Sanford Underground Research Facility

South Dakota Science and Technology Authority

# Below the Hook Lifting Devices and Slings/Rigging Hardware Standard

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## Revision History

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# 1.0 Purpose

The purpose of this standard is to ensure that all Below-the-Hook (BTH) devices, slings, and rigging shall be managed to protect workers and property against associated hazards.

SDSTA references the following to fulfill this standard:

- OSHA 1910.184
- OSHA 1926.753
- ASME B.30.20
- ESH-(10000-S)-73405 Cranes and Hoists Standard
- SOU-(1000-S)-187279 Inspection Criteria for Basic Rigging Equipment

# 2.0 Scope

This standard applies to all personnel and activities using BTH devices and rigging equipment at SDSTA.

# 3.0 Definitions

**Below-the-Hook (BTH) Lifting Device –** That equipment (other than slings or rigging equipment) utilized between the hook and the load. May be used to support, position and bear the weight of a specific load.

**Below the Hook Slings/Rigging Equipment** – An assembly to be used for lifting when connected to a lifting mechanism. The upper portion of the sling is connected to the lifting mechanism and the lower portion supports the load. Types of slings and rigging equipment:

- Synthetic Slings
- Steel/Wire Rope Slings
- Chain Slings
- Clevises/Shackles
- Blocks and Pulleys

**Certified Rigger** – A person who has successfully passed a commercially recognized training course providing certification.

**Competent Person** – A person who is capable of identifying existing and predictable hazards in any personal fall protection systems or any component of it, as well as in their application and uses with related equipment and who has authorization to take prompt, corrective action to eliminate identified hazards.

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

- Safety concerns.
- Size or shape.
- Weight which exceeds 75% of the load chart.
- 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.
- Single lift involving multiple cranes, or other unusual factors.

**Customized lifting devices** – Custom fabricated lifting devices utilized between the hook and the load to handle unique or complicated lifting and rigging applications. May be commercially manufactured, designed and fabricated externally or in-house. Design, testing, certification and rated capacity/load shall be aligned with the requirements of this document.

**Engineering Notes** – Documentation of the professional evaluation performed on structural design specifications.

**Rated Capacity** – Maximum working load (100%) permitted by the manufacturer under specified working conditions. This is indicated on the tag or on the lifting equipment.

**Rated Load / Marking** – The rated load marking of the BTH device shall be plainly identified on the lifting device and shall not exceed 80% of the rated load test or 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.

**Rigging Supervisor** – A person, who by possession of a recognized degree or certificate of professional standing in applicable field, or who by extensive knowledge, rigging training and experience has successfully demonstrated the ability to solve or resolve problems related to rigging and associated rigging work.

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

# 4.0 Responsibilities

**4.1.** SDSTA Executive Director

**4.1.1.** Ensures accountability of the requirements of this standard with direct reports.

**4.2.** SDSTA Department Directors

**4.2.1.** Ensure that direct reports are trained to perform the assigned work.
**4.2.2.** Ensure accountability of the requirements of this document with direct reports.
**4.2.3.** Seek advice from the ESH Department, as appropriate.

**4.3.** Surface Operations and Utilities Department

**4.3.1.** Appoints a qualified person(s), a rigging qualified person(s) and a “Subject Matter Expert” with respect to hoisting and rigging.
**4.3.2.** Maintains a hoisting and rigging training program and establishing training requirements for SURF personnel involved in BTH use.

**4.3.3.** Conducts a biennial review, in conjunction with the ESH Department, of the Hoisting and Rigging Program, including a review of this standard to ensure it still meets SDSTA needs.
**4.3.4.** Selects a qualified contractor to perform annual inspection, testing, maintenance and repair of BTH devices as needed.
**4.3.5.** Conducts an annual review of this standard.

**4.4.** Engineering Department

**4.4.1.** Appoints a qualified engineer(s) to assist the Surface Operations & Utilities Department, who provides engineering support with respect to the certification and load rating of all customized BTH lifting devices.
**4.4.2.** Creates and maintains a record of all engineering notes.
**4.4.3.** Approves all lifting device engineering notes.

**4.5.** Environment, Safety and Health Department

**4.5.1.** Maintains training documentation as required per this standard.
**4.5.2.** Conducts a biennial review, in conjunction with the Surface Operations & Utilities Department, of the Hoisting and Rigging Program, including a review of this standard to ensure it still meets SDSTA needs.
**4.5.3.** Provides consultation services regarding safety of operations.
**4.5.4.** Coordinates and schedules training.
**4.5.5.** Maintains training records.
**4.5.6.** Assists Surface Operations & Utilities Department with development and implementation of training needs.
**4.5.7.** Approves deviations from the requirements of this standard.

**4.6.** Project Managers

**4.6.1.** Ensure accountability of the requirements of this document with contractors/subcontractors.
**4.6.2.** Ensure that contractors/subcontractors are trained to perform the assigned work, including all equipment and tools.
**4.6.3.** Identify work activities that require WPC documents.
**4.6.4.** Seek advice from the ESH Department, as appropriate.

**4.7.** Supervisors

**4.7.1.** Ensure that direct reports are trained to perform the assigned work, including all equipment and tools involving hoisting and rigging activities.
**4.7.2.** Identify work activities that require WPC documents.
**4.7.3.** Ensure accountability of the requirements of this document with direct reports.
**4.7.4.** Seek advice from the ESH Department, as appropriate.
**4.7.5.** Assist the Rigging Supervisor in the administration of inspections and documentation activities for slings, rigging hardware, and BTH lifting devices located in the area under their supervision.

**4.8.** Certified Rigger

**4.8.1.** Ensures all BTH equipment shall be inspected prior to critical lift.
**4.8.2.** Conducts initial inspections of all new, modified, or repaired devices prior to use.
**4.8.3.** Supervises all rigging activities.

**4.9.** Workers and Users

**4.9.1.** Participate in development of the WPC documents.
**4.9.2.** Complete pre-shift/pre-use inspections as required.
**4.9.3.** Participate in a pre-job briefing with co-workers who share in the work performance before work begins.

**4.9.4.** Ensure training on applicable equipment and tools is complete and current prior to performing work.

**4.9.5.** Ensures that all rigging activities are performed under the supervision of a certified rigger.

**4.10.** Rigging Supervisor

**4.10.1.** Maintains an inventory and inspection program for slings, rigging hardware, and BTH rigging devices, including documentation. Appoints and utilizes supervisors and foreman to administer this program.

**4.10.2.** Conducts a yearly audit of the slings, rigging, and BTH device records.

**4.10.3.** Maintains manuals and manufacturer information and records related to testing, lifting capacity, inspection, and repair of all BTH devices.

# 5.0 Instructions

The use of below the hook lifting devices, slings, and rigging equipment require special considerations due to its inherent hazards. The following sections shall be adhered to as required when using any of this equipment.

**5.1.** Manufacturer

- Non-Commercial:
  - BTH lifting devices shall be manufactured to comply with this standard and ASME B30.20.
  - Identification shall be a part of the manufacturing process. Each device in service at SDSTA shall be permanently labeled with a SDSTA lifting device number and other nameplate data.
- Commercial:
  - The manufacturer of purchased devices shall affix its nameplate data and label the device. SDSTA personnel will affix a SDSTA specific device number. (All documentation shall reference the SDSTA device number.)

**5.2.** Commissioning:

- An initial inspection by a certified rigger of all new, modified, or repaired devices is required for commissioning to verify that the:
  - Unit is built and operates to specifications.
  - Device is assigned a SDSTA identification number and affixed to the device.
  - SDSTA identification number is documented in a computerized maintenance management system (CMMS). Rated load/marking shall be affixed to the device.
  - Information is documented in the engineering notes for customized devices.

**5.3.** Load Testing:

- The test must be performed when a BTH lifting device is newly installed, modified, or repaired.
- The load test shall not exceed the specifications of the device.
- The load test results shall be documented and maintained within the engineering notes.
- Manufacture certificate of test may be equivalent if available.

**5.4.** Rated Load/Marking:

- Commercial BTH Devices: Rated capacity equals rated load.

- Customized Lifting Devices require a load test used in the determination of the rated load.
  - The rated load shall not be more than 75% of the confirmed load test or specifications, whichever is less.
  - Example: BTH device specification is 2 tons. The load test was done to 90% of the specification (3600 lbs.). The rated load would be 75% X 3600 lbs. = 2700 lbs. 2700 lbs. would be the value on the marking. The rated load shall be plainly identified on the BTH device.
  - The rated load shall be documented and maintained within the engineering notes.

**5.5.** Engineering Notes for Customized BTH Devices

- Customized BTH lifting devices shall only be used after an engineering analysis has been performed on the modified BTH and this analysis documented with an engineering note.
  - Engineering notes shall be prepared by a qualified engineer for:
    - All customized BTH lifting devices owned by SDSTA or;
    - Research collaborators' equipment used at SDSTA whether purchased or fabricated at SDSTA or a collaborating institution.
      - All subsequent changes in BTH usage that could affect the safety of personnel, or the capability of performance shall require an amendment to the original engineering note.
    - Modifications to BTH lifting devices or custom devices shall be documented, prior to use.
    - Lifting devices that are manufactured or fabricated to meet previously engineered, fabricated and reviewed lifting devices need not have the full engineering analysis repeated.
    - Documentation shall be provided for an existing approved engineering note and the detailing of all differences.
  - Contractors may utilize an equivalent documented process such as a commercial source engaged in the manufacturing of lifting devices.
    - An engineering note equivalency may include:
      - Commercial BTH devices:
        - Manufacturer's certificate of test.
        - Copies of the operator's manual and inspections (if applicable).
      - Non-Commercial BTH devices:
        - Device designed by a professional engineer.
  - All engineering notes shall include all safety precautions, operating, and maintenance procedures, service or duty cycle rating (if applicable), recommended inspection frequency, and complete nameplate data required for the lifting device.
    - Where any fixture lifts a load at a point below the center of gravity, the engineering note must explicitly address the issue of the stability of the load and fixture combination.
    - Load tests results (see below load test requirements).
    - Initial inspection results (see below inspection requirements).
  - All lifting device engineering notes shall be reviewed by a qualified person for compliance with the requirements of this standard and approved by the Engineering Director.
  - Any customized or modified BTH device requires a third-party engineer note.

**5.6.** Pre-Use Inspection:

- All devices shall be visually inspected by the competent person prior to each use. This is not a documented inspection but will cover the following:
  - Verification of nameplate, load rating, and validation date of previous annual inspection. The device shall not be used if the nameplate is missing, rated load is insufficient for the lift, or annual inspection is older than one year.
  - Structural members for deformation, cracks or excessive wear on any part of the lifter.
  - Loose or missing guards, fasteners, covers, or stops.
  - All functional operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation.
  - All lifting devices requiring repair shall be:
    - Tagged out of service.
    - Reported to the supervisor.
    - Documented as per its SURF identification number.
    - Repair activities are entered into the CMMS.

**5.7.** Annual Inspection

- An annual inspection performed by a certified rigger must be completed for all BTH devices. The inspection must be documented, and records entered in the CMMS and available for review by operators and others requiring access to inspection data and information. The annual inspection date shall be affixed on the lifting devices. The annual inspection at a minimum, shall consider the following information:
  - Verification of nameplate and load rating.
  - Structural members for deformation, cracks or excessive wear on any part of the lifter.
  - Loose or missing guards, fasteners, covers, or stops.
  - All functional operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation.
  - Missing hardware.
  - Excessive abrasion, nicks, or discoloration.
  - Unauthorized modifications.
  - All lifting devices requiring repair shall be:
    - Tagged out of service.
    - Reported to the supervisor.
    - Documented as per its manufacture identification number.
    - Repair activities entered into the CMMS.

**5.8.** Slings and Rigging Equipment Program Elements

- The slings/equipment shall be marked in such a fashion as to provide the information for the pre-use inspection to determine whether hardware can sustain the expected load. See table below for specifics.

| **Information** | **Slings** | | **Rigging Equipment** (Non-BTH devices) | **Chains** |
|---|---|---|---|---|
| | Wire | Synthetic | | |
| Rated Capacity | X | X | X | X |
| Hitch Type | X | X | | |
| Manufacturer | X | X | X | X |
| Diameter (size) | X | X | | X |
| Angle | X | X | | |
| Legs (if more than 1) | X | X | | |
| Length | | | | X |
| Hook Size | | | | X |
| Type of Material | | X | | |
| Grade | | | | X |

- Use:
  - All slings and rigging hardware shall be used in accordance with the manufacturer's recommendations, OSHA and SDSTA requirements.
  - Damaged slings and rigging equipment are to be destroyed and discarded.
  - Environmental conditions are to be considered in the use of sling or rigging equipment, e.g., UV damage on synthetic, fumes, acids, corrosives on steel.
- Storage:
  - Specific facilities are to be utilized to organize and store equipment when not in use. Storage facilities shall consider the following:
    - Clean, dry, and free of chemicals.
    - Sufficient room to hang and organize.
    - Good illumination for inspections.
    - Controlled access.
    - Strategic location to support work.

# 6.0 Documented Information/Related Document

**6.1.** ESH-(10000-S)-73405 Cranes and Hoists Standard
**6.2.** SOU-(1000-S)-187279 Inspection Criteria for Basic Rigging Equipment
**6.3.** OSHA 1910.184
**6.4.** OSHA 1926.753
**6.5.** ASME B.30.20