 CFR 1910.333(c)(3) requirements.

21. Crawler & wheel mounted cranes - must not be operated without the full amount of any ballast or counterweight in place as specified by the maker, but truck cranes that have dropped the ballast or counterweight may be operated temporarily with special care and only for light loads without full ballast or counterweight in place. The ballast or counterweight in place specified by the manufacturer must not be exceeded.
4.0 SAFE OPERATING REQUIREMENTS

4.1 Operator Training

- Employees shall be properly trained and authorized before being allowed to operate a crane.
- Operator training shall include:
  - Information on rules, regulations, requirements, and limits
  - Actual hands-on training with the equipment, which shall be done under the direction of a qualified crane operator
  - Review of trainee’s knowledge through a written examination

4.2 General Safety Tips

1. During hoisting sudden acceleration or deceleration of the moving load is to be avoided.
2. When hoisting make sure the load does not come in contact with any obstructions (primarily electrical).
3. Cranes should not be used for side pulls except when specifically authorized by a responsible person who had determined that the stability of the crane is not thereby endangered and that various parts of the crane will no be overstressed.
4. At all times the operator must avoid carrying loads over people.
5. The load must not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.
6. When two or more cranes are used to lift a load one qualified responsible person shall be in charge of the operation. That person must analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.
7. Make sure the sling is well balanced. Avoid tip loading, and loading on hook latch.
8. Never lift the load over the rated capacity.
9. Do not operate with kinked, twisted or damaged chain.
10. Never leave the suspended load unattended.
11. Holding brakes on hoists shall be applied automatically when power is removed.
12. A drag brake (a brake which provides retarding force without external control) may be applied to hold the trolley in a desired position on the bridge and to eliminate creep with the power off.
13. Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a wire rope manufacturer due to actual working condition requirements.
14. If a load is supported by more than one part of rope, the tension in the parts shall be...
equalized.

15. Hooks shall meet the manufacturer's recommendations and shall not be overloaded.

4.3 Rigging Safety Tips

1. Accurately determine the weight of the load. Do not guess.
2. Determine the proper size for slings and components
3. Do not use manila rope for rigging
4. Do not use slings, eye bolts, shackles, or hooks that have been cut, welded, or brazed
5. Determine the center of gravity and balance the load before moving it
6. Initially lift the load only a few inches to test the rigging and balance
7. Loads should be well secured.
8. Slings should be adequate to the task.
9. Slings should be un-kinked and load balanced and secured.
10. No sudden stops.
11. No loose items on load or crane before lift.
12. Bumping into runway stops is prohibited.
13. Hoist line must be vertical prior to the lift (remove slack in the hoist slowly).

4.4 Rope must be secured to drum as follows:

1. No less than two wraps of rope shall remain on the drum when the hook is in its extreme low position.
2. Rope end shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer
3. Rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope. Spacing and number of all types of clips shall be in accordance with the clip manufacturer's recommendation. Clips shall be drop-forged steel in all sizes manufactured commercially. When a newly installed rope has been in operation for an hour, all nuts on the clip bolts shall be retightened.
5.0 HANDLING THE LOAD

➢ **Size of load** - The crane shall not be loaded beyond its rated load except for test purposes as provided in the Rated Load Test section

➢ **Attaching the load**

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

➢ **Moving the load**

  - The load shall be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches
  - Before starting to hoist the following conditions shall be noted:
    - Hoist rope shall not be kinked
    - Multiple part lines shall not be twisted around each other
    - The hook shall be brought over the load in such a manner as to prevent swinging

➢ **During hoisting care shall be taken that:**

  - There is no sudden acceleration or deceleration of the moving load
  - The load does not contact any obstructions
  - While any employee is touching the load or hook, there shall be no hoisting, lowering, or traveling
  - Operators shall avoid carrying loads over people
  - The operator shall test the brakes each time a load approaching the rated load is handled. The brakes shall be tested by raising the load a few inches and applying the brakes
  - The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum
  - The employer shall insure that the operator does not leave his position at the controls while the load is suspended
  - When starting the bridge and when the load or hook approaches near or over personnel, the warning signal shall be sounded
• The hoist limit switch which controls the upper limit of travel of the load block shall never be used as an operating control

• Hand Signals

• Audible and discernible voice communication should be kept with the operator at all times. If this cannot be accomplished, a signal system familiar to both the operator and the assistor should be understood and agreed upon. Standard signals used in industry are shown below.
6.0 INSPECTION, TESTING, AND MAINTENANCE

6.1 General Inspection Guidelines

1. As defined by OSHA “frequent” inspections are daily to monthly inspections dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction.

2. As defined by OSHA “periodic” inspections are 1 to 12 month intervals.

3. All new and altered cranes, prior to initial use must be inspected to insure compliance with the provisions of this section.

4. The wearing surface of all holding-brake drums or discs shall be smooth.

5. The wearing surface of all brake drums or discs shall be smooth.

6. Where multiple conductor cable is used with a suspended pushbutton station, the station must be supported in some satisfactory manner that will protect the electrical conductors against strain.

7. Pendant control boxes must be clearly marked for identification of functions.

8. Electrical equipment must be so located or enclosed that live parts will not be exposed to accidental contact under normal operating conditions.

9. Electric equipment must be protected from dirt, grease, oil, and moisture.

10. Pendant control stations shall be kept clean and function labels kept legible.

11. Guards must be securely fastened.

12. Sheave grooves shall be smooth and free from surface defects which could cause rope damage.

6.2 Daily Inspection (or inspection before each daily use) Guidelines:

1. Make sure that all functional operating mechanisms used for maladjustment are not interfering with proper operation.

2. Deterioration or leakages in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems.

3. Visually inspect hooks for deformation or cracks.

4. Visually inspect hoist chains, including end connections, for excessive wear, twist, distorted links that may interfere with proper function, or stretch beyond manufacturer's recommendations.

6.3 Monthly Inspection Guidelines:

1. Hooks must be inspected for deformation or cracks; these inspections must be recorded with information which includes the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the hook inspected.
a. Hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10° twist from the plane of the unbent hook showing these defects shall be discarded. Repairs by welding or reshaping are not generally recommended.

2. Visually inspect hoist chains, including end connections, for excessive wear, twist, distorted links that may interfere with proper function, or stretch beyond manufacturer’s recommendations. A record must be kept of this inspection which shall include the date of inspection, the signature of the person who performed the inspection and an identifier of the chain which was inspected.

3. Inspect all functional operating mechanisms for excessive wear of components.

4. Rope reeving per manufacturer’s recommendations for noncompliance.

5. A thorough inspection of all ropes shall be made at least once a month.

6.4 Annual Inspection Guidelines (listed are dependent upon use and wear, may need to be inspected monthly depending):

1. Deformed, cracked, or corroded members

2. Loose bolts or rivets

3. Cracked or worn sheaves and drums

4. Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices

5. Excessive wear on brake system parts, linings, pawls, and ratchets.

6. Load, wind, and other indicators over their full range, for any significant inaccuracies

7. Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements

8. Excessive wear of chain drive sprockets and excessive chain stretch

9. Electrical apparatus, for signs of pitting or any deterioration of controller contactors, limit switches and pushbutton stations

6.5 Cranes Not In Regular Use:

1. A crane which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with the requirements of a daily inspection before operating.

2. A crane that has been idle for a period of over 6 months shall be given a complete inspection meeting the requirements of a daily, monthly, and wire rope inspection before operating.

3. Standby cranes shall be inspected at least semi-annually in accordance with the frequent inspection requirements and wire rope inspection requirements.
6.6 Sling Inspection:

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

6.7 Rope Inspection

- **Running Ropes:**
  - A thorough inspection of all ropes shall be made at least once a month and a certification record which includes the date of inspection, the signature of the person who performed the inspection and an identifier for the ropes which were inspected shall be kept on file where readily available to appointed personnel
  - Any deterioration, resulting in appreciable loss of original strength, shall be carefully observed and determination made as to whether further use of the rope would constitute a safety hazard. Some of the conditions that could result in an appreciable loss of strength are the following:
    - Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires
    - A number of broken outside wires and the degree of distribution or concentration of such broken wires
    - Worn outside wires
    - Corroded or broken wires at end connections
    - Corroded, cracked, bent, worn, or improperly applied end connections
    - Severe kinking, crushing, cutting, or unstranding
Other ropes:

- All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given a thorough inspection before it is used.
- This inspection shall be for all types of deterioration and shall be performed by an appointed person whose approval shall be required for further use of the rope. A certification record shall be available for inspection which includes the date of inspection, the signature of the person who performed the inspection and an identifier for the rope which was inspected.

Additional Requirements for Crawler/Wheel Mounted Crane Use

The margin of stability for determination of load ratings, with booms of stipulated lengths at stipulated working radii for the various types of crane mountings, is established by taking a percentage of the loads which will produce a condition of tipping or balance with the boom in the least stable direction, relative to the mounting. The load ratings must not exceed the following percentages for wheel mounted cranes, with the indicated types of mounting under conditions stipulated in the paragraphs below the following chart:

<table>
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<tr>
<th>Type of Crane Mounting</th>
<th>Maximum Load Ratings (Percent of Tipping Loads)</th>
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<tr>
<td>Locomotive, without outriggers:</td>
<td></td>
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<tr>
<td>Booms 60 feet or less</td>
<td>(1) 85</td>
</tr>
<tr>
<td>Booms over 60 feet</td>
<td>(1) 85</td>
</tr>
<tr>
<td>Locomotive, using outriggers</td>
<td>80</td>
</tr>
<tr>
<td>Crawler, without outriggers</td>
<td>75</td>
</tr>
<tr>
<td>Crawler, using outriggers</td>
<td>85</td>
</tr>
<tr>
<td>Truck and wheel mounted without outriggers or using outriggers fully extended</td>
<td>85</td>
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1. Unless this results in less than 30,000 pound-feet net stabilizing moment about the rail, which must be minimum with such booms.

Stipulations governing the application of the values in the chart found above for crawler, truck, and wheel-mounted cranes must be in accordance with Crane Load-Stability Test Code, Society of Automotive Engineers (SAE) J765.

The effectiveness of these preceding stability factors will be influenced by such additional factors as freely suspended loads, track, wind, or ground conditions, condition and inflation of rubber tires, boom lengths, proper operating speeds for existing conditions, and, in general, careful and competent operation. All of these must be taken into account by the user.

"Load rating chart." A substantial and durable rating chart with clearly legible letters and figures must be provided with each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at his control station.
7.0 TESTING

7.1 Operational Test:

- Prior to initial use all new and altered cranes shall be tested to insure compliance with this section including the following functions:
  - Hoisting and lowering
  - Trolley travel
  - Bridge travel
  - Limit switches, locking and safety devices

- The trip setting of hoist limit switches shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit switch shall be located so that it will trip the switch, under all conditions, in sufficient time to prevent contact of the hook or hook block with any part of the trolley.

7.2 Rated Load Test:

- Test loads shall not be more than 125 percent of the rated load unless otherwise recommended by the manufacturer. The test reports shall be placed on file where readily available to appointed personnel.

7.3 Maintenance

- Preventative Maintenance
- A preventive maintenance program based on the crane manufacturer's recommendations shall be established & followed by departments using cranes.

- Before adjustments and repairs are started on a crane the following precautions shall be taken:
  - The crane to be repaired shall be positioned in a location where it will cause the least interference with other cranes and operations in the area
  - All controllers shall be at the off position
  - The main or emergency switch shall be open and locked in the open position
  - Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor or surface level
  - Where other cranes are in operation on the same runway, rail stops or other suitable means shall be provided to prevent interference with the idle crane.
  - After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated and maintenance equipment removed.

Revised on 12/21/2007
7.4 Adjustments and Repairs

- Any unsafe conditions disclosed by the inspection requirements shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel or by a contractor with experience adjusting and repairing that specific type crane or hoist.

- All adjustments shall be maintained to assure correct functioning of components. The following are examples:
  - All functional operating mechanisms
  - Limit switches
  - Control systems
  - Brakes
  - Power plants

- Cranes needing to have any critical component repaired or replaced must not be used.

- Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples:
  - Crane hooks showing deformation or cracks or hooks having more than 15 percent in excess of normal throat opening or more than 10< twist from the plane of the unbent hook shall be discarded. Repairs by welding or reshaping are not generally recommended.
  - Load attachment chains and rope slings showing defects described as followed: hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations
  - All critical parts which are cracked, broken, bent, or excessively worn

7.5 Required Inspections

All cranes must be inspected prior to initial use, prior to each days use, frequently, and periodically.

All new and altered cranes must be inspected prior to initial use. The inspection will insure that the crane meets all applicable manufacturer, ANSI, and OSHA requirements. Use Appendix A, B & C criteria and the manufacturer’s recommendations when performing crane inspections.

Using the checklist found in Appendix A, all cranes must receive an inspection prior to each days use.

All cranes must receive an inspection at least annually using the checklist found in Appendix C. Any deficiencies must be corrected prior to use.
<table>
<thead>
<tr>
<th>Required - Select the Appropriate Frequency for Frequent Inspections, Based Upon Crane Use:</th>
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</thead>
<tbody>
<tr>
<td><strong>Monthly</strong> - Cranes in regular use (those used at least once a month) must be inspected at least monthly using the checklist found in Appendix B. Any deficiencies must be corrected prior to use.</td>
</tr>
<tr>
<td><strong>Prior to Use</strong> - A crane which has been idle for a period of 1 month or more, but less than 6 months, must be inspected using the checklist found in Appendix B before being placed into service.</td>
</tr>
<tr>
<td><strong>Combo, Prior to Use</strong> - All cranes that have been idle for a period of 6 months or longer must receive an inspection using the checklists found in Appendices B &amp; C prior to being placed into service. Any deficiencies must be corrected prior to placing the crane into service.</td>
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</tbody>
</table>
8.0 TRAINING

Only designated trained persons are allowed to operate a crane.

Training for designated crane operators must consist of a review of this program and manufacturer information related to the specific equipment being used and all of the following requirements:

8.1 Handling the Load

- The crane must not be loaded beyond its rated load except for test purposes as instructed by the manufacturer.
- Hoist chains or ropes must be free from kinks or twists and must not be wrapped around the load.
- The load must be attached to the load block hook by means of slings or other approved devices.
- For crawler and wheel mounted cranes – when loads that are limited by structural competence rather than by stability are to be handled, it must be ascertained that the weight of the load has been determined within plus or minus 10% before it is lifted.

8.2 Moving the Load – Overhead and Gantry Cranes

- The load must be well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches.
- Before starting to hoist a load the following conditions must be met:
  - Hoist rope must not be kinked.
  - Multiple part lines must not be twisted around each other.
  - The hook must be brought over the load in such a manner as to prevent swinging.
- During hoisting care must be taken so that:
  - There is no sudden acceleration or deceleration of the moving load.
  - The load does not contact any obstructions.
- Cranes must not be used for side pulls except when specifically authorized by a responsible person who has determined that the stability of the crane is not thereby endangered and that various parts of the crane will not be overstressed.
- While any employee is on the load or hook, there must be no hoisting, lowering, or traveling.
- Do not carry loads over people.
- Do not leave the controls when the load is suspended.
The brakes must be tested each time a load approaching the rated load is handled. The brakes must be tested by raising the load a few inches and applying the brakes.

The load must not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.

When the load or hook approaches personnel, the warning signal must be sounded.

8.3 Moving the Load – Crawler & Wheel Mounted Cranes

Ensure that:

- The crane is level and where necessary blocked properly
- The load is well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches

Before starting to hoist, the following conditions must be noted:

- Hoist rope must not be kinked
- Multiple part lines must not be twisted around each other
- The hook must be brought over the load in such a manner as to prevent swinging

During hoisting care must be taken that:

- There is no sudden acceleration or deceleration of the moving load
- The load does not contact any obstructions
- Side loading of booms must be limited to freely suspended loads. Cranes must not be used for dragging loads sideways.
- No hoisting, lowering, swinging, or traveling must be done while anyone is on the load or hook.
- On truck-mounted cranes, no loads must be lifted over the front area except as approved by the crane manufacturer.
- The operator must test the brakes each time a load approaching the rated load is handled by raising it a few inches and applying the brakes.

Outriggers must be used when the load to be handled at that particular radius exceeds the rated load without outriggers as given by the manufacturer for that crane. Where floats are used they must be securely attached to the outriggers.

Wood blocks used to support outriggers must:

- Be strong enough to prevent crushing
- Be free from defects
- Be of sufficient width and length to prevent shifting or toppling under load
- Neither the load nor the boom must be lowered below the point where less than two full
wraps of rope remain on their respective drums

- Before lifting loads with locomotive cranes without using outriggers, means must be applied to prevent the load from being carried by the truck springs
- When two or more cranes are used to lift one load, one designated person must be responsible for the operation. He must be required to analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made

**In transit the following additional precautions must be exercised:**

- The boom must be carried in line with the direction of motion
- The superstructure must be secured against rotation, except when negotiating turns when there is an operator in the cab or the boom is supported on a dolly
- The empty hook must be lashed or otherwise restrained so that it cannot swing freely
- Before traveling a crane with load, a designated person must be responsible for determining and controlling safety. Decisions such as position of load, boom location, ground support, travel route, and speed of movement must be in accord with his determinations
- A crane with or without load must not be traveled with the boom so high that it may bounce back over the cab
- When rotating the crane, sudden starts and stops must be avoided. Rotational speed must be such that the load does not swing out beyond the radii at which it can be controlled. A tag or restraint line must be used when rotation of the load is hazardous
- When a crane is to be operated at a fixed radius, the boom-hoist pawl or other positive locking device must be engaged
- Ropes must not be handled on a winch head without the knowledge of the operator
- While a winch head is being used, the operator must be within convenient reach of the power unit control lever

**8.4 Hoist Limit Switch**

- At the beginning of each operator’s shift, the upper limit switch of each hoist must be tried out under no load. Extreme care must be exercised; the block must be “inched” into the limit or run in at slow speed. If the switch does not operate properly, the appointed person (supervisor) must be immediately notified, and the crane is not to be operated until repaired.
- The hoist limit switch which controls the upper limit of travel of the load block must never be used as an operating control.
8.5 Holding the Load – Crawler & Wheel Mounted Cranes

- The operator must not be permitted to leave his position at the controls while the load is suspended.
- No person should be permitted to stand or pass under a load on the hook.
- If the load must remain suspended for any considerable length of time, the operator must hold the drum from rotating in the lowering direction by activating the positive controllable means of the operator's station.

8.6 Other Training Content

- Crane operators that have access to a fire extinguisher must receive “Fire Extinguisher Training” from a qualified person.
- Refueling of crawler & wheel mounted cranes, using small portable containers, must be done with an approved safety type can equipped with an automatic closing cap and flame arrester. Cranes must not be refueled while the engine is running.
- Training must be documented by creating a training record that contains the name and ID number of the trained individuals, the date of training, and the name and signature of the competent person providing the training. Only the most current training records need be retained.
- All operations near overhead lines must be done in accordance with 29 CFR 1910.333(c)(3) requirements – workers must be trained accordingly.
9.0 RECORDKEEPING

Records must be kept for all cranes, hoist, and rigging equipment maintenance and inspections; these records are to be maintained by each department conducting the inspections for a period no less than 3 years. Training records and a list of “qualified operators” will be maintained by the Environmental Health and Safety Office for a period no less than 3 years.
10.0 GLOSSARY

**Automatic Crane** - a crane which when activated operates through a preset cycle or cycles.

**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.

**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 conductor** - electrical conductors located along the bridge structure of a crane to provide power to the trolley

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

**Bumper** - is an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel; or when two moving cranes or trolleys come in contact

**Control braking means** - a method of controlling crane motor speed when in an overhauling condition

**Designated person** - selected or assigned by the employer or the employer’s representative as being qualified to perform specific duties

**Drag brake** - is a brake which provides retarding force without external control

**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

**Holding brake** - a brake that automatically prevents motion when power is off

**Hoist** - an apparatus, which may be part of a crane, exerting a force for lifting or lowering
**Overhead crane** - means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

**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.

**Pulpit-operated crane** - is a crane operated from a fixed operator station not attached to the crane.

**Puller winch** - a power driven spool for handling loads by means of friction between fiber or wire rope and spool

**Rated capacity** - the amount of weight that the crane can safely handle

**Remote-operated crane** - is a crane controlled by an operator not in a pulpit or in the cab attached to the crane, by any method other than pendant or rope control.

**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

**Standby crane** - a crane which is not in regular service but which is used occasionally or intermittently as required

**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
APPENDIX A

DAILY CRANE INSPECTION CHECKLIST

(Prior to Each Daily Use)

Date ___________________ Time ____________ Inspector ____________________

Crane (Make, Model & SN) ______________________________

Location ____________________________

<table>
<thead>
<tr>
<th>Item</th>
<th>Pass</th>
<th>Fail</th>
<th>Action Taken</th>
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</thead>
<tbody>
<tr>
<td>1. Check functional operating / control mechanisms for maladjustment.</td>
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<tr>
<td>2. All control mechanisms for contamination.</td>
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<tr>
<td>3. Check for deterioration or leakage in lines, tanks, valves,</td>
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<td>drain pumps, and other parts of air or hydraulic systems.</td>
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<tr>
<td>4. Visually inspect hooks for deformation and cracks. Hooks</td>
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<td>having a throat opening in excess of 15% of what it should be,</td>
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<td>and/or more than a 10 degree twist from the plane of the unbent</td>
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<td>hook need to be replaced.</td>
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<tr>
<td>5. Visually check hoist chains, including end connections, for</td>
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<tr>
<td>excessive wear, twist, distorted links interfering with proper</td>
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<td>function, or stretch beyond manufacturer’s recommendations.</td>
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<tr>
<td>6. Utilizing item 6 from the Appendix B form, perform a thorough</td>
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<tr>
<td>inspection of any running ropes that have been idle for a period</td>
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<td>of one or more months.</td>
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</table>
### APPENDIX B

**FREQUENT CRANE INSPECTION CHECKLIST**

Date ___________________ Time ____________ Inspector ____________________

<table>
<thead>
<tr>
<th>Item</th>
<th>Pass</th>
<th>Fail</th>
<th>Action Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All control mechanisms for excessive wear of components</td>
<td></td>
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</tr>
<tr>
<td>2. Check hooks for cracks and a throat opening in excess of 15% of what it should be, and/or more than a 10 degree twist from the plane of the unbent hook. (Keep track of what hooks have been inspected using the form in Appendix D).</td>
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<tr>
<td>3. Check hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer’s recommendations. (Keep track of what hooks have been inspected using the form in Appendix D).</td>
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<tr>
<td>4. Check all functional operating mechanisms for excessive wear of components</td>
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<tr>
<td>5. Check rope reeving for noncompliance with manufacturer’s recommendations.</td>
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<tr>
<td>6. Perform a thorough inspection of all running ropes. Any deterioration, resulting in appreciable loss of original strength, must be carefully observed and determination made as to whether further use of the rope would constitute a safety hazard. (Keep track of what hooks have been inspected using the form in Appendix D).</td>
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<tr>
<td>Some of the conditions that could result in an appreciable loss of strength are the following:</td>
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<tr>
<td>I. Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.</td>
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<tr>
<td>II. A number of broken outside wires and the degree of distribution or concentration of such broken wires.</td>
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<td>III. Worn outside wires.</td>
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<tr>
<td>IV. Corroded or broken wires at end connections.</td>
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<tr>
<td>V. Corroded, cracked, bent, worn, or improperly applied end connections.</td>
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<tr>
<td>VI. Severe kinking, crushing, cutting, or unstranding.</td>
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<tr>
<td>7. All safety devices for malfunction.</td>
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<tr>
<td>8. Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation.</td>
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</table>
## APPENDIX C
### PERIODIC CRANE INSPECTION CHECKLIST

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Inspector</th>
<th>Crane (Make, Model &amp; SN)</th>
<th>Location</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Pass</th>
<th>Fail</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deformed, cracked, or corroded members.</td>
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<tr>
<td>2. Loose bolts or rivets.</td>
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<td>3. Cracked or worn sheaves and drums.</td>
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<td>4. Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.</td>
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<tr>
<td>5. Excessive wear on brake (and clutch) system parts, linings, pawls, and ratchets.</td>
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<tr>
<td>6. Load, (boom angle), wind, and other indicators over their full range, for any significant inaccuracies.</td>
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<tr>
<td>7. Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements.</td>
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<tr>
<td>8. Excessive wear of chain drive sprockets and excessive chain stretch.</td>
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<tr>
<td>9. Electrical apparatus, for signs of pitting or any deterioration of controller contractors, limit switches and pushbutton stations,</td>
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<tr>
<td>10. (Travel, steering, braking, and locking devices for malfunction, and tires for excessive wear.)</td>
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</table>

Note: Items in parenthesis apply only to locomotive, crawler and wheel mounted cranes.

Revised on 12/21/2007
<table>
<thead>
<tr>
<th>Date</th>
<th>Item (hook, rope, etc.)</th>
<th>Serial Number or other identifier</th>
<th>Signature of inspector</th>
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</thead>
<tbody>
<tr>
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APPENDIX E
SHEAVE & ROPE INSPECTION GUIDANCE

The following requirements have been obtained from 29 CFR 1910. Additional inspection criteria must be included to the inspection regimen based upon manufacturer recommendations.

SHEAVES

- Sheave grooves must be smooth and free from surface defects which could cause rope damage.
- Sheaves carrying ropes which can be momentarily unloaded must be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.
- The sheaves in the bottom block must be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with ropes loose.
- Pockets and flanges of sheaves used with hoist chains must be of such dimensions that the chain does not catch or bind during operation.
- All running sheaves must be equipped with means for lubrication. Permanently lubricated, sealed and/or shielded bearings meet this requirement.

ROPES

- In using hoisting ropes, the crane manufacturer’s recommendations must be followed. The rated load divided by the number or parts of rope must not exceed 20% of the nominal breaking strength of the rope.
- Rope must not be secured to the drum as follows:
  - No less than two wraps of rope must remain on the drum when the hook is in its extreme low position.
  - The rope end must be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer.
- Rope clips attached with U-bolts must have the U-bolts on the dead or short end of the rope (“never saddle a dead horse”). Spacing and number of all types of clips must be in accordance with the clip manufacturer’s recommendations. Clips must be drop-forged steel in all sizes manufactured commercially.
- Swaged or compressed fittings must be applied as recommended by the rope or crane manufacturer.
- Heavy wear and/or broken wires may occur in sections in contact with equalizer sheaves or other sheaves where rope travel is limited, or with saddles. Particular care must be taken to inspect ropes at these locations.
- Particular care must be taken when inspecting non-rotating rope.