Sanford Underground Research Facility

South Dakota Science and Technology Authority

Cranes and Hoists Standard

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Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
01	8/8/2023	NA	NA	Initial Release	CCR 792
02	4/30/2024	1, 4, 5 & 6	4.1, 4.1.11, 4.2.4, 4.10, 5.3, 5.6, 5.7, 6.2, 6.3 & 6.7-6.11	Added responsibilities for Master Rigger, added inspection content, and added statement on signage	CCR 940

1.0 Purpose

The purpose of this standard is to ensure that all hoisting and rigging equipment, design, installation, inspection, testing, and operations activities shall be managed to protect workers against associated hazards.

South Dakota Science and Technology Authority (SDSTA) references the following to fulfill this standard:

- 29 CFR 1910, Subpart N, OSHA General Industry Standards - Materials Handling and Storage.
- 29 CFR 1926 Subpart N, OSHA Construction Standard - Helicopters, Hoists, Elevators, and Conveyers
- OSHA 29 CFR 1926.1431(k)-(o).

2.0 Scope

This standard applies to all personnel and equipment used to perform any crane and hoist activity at Sanford Underground Research Facility (SURF).

3.0 Definitions

Annual Inspection — A formal process which evaluates operational status of equipment. See ESH-(10000-A)- 207753 Crane Operators Inspection Table.

Certified Inspector — A person who has successfully passed a commercially recognized training course providing certification.

Competent Person — A person capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Crane — A device for lifting and lowering a load and moving it horizontally. Cranes may be driven manually, by power, or by a combination of both.

Critical Lift — Any load requiring exceptional care in handling. For example:

- Safety concerns.
- Size or shape.
- Weight which exceeds 75% of the rated load.
- Close-tolerance installation.
- High susceptibility to damage.
- High value or potential impact of a high value item.
- Impact to operations (budget, schedule).
- Load out of view of the crane operator.
- Potential release of hazardous material into the environment.
- Hoisting of personnel from an overhead crane.
- Single lift involving multiple cranes, or other unusual factors.

Fall Zone — The area where it is reasonably foreseeable that a partially or completely suspended material(s) could fall in the event of a failure. Including:

- The area directly beneath the load.
- The strike/impact zone and the resulting tip radius.
- The secondary effects of the load impacting anything unrelated to the lift which in turn may create a larger exposure zone.

Frequent Inspection (Daily) — An undocumented visual inspection conducted before each use. See Crane Operators Inspection Table.

Hoist — A mechanical device that is used for lifting or lowering a freely suspended load. Hoists may be integral to a crane or mounted in an affixed position, permanently or temporarily. Hoists may be hand-operated, air, or electric powered. Hoisting devices may include the following: Hoist, cranes, winches, tuggers and come-a-longs.

Incidental Operator — Non-SDSTA personnel who operate SDSTA lifting devices or an SDSTA employee who operates a lifting device not owned or managed by SDSTA.

Inspection — An assessment of the condition of equipment to assure its ability to perform intended tasks. Inspection frequency and schedule are outlined in Crane Operators Inspection Table.

Load — The total weight superimposed on the load block or hook. This includes not only the material being lifted but also all the rigging equipment necessary to attach the load to the load block; i.e., lines, shackles, rigging, etc.

Modified — A variation or alteration that changes the original configuration of the crane or adds other features not originally installed with the crane and impacts the crane's lifting capacity or load bearing components.

Mobile Crane — A cable-controlled crane mounted on crawlers or rubber-tired carriers. May consist of a fixed length boom, telescopic or lattice extensions, capable of being moved between operating locations by transport over the road.

Overhead/Bridge Crane — A crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

Periodic Inspection — Includes monthly and annual inspection requirements. See Crane Operators Inspection Table.

Person-in-Charge — A qualified person appointed to be responsible for the safe execution of a critical lift.

Qualified Person — A person who, by possession of a recognized degree, certificate or professional standing, or who by extensive knowledge, training and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work or the project.

Qualified Operator — A person who has successfully completed the training requirements outlined in this standard. Licensing or certification is required for mobile cranes with a lifting capacity above 2,000 lbs.

Qualified Rigger — An individual responsible for rigging activities associated with a critical lift. One who has extensive experience, knowledge, or possess a recognized degree or certificate.

Rated Load — The posted maximum load designated by the manufacturer for which a crane or individual hoist is designed and built. This load shall not exceed 80% of the rated load test or manufacturer's specification, whichever is less.

Rated Load Test — A formal process utilizing a known weight to evaluate both the hoisting device and supporting structure capability to safely establish the rated load.

Suspended Platform — An engineered designed conveyance which is attached below-the-hook. Serves as a Work Deck which may be raised and lowered by a crane.

4.0 Responsibilities

4.1. Director of Surface Operations and Utilities

- **4.1.1.** Provides oversight to the Rigging Specialist.
- **4.1.2.** Maintains inventory of all hoisting devices.
- **4.1.3.** Maintains load testing equipment.
- **4.1.4.** Completes and documents all required maintenance.
- **4.1.5.** Ensures annual inspections of hoisting devices are completed.
- **4.1.6.** Maintains records by third-party inspections.
- **4.1.7.** Establishes competency requirements for specific hoisting devices.
- **4.1.8.** Evaluate hoisting devices to ensure for safe operations.
- **4.1.9.** Maintains manuals and manufacturer information and records related to testing, lifting capacity, inspection, and repair of all hoisting devices.
- **4.1.10.** Selects a qualified contractor to perform annual inspections, testing, maintenance and repair of cranes as needed.
- **4.1.11.** Assists in an annual review of this standard.
- **4.1.12.** Designates qualified operators, certified inspectors and qualified riggers.

4.2. Certified Inspector

- **4.2.1.** Performs all periodic inspections on cranes and hoists.
- **4.2.2.** Performs the rated load test.
- **4.2.3.** Ensures that the inspection tag is completed and visible.
- **4.2.4.** Provides all results to the Director of Surface Operations and Utilities.

4.3. Rigging Specialist

- **4.3.1.** Provides oversight of all cranes, hoisting, rigging and system maintenance programs.
- **4.3.2.** Maintains certifications as crane inspector and master rigger.

4.4. Environment, Safety, and Health (ESH) Department

- **4.4.1.** Provides input regarding safety of operations.
- **4.4.2.** Coordinates and schedules training.
- **4.4.3.** Maintains training records.
- **4.4.4.** Issues critical lift permits.

4.4.5. Reviews critical lift plans and associated work planning and control (WPC) documents (ESH-(2000-S)-73320 Work Planning and Controls Standard)
4.4.6. Reviews hoisting operations for compliance with the requirements of this document.
4.4.7. Coordinates with the Surface Operations and Utilities Department for development and implementation of training needs.
4.4.8. Reviews and approves deviations from the requirements of this standard.
4.4.9. Reviews and approves suspended platform WPC documents (Director of ESH).

4.5. Engineering Department

4.5.1. Reviews and approves crane modifications.
4.5.2. Evaluates support structures for load capacity.
4.5.3. Provides consultation and design of all new hoisting devices that are attached to supporting structure. (The supporting structure must exceed the lifting capacity of the hoisting device.)
4.5.4. Arranges for initial inspection of all new, modified or re-installed cranes, hoists, and monorails that are attached to supporting structure.
4.5.5. Maintains documentation of all structural support evaluations and modifications.
4.5.6. Establishes the design criteria for suspended work platforms.
4.5.7. Completes the ESH-(10000-F)-152762 Load Test Form.

4.6. Supervisors

4.6.1. Ensure that personnel assigned to operate hoisting devices are competent or under supervision of a competent person.
4.6.2. Ensure that all hoisting devices within their areas of responsibility are inspected, tested, maintained, and repaired as required in this document.
4.6.3. Inspect all hoisting devices for defects prior to use.
4.6.4. Ensure that lift plans are submitted for all critical lifts.
4.6.5. Appoints a qualified Person-in-Charge for critical lifts.
4.6.6. Arranges for the monthly and annual inspections of the hoisting equipment within their work areas.

4.7. Person-In-Charge

4.7.1. Ensures that WPC documents have been developed and approved for critical lifts.
4.7.2. Ensures execution of the lift in accordance with WPC documents.
4.7.3. Maintains current rigger/crane training.

4.8. Qualified Operator

4.8.1. Executes the lift in accordance with the WPC documents.
4.8.2. Identifies hazards and mitigations associated with the task, including appropriate personal protective equipment (PPE).
4.8.3. Identifies trained individuals, if required, to participate in the lift. (The skill level of each participant in the lift shall be commensurate with the assigned duty).
4.8.4. Performs a pre-lift inspection that includes the following:

- Lift site location
- Crane inspection
- Below-the-hook devices
- Rigging

4.8.5. Reports and documents all deficiencies.
4.8.6. Maintains current rigger/crane training.

4.9. Qualified Rigger

4.9.1. Performs rigging activities associated with a critical lift.

4.9.2. Coordinates with Qualified Operator and the Person-In-Charge
4.9.3. Maintains current rigger/crane training.

4.10. Master Rigger

4.10.1. Performs rigging activities associated with a critical lift.
4.10.2. Coordinates with Qualified Operator and the Person-In-Charge
4.10.3. Maintains current rigger/crane training.
4.10.4. Develops WPC documents associated with critical lifts.
4.10.5. Guides and directs critical lifts according to specific lift plans.

4.11. Certified Inspector

4.11.1. Maintains current training.
4.11.2. Performs monthly, annual, and periodic inspections on cranes.
4.11.3. Performs rated load tests.

5.0 Instructions

5.1. Equipment involved in lifting activities include:

- Overhead/Bridge Cranes
- Mobile Cranes
- Ross and Yates Hoists
- Hoists (non-regulated MSHA hoist)
  - Electric winches (cable)
  - Air tuggers
  - Chainfall (mechanical)
  - Chainfall (electrical)
- Hand winch
  - Come-a-long
  - PullzAll™
- Rigging hardware and accessories

5.2. Incidental Operator

- Third Party: May operate SDSTA cranes/hoist only when they have met the following conditions:
  - Permission to use a SDSTA crane is required from the associated department director.
  - The appointed SDSTA representative overseeing the work activity reviews the qualifications and training of Incidental Operator.
  - Demonstrates to a SDSTA Qualified Operator their competency to operate the specific hoist.
  - Contractor use of cranes/hoist (regardless of whether the crane is owned by SDSTA or the Contractor) should be included in the contract or corresponding Science documentation.
- SDSTA personnel: May operate a third-party crane or hoist when they have met the following conditions:
  - Permission to use a third-party crane is required from the associated owner and SDSTA supervisor.

- The appointed SDSTA representative overseeing the work activity reviews the qualifications and training of Incidental Operator.
- Demonstrate to a SDSTA Qualified Operator their competency to operate the specific hoist.

5.3. Inspections, Deficiencies, and Repairs

- Frequent (Daily) Inspection
  - A non-documented visual inspection completed by the operator.
- Monthly Inspection
  - A visual inspection completed by the certified inspector. (Crane Operators Inspection Table).
  - Shall be performed on a crane that has been idle for a period of one month or more.
  - Shall be annotated on an inspection tag attached to the controls or to the device.
    - New/Repaired/Adjusted Crane
    - Records are maintained in an electronic database.
- Running Rope Inspection
  - Any deterioration, resulting in loss of original strength, shall be carefully monitored and determination made as to whether further use of the rope would constitute a safety hazard.
  - Conditions that could result in loss of strength are shown in the Crane Operators Inspection Table.
  - Inspection must be documented by the certified inspector.
- Periodic Inspection (Monthly/Quarterly/Annual)
  - Only cranes and hoists that have been inspected by a certified inspector and have passed inspection within the past year may be operated.
  - Must be performed on all cranes (see Crane Operators Inspection Table).
  - If a crane or hoist has not passed its inspection, it must be taken out of service. Inspection requirements must be met before unit is placed back in service.
  - Records of inspections, repairs and modifications shall be available for review.
  - Repairs to cranes or hoists may only be performed by qualified personnel.
- Chainfalls, PullzAll™, and Come-a-longs are inspected on a quarterly basis.
- Crane travel ways shall be visually inspected to ensure unobstructed and safe movement.
- Deficiencies and Repairs
  - Shall be isolated per ESH-(7000-S)-73361 Lockout-Tagout Standard.
  - Shall be reported to the supervisor.
  - Incidents resulting in damage to a crane shall be reported to ESH.
- The crane shall not be returned to service until it has been repaired and appropriate acceptance testing is conducted.

5.4. New, Re-Installed, Altered, Repaired, and Modified Cranes and Hoists Operation Tests

- Prior to being placed into service; equipment shall be evaluated by a qualified person. Evaluation must consider:
  - New or re-installed cranes and hoists:

- Are subject to the annual inspection requirements (Crane Operators Inspection Table).

- Repaired equipment:
  - Must be evaluated for functional reliability commensurate with repair.
- Altered or modified cranes and hoists:
  - Modifications and the supporting structure are checked thoroughly for the new rated load by a qualified engineer or the equipment manufacturer. The crane shall have a rated load test performed and documented on the Load Test Form. New rated load shall be displayed. Considerations shall be given to the following:
    - Design
    - QA/QC construction processes
    - Pre-defined commissioning requirements
  - Only qualified engineers may design and direct QA activities.
  - Must be commissioned and are subject to the requirements of the annual inspection and Rated Load Test processes.
- Records are maintained in an electronic database.

5.5. Rated Load Tests

- This test must be performed by a certified inspector.
- The test loads shall be between 100 and 125 percent of the rated load unless otherwise recommended by the manufacturer.
- The test reports (Load Test Form) shall be placed on file where readily available.
- Rated load tests do not meet the requirements of a critical lift.

5.6. Working from a Suspended Platform or on a Bridge Crane

- Using a crane platform may be a suitable alternative method to perform a task. All platforms shall comply with the following:
  - A qualified person must design the personnel platform and attachment/suspension system used for hoisting personnel.
    - The personnel platform and attachment/suspension system shall be approved by a qualified engineer.
  - The personnel platform must be equipped with a guardrail system and must be enclosed at least from the toeboard to mid-rail with either solid construction material or expanded metal having openings no greater than ½ inch (1.27 cm).
  - Anchor points to which personal fall arrest systems are attached must meet the OSHA requirements of 5000 lbs.
  - All rigging (below-the-hook) shall be included in the suspended platform design and is a dedicated stand-alone system.
- Prior to starting work from a crane platform, required WPC documentation shall be completed. This work shall comply with OSHA 29 CFR 1926.1431(k)-(o). All suspended platform WPC documents shall be reviewed by the Director of ESH.

- At a minimum the WPC documents shall consider:
  - Suspended Platform
    - Personnel may only work from within an engineered platform.
    - Fall protection shall be used.
    - Personnel suspended in a platform may only travel vertically. If horizontal movement is needed, personnel will go to the ground and the platform relocated to desired location first.
    - The platform shall not be moved until all employees on the crane are in locations where they will not be exposed to injury.
    - A means of positive communication shall be established between the crane operator, the platform personnel, and any affected personnel.
    - When two bridge cranes utilize the same runway, rail-stops, or other suitable methods shall be used to prevent contact.
    - The area shall be guarded, barricaded, or other positive controls established to prevent access to overhead hazards.
    - Lockout/Tagout shall be implemented, as appropriate.
  - On a Bridge Crane
    - Safe egress to and from a crane shall be provided.
    - Verify guardrail system is in place prior to commencing work.
    - When two bridge cranes utilize the same runway, rail-stops, or other suitable methods shall be used to prevent contact.
    - Lockout/Tagout shall be implemented, as appropriate.

5.7. Performing Lifts

- Must be performed in accordance with WPC. Deviations from the established lift planning must be reviewed by the qualified person, and the supervisor may be consulted as necessary.
- Must have a designated qualified person overseeing the activity.
- Only trained, qualified, and authorized personnel will be allowed to rig loads or operate cranes or hoists.
- All required inspections for hoists, cranes, and hoisting and rigging hardware and accessories must be performed prior to the lift. (ESH-(10000-S)-73406 Below the Hook Lifting Devices and Slings-Rigging Hardware Standard).
- Personnel must not place any part of their body under a suspended load within a fall zone. However, if no alternative exists and the work must be performed under a suspended load or in the fall zone, a qualified rigger is required, and critical lift requirements apply.
- Critical Lifts
  - When lifting a load that exceeds 75% of the rated load requires exceptional care in handling because of its size, shape, close tolerance installation, a high susceptibility to damage, value, impact to operations, hoisting of personnel with an overhead crane or other unusual factors.
  - A Master Rigger shall provide guidance and direction for all critical lifts.

- WPC shall be utilized.
  - An ESH-(10000-P)-152761 Critical Lift Plan Permit and number will be obtained from ESH.
  - A written lift plan will be developed that includes the following:
    - Identification of the Person-in-charge of the lift.
    - Detailed plan including equipment, PPE, and description of how critical connections will be made.
    - Pre-lift inspection of lift site location.
    - Pre-lift inspection of equipment.
- A Post-lift review shall be conducted, and any lessons learned shall be documented.

- Critical Lifts Using Ross or Yates Hoists
  - The same criteria for determining if a lift qualifies as a critical lift applies to the hoists as to cranes.
  - Associated WPC documents will be followed where applicable.
  - An ESH-(10000-P)-207755 Hoist Critical Lift Permit and permit number will be obtained from ESH.
  - A written lift plan will be developed that includes the following:
    - Identification of the person-in-charge of the lift.
    - Detailed plan including equipment, PPE, and description of how critical connections will be made.
    - Pre-lift inspection of lift site location.
    - Pre-lift inspection of equipment.
    - Landing the load at a specific underground level
  - Approved Critical Lift Plans and Permits may be reused for similar lifts of like material in similar conditions.
  - A pre-lift will be performed on all new materials that will be slung to evaluate how the item will hang, determine center of gravity, and make adjustments as necessary to ensure item will hang properly and remain between the guides when transporting down shaft.
  - Only authorized SDSTA personnel may perform critical lifts involving the hoists.
  - Unauthorized personnel shall remain at least 50 feet from lift activities.
    - Signage shall be posted on all active level stations.
  - Rigging personnel will travel in the cage during the slung load and will watch the load through an observation opening in cage floor.
  - If the load is being transported for a third party (contractor), SDSTA personnel will land the load and then release to third party.
  - A post-lift review shall be conducted, and any lessons learned shall be documented.

- Mobile Crane (less than 2000 lbs)

- Must submit an ESH-(2000-F)-198730 Job Hazard Analysis (JHA) prior to work being performed.
  - ♦ All individuals involved in a mobile crane lift or exposed to those activities must review and sign off on the JHA.
  - ♦ The JHA must reflect the highest risk lift planned for daily activities.

- Mobile Crane (equal to or greater than 2000 lbs)
  - Must submit a JHA prior to work being performed.
  - All individuals involved in a mobile crane lift or exposed to those activities must review and sign off on the JHA.
  - The JHA must reflect the highest risk lift planned for daily activities.
  - Require a licensed operator approved by a government accredited crane operator testing organization.
  - Must complete the Critical Lift Plan-Permit.

5.8. Training

- Training requirements are based on the complexity of specific equipment and processes used. Training may include:
  - Vendor provided training.
  - Regulatory requirements.
  - Training in accordance to manufacture direction.
  - Practical demonstration on hoisting devices.
  - Inspection requirements.

6.0 Documented Information/Related Documents

6.1. ESH-(2000-S)-73320 Work Planning and Controls Standard
6.2. ESH-(7000-S)-73361 Lockout-Tagout Standard
6.3. ESH-(10000-S)-73406 Below the Hook Lifting Devices and Slings-Rigging Hardware Standard
6.4. ESH-(2000-F)-198730 Job Hazard Analysis (JHA)
6.5. ESH-(10000-P)-152761 Critical Lift Plan Permit
6.6. ESH-(10000-P)-207755 Hoist Critical Lift Permit
6.7. ESH-(10000-A)-207753 Crane Operators Inspection Table
6.8. ESH-(10000-F)-152762 Load Test Form