# Purpose

This Crane and Rigging Standard Operating Procedure is to establish safe work practices and inspection procedures to help ensure that the operation of overhead cranes, as well as the contractor community, are protected from potential hazards associated with the movement of equipment and material using a crane, hoist, rigging and related equipment.

# Scope

This procedure applies to all Clemson employees, all contractors and vendors performing work on company property, and all other individuals who are visiting or have business with our university. *All cranes in our facility will comply with this procedure.*

## Reference Standard

Occupational Safety and Health Administration: 1910.179

# Responsibilities

Management is responsible for the annual review, scheduling employee training, and enforcement of this program.

Employees shall comply with all procedures outlined in this policy.

Contractors and vendors shall comply with all procedures outlined in this policy when authorized to use Clemson equipment.

# Definitions

Bridge: The part of the crane that carries the trolley and that is supported on both ends by a runway.

Contractor: A non-company employee being paid to perform work in our facility.

Crane: A machine for lifting and lowering a load and moving it horizontally, with an integral hoisting mechanism.

Hoist: The device that lifts and lowers a load.

Load block: The assembly that is used as the attachment point for the load to be lifted.

Overhead crane: A crane with a moveable bridge carrying a movable or fixed hoisting mechanism and traveling overhead on a fixed runway structure, commonly called a bridge crane.

Runway: Rails or other framework on which the crane or trolley travels.

Trolley: The part of the crane that carries the hoist.

Critical Lift Plan: A plan that is developed when a lift meets certain criteria. (See below Critical Lift Plan Parameters Section)

# Procedure

## General Requirements

* Crane and hoist modifications will only be made as follows:
  + When permitted by the crane manufacturer
  + Using components supplied by or approved by the manufacturer
  + By personnel who are qualified to perform the modification
* Modified cranes and hoists will be tested prior to being returned to service
* All cranes and hoists will be marked with their rated load. Cranes will be marked on both sides. Hoists will have the load block marked with the rated load.
* Only trained and authorized (designated) personnel are permitted to operate cranes and hoists
* All cranes with a power traveling mechanism that are not floor operated will be equipped with an automatic warning device to warn of bridge or trolley travel
* Load hooks equipped with a safety catch (gate) will be maintained and used to assure safe lifting.
* Any crane or hoist that is found to be defective, damaged or not properly operating, will be immediately removed from service
* At no time will the maximum rated load of a crane or hoist be exceeded.

# Crane Inspections

## Before Use Inspection / Frequent Inspection

Prior to each use the crane operator will inspect and document the below items: (Crane inspection data sheet used)

Visually examine the crane and/or hoist to check for damage or missing parts including:

1. hooks
2. chains and wire rope
3. hydraulic and/or pneumatic components, if present

Test all functional mechanisms for improper adjustment

Test the function of the upper load limit switch

Assure operation of all controls

## Periodic Inspection

On an *annual* basis, or if the crane has not been used within 6 months, a written inspection will be conducted by a qualified contractor or an employee qualified by training and/or experience, and consisting of:

1. all elements listed under Frequent Inspection
2. deformed, cracked or corroded parts
3. loose bolts or rivets
4. cracked or worn sheaves or drums
5. excessive wear on brake system parts
6. load, Wind and other indicators over their entire functional range
7. power plants including conformance to safety standards
8. excessive wear of chain drive sprockets
9. excessive chain elongation (stretch)
10. electrical components
11. control components
12. additional inspection elements as required by the crane or hoist manufacturer

# Crane and Hoist Operation

## General Safety Requirements

* Read the manufacturer’s general safety instructions
* Perform and document a visual inspection prior to each use in the crane log
* Only trained and authorized personnel will operate cranes and hoists
* The operator is responsible for the safety of other personnel and material in the immediate location of the lift
* The operator will communicate crane and hoist movement to others in the area who may be affected
* Sound the warning signal when approaching personnel
* Cranes will not be used to lift personnel unless the crane is approved for that service and an approved personnel cage or basket is used
* The maximum load rating is not to be exceeded
* The set down point of the load should be clear of any obstructions
* The path of the lift should be clear to avoid any collisions

## Operation

* The hoist chain or rope will be maintained free of kinks and knots and should not be in contact with the load
* Use only designed and rated slings and lifting devices that have been inspected prior to use
* The load will be attached by means of slings, chains or other lifting devices specifically designed for this purpose
* The load will be secure and balanced with the hook at or near the balance point of the load (center of gravity)
* The sling, chains and other lifting devices will not be twisted upon themselves and/or with the hoist chain/rope
* No personnel will place any body part under a suspended load
* A suspended load will never be lifted over people
* Loads will be moved with fluid motions avoiding sudden accelerations or stops
* Side pulls are not allowed
* Do not use limit switches to stop crane or hoist motion: use the controls
* Test hoist breaks whenever lifting a load approaching maximum capacity: lift the load a few inches and stop motion with the brakes
* If a load starts to slip or fall do not try to stop it: get to a safety area away from the drop zone
* When two or more cranes are used in one lift, a certified crane operator will oversee the operation
* A load will not remain suspended without the crane operator being at the controls

# General Rigging Safety Requirements

* Rigging a load greater than 10 tons must be performed by a designated employee who is a level II qualified rigger.
* Rigging must be in satisfactory condition based on a pre-operation inspection.
* Defective equipment must be immediately removed from service and evaluated further for repair or destroyed.
* The load capacity limits must be legible and affixed to all rigging components; else the rigging component is considered damaged.

## Types of Defective Slings

The following types of slings must be placed out of service if there is any indication of potential damage or defect or if any of the following exist:

a) Synthetic Slings:

* Damage including burns, discoloration, snags, holes, tears, cuts and abrasive wear.
* Broken or worn stiches
* Fittings that are corroded, distorted or damaged
* Knotting of the sling
* Any other visible defect that may compromise the integrity of the sling

b) Wire rope slings:

* Kinking, crushing, bird-caging, or other distortion
* Cracks, deformation, worn end attachments
* Six broken strands in a rope lay
* Hooks opened more than 15% at throat
* Twisted hooks greater than 10 degrees from the plane

c) Alloy steel chain slings:

* + - Cracked, bent, or elongated links or components
    - Not appropriately labeled, or inspected
    - Large gouges or nicks that effect the integrity of the sling

## Requirements of Rigging a Load

Rigging a load for transport or hoisting is one of the most important components of a successful lift. A successful lift is contingent on proper planning, communication, and rigging.

Operators shall do the following when rigging a load:

* + 1. Determine the weight of the load through measurement or calculation
    2. Determine the proper size for slings and components
    3. Make sure that shackle pins and eye bolts are installed to manufacturer’s specifications.
    4. Use “softeners” to protect slings from sharp edges
    5. When synthetic slings are used with a shackle, softeners are recommended to protect the sling when potential for contact with the pin end
    6. Remember that machinery foundations or angle-iron edges may not feel sharp to the touch but will cut into rigging under several tons of load. Wood, tire rubber, or other pliable materials are suitable for padding
    7. Do not use slings, eye bolts, shackles, or hooks that have been cut, welded, brazed, or altered
    8. Estimate the center of gravity and initially lift the load only a few inches to test the rigging and balance
    9. Tag lines should be used to control the load as necessary for maneuvering
    10. Shackle pins are to be screwed completely into the shackle
    11. Shackle to shackle connections must be connected bow to bow or bow to pin.

# Critical Lift Plan Parameters

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| A | A lift requires more than one hook be used due to magnitude of load. |
| B | A lift contained within a tight space or congested area. |
| C | Personnel in cages/man baskets attached to equipment not designed for the explicit purpose of lifting people. |
| D | Material requiring special handling, non-standard rigging or is of high monetary value. |
| E | A lift to remove an item from a previously attached position. (Test rig mechanical interfaces such as: main shaft adapter, tower base, shafts, gearbox etc.) |
| F | When lift is > 90% of rated crane load. |
| G | Material requiring special handling (e.g. dangerous goods, size/shape, requires non‐ standard rigging, or is of high monetary value) |
| H | Travelling with load greater than 60% of crane capacity, or as recommended by the manufacturer. |

# Forms

[Frequent Inspection Form](https://clemson.sharepoint.com/teams/SafetySteeringCommitee/Shared%20Documents/Safety%20System%20Documents/Safety%20Policies%20and%20Programs/F-056-EIC%20Crane%20Inspection%20Checklist.docx)

[Critical Lift Plan](https://clemson.sharepoint.com/teams/SafetySteeringCommitee/Shared%20Documents/Safety%20System%20Documents/Safety%20Policies%20and%20Programs/F-057-EIC%20Critical%20Lift%20Plan.docx)

# Revision History

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| --- | --- | --- | --- | --- |
| Revision | Date | Summary of change | Author | Approver |
| A | 23 JUN 2020 | Initial issue | Kurt Rayburg  J. Curtiss Fox | Kurt Rayburg  Randy Collins  J. Curtiss Fox  Tom Salem  Jesse Leonard  Jim Tuten  Nancy LaFlair  Konstantin Bulgakov |
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