Chapter 41: Hoisting and Rigging

Quick Start Summary

Product ID: 678 | Revision ID: 2512 | Date published: 10 August 2022 | Date effective: 10 August 2022
URL: https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingQuickstart.pdf

1. Who needs to know about these requirements

The requirements of Hoisting and Rigging apply to workers (as operators, riggers, signal persons, and designated leaders/persons-in-charge), supervisors, ESH coordinators, line management; equipment custodians, load owners, and qualified engineers; the hoisting and rigging inspector, crane and hoist inspector, and the hoisting and rigging program manager; and Purchasing, Facilities and Operations Crane Maintenance, and subcontractors.

2. Why

Improper design, use, or maintenance of hoisting and rigging equipment and accessories can cause equipment to fail or a load to drop, resulting in personnel injury, death, damage to the environment or significant property loss.

3. What do I need to know

All hoisting and rigging equipment, accessories, and activities must comply with Department of Energy Standard 1090, “Hoisting and Rigging” (DOE-STD-1090). All equipment is subject to purchase approval, a review of conformance, initial inspection, and registration before being placed in use, and pre-use and periodic inspections afterwards. Any equipment not in compliance must be removed from service.

Only qualified workers may operate, maintain, and inspect hoisting and rigging equipment. At least two persons must be present for any lift (unless the directorate ESH coordinator and supervisor approve for an ordinary lift; the hoisting and rigging program manager must be notified). A designated leader is required for ordinary lifts and a person-in-charge for critical lifts. Signal persons and professional riggers are required for lifts involving mobile cranes.

All lifts require a documented lift plan, approved either by the supervisor for ordinary lifts or the hoisting and rigging program manager for critical lifts.

4. When

These requirements take effect 10 August 2022.

5. Where do I find more information

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)
- Chapter 41, “Hoisting and Rigging”

Or contact the program manager.
Chapter 41

Hoisting and Rigging

1 Purpose

The purpose of this program is to ensure that hoisting and rigging equipment is safe to operate and that lifts are performed safely.

It covers purchase and fabrication, identification and registration, and inspection, testing, and maintenance of hoisting and rigging equipment and accessories and assigning personnel and planning, preparing, and performing lifts.

It applies to workers (as operators, riggers, signal persons, and designated leaders/persons-in-charge), supervisors, ESH coordinators, line management; equipment custodians, load owners, and qualified engineers; the hoisting and rigging inspector, crane and hoist inspector, crane maintenance supervisor and coordinator, and the hoisting and rigging program manager; and Purchasing, Facilities and Operations, and subcontractors.

2 Roles and Responsibilities

Functional roles and general responsibilities for each under this program are listed below. More detailed responsibilities and when they apply are provided in the procedures and requirements.

The roles may be performed by one or more individuals and one individual may play more than one role, depending on the structure of the organizations involved. Responsibilities may be delegated.

2.1 Operator

- Has the necessary training, knowledge, and experience for the class of lift and the type of equipment used
- Conducts pre-use inspection of hoisting and rigging equipment and submits inspection forms to the equipment custodian
- Performs the lift as planned

2.2 Rigger

- Ensures that
  - The load is attached to the hook by means of slings or other suitable and effective means that must be rigged to ensure the safe handling of the load
– Slings are freed of kinks or twists before use
– Baskets, tubs, skips, or similar containers used for hoisting bulk materials are loaded so as not to exceed their safe carrying capacity
– The load is well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches
– The hoist rope is not kinked
– Multiple part lines are not twisted around each other
– The hook is positioned over the load in such a manner as to prevent swinging of the load when lifted

2.3 Professional Rigger

- Is required for lifts performed with mobile cranes

2.4 Signal Person

- Is required for lifts performed with mobile cranes
- Knows and understands the type of signals used. If hand signals are used, the signal person must know and understand the standard method for hand signals.
- Is competent in the application of the type of signals used
- Has a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads
- Must be trained by a qualified evaluator

2.5 Purchase Requester

- Determines equipment need
- Consults with hoisting and rigging program manager and hoisting and rigging inspector as needed
- Consults regulations for equipment-specific requirements (for instance Cal OSHA [specifically, 8 CCR 1500–1962 and 8 CCR 4884–5049], ANSI/ASME standards, and Department of Energy Standard 1090, “Hoisting and Rigging” [DOE-STD-1090])
- Defines purchase specifications, including requirement for vendor to supply any documentation needed for the review of conformance (see Hoisting and Rigging: Review of Conformance Form)

2.6 Designated Leader

- Is required for ordinary lifts
- Is assigned by supervisor
- Is present at the lift site during the entire lifting operation
- Has the necessary knowledge and experience for the type of equipment used and assigned lifting operations
Ensures that lift plan is completed, reviews the plan with all participating personnel before the lift begins to ensure they fully understand the requirements of the lift plan and their role in the operation and have signed plan, and keeps a copy of the plan at the work site

Verifies that all equipment, fixtures, and accessories are operative, up to date on required periodic inspections, and in good condition before the operation begins

Ensures that all equipment pre-use inspections are completed and forms submitted to the equipment custodian

Surveys the lift site for hazardous or unsafe conditions; clears lift path of obstructions

Ensures that all personnel are trained on the types of equipment they will be using

Provides the task-qualified supervision specified in the planning process

Vacates all non-essential personnel from the lift area

Identifies the operator

Ensures a signal person is assigned, if required, and identified to the operator

Checks that basic operating instructions of all lifting equipment are posted or otherwise available to the operator

Ensures that equipment is properly set up and positioned

Ensures that the load hook is directly over the center of gravity of the load to the extent possible

Checks load lines after strain is put on them but before the load is lifted clear of the ground; if load lines are not plumb, repositions the slings or equipment so that the lines are plumb before continuing

Directs the lifting operation to ensure that the lift is completed safely and efficiently

Directs operations if an accident or injury occurs

Develops a written guideline or procedure for each forklift that an attachment will be used on for performing lifts

### 2.7 Person-in-Charge

- Performs all the duties of a designated leader
- Is required for critical lifts and cannot be the operator or rigger
- Is designated by the supervisor
- Has the necessary knowledge and experience for critical lifts and the type of equipment used

### 2.8 Supervisor

- Classifies lifts
- Assigns hoisting and rigging activities, such as using hoisting and rigging equipment, inspecting rigging hardware and accessories, and preparing lift plans
- Designates qualified personnel to perform hoisting and rigging activities
- Assigns a designated leader for ordinary lifts
2.9 Subcontractor
- Must meet all applicable requirements of Cal OSHA (specifically, 8 CCR 1500–1962 and 8 CCR 4884–5049) in addition to the requirements of this chapter

2.10 ESH Coordinator
- Approves, with the supervisor, one-person ordinary lift plans and notifies the hoisting and rigging program manager

2.11 Line Management
- Ensures organization clearly defines roles and responsibilities for all persons involved in hoisting and rigging activities
- Ensures that personnel who perform hoisting and rigging activities, such as design of lifting fixtures, inspection of equipment, preparation and approval of lift plans, and review of equipment compliance, are qualified to do so. A person may be qualified to inspect one type of equipment but not qualified to inspect another. When designating personnel to perform hoisting and rigging functions, line management must be specific as to the scope and limitations of the designation.
- Ensures organization complies with requirements of this program

2.12 Load Owner
- Assists supervisor in classifying lifts
- Ensures loads are maintained in safe working condition
- Describes loads as required for lift planning
- Ensures structural integrity of the load, including attachment points

2.13 Equipment Custodian
- Is responsible for hoisting and rigging equipment under his or her charge
- Controls the use of the equipment
- Ensures equipment is in safe working order, undergoes required initial and periodic inspections, and is posted with a current inspection label
- Maintains record of the required pre-use/frequent inspections
Ensures non-compliant equipment is removed from service and informs the Facilities and Operations Crane Maintenance Group of any deficiencies

Attaches data plate to the forklift that a lifting attachment will be installed on

Maintains the record of approval, safety analysis, and procedures for forklift attachments used for lifts

2.14 Qualified Engineer

Must have structural/mechanical engineering qualifications and experience with hoisting and rigging equipment and operations

Provides design certification for hoisting and rigging equipment, if not available from manufacturer, as part of review of conformance

Provides safety analysis and approval for forklift attachments, if not available from manufacturer

Reviews lift plans for critical lifts

2.15 Hoisting and Rigging Inspector

Performs initial and periodic inspections of below-the-hook rigging equipment

Assists SLAC line organizations with hoisting and rigging activities

Approves forklift attachments used for below-the-tine lifts

2.16 Crane and Hoist Inspector

Has the necessary training, knowledge, and experience to perform initial and periodic inspections of cranes, hoists, and miscellaneous lifting devices

Performs initial and periodic inspections of cranes, hoists, and miscellaneous lifting devices

2.17 Facilities and Operations Division

Maintains the Crane Information Database

2.18 Facilities and Operations Crane Maintenance Group

Maintains cranes, hoists, and miscellaneous lifting devices

Schedules necessary repairs

Initiates scheduled preventative maintenance and inspections

2.19 Crane Maintenance Supervisor

Coordinates maintenance, repair, inspection, and certification of cranes through the crane maintenance program

Ensures that a functional test of cranes is completed after maintenance or repairs
Ensures that documentation is made readily available of any load testing, inspection, preventive maintenance, or certification performed

Ensures labeling and recordkeeping of periodic inspections as necessary to comply with the requirements of this program

2.20 Crane Maintenance Coordinator

- Tracks all required crane inspection and maintenance activities for on-time completion
- Performs lock-out requirements for cranes placed in stand-by or out-of-service conditions

2.21 Purchasing Department

- Selects vendors for purchase or fabrication of hoisting and rigging equipment
- Places orders and specifies documentation that vendors must supply in order to meet SLAC technical standards

2.22 Hoisting and Rigging Program Manager

- Approves lift plans for ordinary lifts, if requested
- Is notified of any one-person ordinary lift plans
- Approves lift plans for critical lifts
- Approves pre-engineered and personnel lifts

3 Procedures, Processes, and Requirements

These documents describe the detailed requirements for this program and describe how to implement them:

- **Hoisting and Rigging: Purchasing Procedure** (SLAC-I-730-0A21C-023). Describes process for purchasing new equipment
- **Hoisting and Rigging: Equipment Requirements** (SLAC-I-730-0A21S-035). Describes requirements for purchasing and fabrication, identification and registration, and inspection, testing, and maintenance
- **Hoisting and Rigging: Forklift Attachment Approval Procedure** (SLAC-I-730-0A21C-020). Describes process for approval of attachments for below-the-tine lifts performed with a forklift or other powered industrial vehicle (PIV)
- **Hoisting and Rigging: Requirements for Below-the-Hook Lifting Devices, Slings, and Rigging Hardware and Accessories** (SLAC-I-730-0A21S-036). Describes requirements for fabricating, marking, and pre-use inspections of below-the-hook lifting devices, slings, and rigging hardware and accessories
- **Hoisting and Rigging: Lift Requirements** (SLAC-I-730-0A21S-060). Describes requirements for planning, preparing, and performing lifts

These are the forms and tools for this program:
4 Training

4.1 Operator, No-load Operator, and Crane Maintenance Personnel

Operators, no-load operators, and crane maintenance personnel must complete the following:

- ESH Course 280, Basic Crane Operations and Rigger Training (ESH Course 280) (every 36 months)
- ESH Course 280PRA, Basic Crane Operations and Rigger Practical (ESH Course 280PRA)
- ESH Course 280PRR, Basic Crane Operations and Rigger Practical Refresher (ESH Course 280PRR) (every 36 months)

4.2 Mobile / Truck / Overhead Crane Operator

In addition to the basic operator training above, operators of mobile cranes (and of cab-operated truck cranes of more than one ton capacity and of overhead cranes operated from a pulpit) must be in continual possession of a valid certificate of competency from an accredited certifying entity for the type of mobile crane to be used. Certificate renewal is in accordance with the certifying entity’s renewal schedule. Certification is documented by the card issued by the certifying entity.

Mobile crane operators will also be current in the following:

- ESH Course 280ME, Crane Operator Medical Exam (ESH Course 280ME) (every 36 months)

4.3 Professional Rigger

In addition to the basic operator training above, workers whose job title is “rigger” (that is, are qualified professional riggers) must be in continual possession of a valid certificate of competency from an accredited certifying entity for the type of rigging equipment and crane to be used. Certificate renewal is in
accordance with the certifying entity’s renewal schedule. Certification is documented by the card issued by the certifying entity.

Qualified professional riggers will also be current in the following:

- ESH Course 280ME, Crane Operator Medical Exam (ESH Course 280ME) (every 36 months)

### 4.4 Supervisor

Supervisors of workers performing hoisting and rigging activities must complete the following:

- ESH Course 280, Basic Crane Operations and Rigger Training (ESH Course 280) (every 36 months)

### 4.5 Hoisting and Rigging Inspector

A qualified hoisting and rigging inspector must complete, at minimum, the following:

- ESH Course 280, Basic Crane Operations and Rigger Training (ESH Course 280) (every 36 months)

### 4.6 Crane and Hoist Inspector

Crane and hoist inspectors must be in continual possession of a valid certificate of competency from an accredited certifying entity. Certificate renewal is in accordance with the certifying entity’s renewal schedule. Certification is documented by the card issued by the certifying entity.

### 5 Definitions

**attachment point.** Designed lifting point that is part of a load

**come-along.** See hoist, lever operated

**crane.** A machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine

**crane maintenance supervisor.** Supervisor in the organization designated to maintain cranes and hoists

**designated leader.** An individual assigned responsibility for safe handling of ordinary lifts

**device, below-the-hook (BTH) lifting.** Device that, used singularly or in combination, alters or transfers the direction or sequence of loading from the lifting device to the load, such as spreader bars, structural lifters, vacuum lifters, magnetic lifters

**device, miscellaneous lifting.** Portable A frames (portable gantries), truck-mounted cranes with a capacity of one ton or less not covered by ASME B30.5 and self-contained shop cranes as addressed by ASME Portable Automotive Lifting Devices (PALD-2005)

**equipment custodian.** A person assigned responsibility for a piece of hoisting and rigging equipment
free rigging. The direct attachment to or placement of rigging equipment (such as slings, shackles, or rings) onto the tines (forks) of a powered industrial truck for a below-the-tines lift.

hoist. A device that applies a force for lifting or lowering

hoist, chain operated. A chain operated manual device used to lift or lower a load and to apply or release tension; commonly referred to as a chain-fall

hoist, lever operated. A lever-operated manual device used to lift, lower, or pull a load and to apply or release tension; commonly referred to as a come-along

hoisting and rigging equipment. Cranes, hoists, miscellaneous and below-the-hook lifting devices, and wire-rope slings and bridles. This definition includes rigging hooks but excludes other rigging hardware and accessories.

inspector, crane. Inspector qualified to inspect cranes, hoists, and miscellaneous lifting devices

inspector, qualified. Person recognized for competence and whose qualification to perform specific inspection activities has been determined, verified, and documented

lift, critical. A lift for which the application of requirements applicable to ordinary lifts would not adequately eliminate or control the likelihood or severity of the following:

- Personnel injury or significant adverse health impact (on-site or off-site)
- Significant release of radioactivity or other hazardous material or other undesirable conditions
- Undetectable damage that would jeopardize future operations or the safety of a facility
- Damage that would result in delay to schedule or other significant program impact such as loss of vital data

lift, ordinary. A lift that does not meet the requirements of a critical lift

lift, personnel. Use of a crane to hoist personnel in a lift platform

lift, pre-engineered. Defined in DOE-STD-1090 as a “repetitive lift that is performed by production line personnel in the assembly or disassembly of components or systems” in which the items to be lifted are “identical in terms of dimensions, weight, center of gravity, load path, method of attachment to the lifting equipment, and selection of lifting equipment” and “all items can be lifted in adherence to a specific step-by-step procedure that eliminates rigging decisions or calculations by lift personnel”.

lift plan. Pre-job plan or procedure for safely executing a lift

load owner. Person responsible for the load to be lifted including attachment and lift points

non-destructive examination. The development and application of technical methods to examine materials or components in ways that do not impair future usefulness and serviceability in order to detect, locate, measure, and evaluate discontinuities, defects, and other imperfections; assess integrity, properties, and composition; and measure geometrical characteristics

non-destructive test. Testing that does not destroy or damage the item. Examples include magnetic particle, ultrasonic, liquid penetration, or radiographic testing.
operator. Person who operates cranes, hoists, and miscellaneous lifting devices

operator, no-load. Operators who use hoist bridges and trolleys only as a personal platform to perform maintenance (for example, changing light bulbs)

person, authorized. A person at SLAC who has completed the required training and is authorized to perform the work

person, designated. An individual selected or assigned as being qualified to perform specific duties

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

person-in-charge. A qualified person responsible for the safe planning and performance of a critical lift

person, signal. A qualified person who provides signals to the lift operator to guide a lift

professional rigger. In this document, a journeyman rigger is referred to as a professional rigger

qualified engineer/engineering organization. An engineer or engineering organization whose competence in evaluation of the type of equipment in question has been demonstrated to the satisfaction of the responsible line management

review of conformance. A comprehensive review of the equipment for compliance with DOE-STD-1090 and the requirements of this chapter

rigging hardware and accessories. Such items as shackles, eyebolts, rings, links, swivel hoist rings, turnbuckles, wire rope clips, load-indicating devices, and synthetic slings

rigging hook. A rigging hardware component typically attached to chain, wire rope, or suspension members

sling. Wire rope, chain, synthetic web, and metal mesh made into forms, and with or without fittings, for handling loads

wire running rope. Wire rope that “runs” over sheaves, pulleys, and drums used to hoist the load

6 References

6.1 External Requirements

The following are the external requirements that apply to this program:

- Department of Energy Standard 1090, “Hoisting and Rigging” (DOE-STD-1090), and third-party standards referenced in it

6.2 Related Documents

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)
- Chapter 45, “Fall Protection”
- Chapter 47, “Mobile Elevating Work Platforms (MEWP)”
- Chapter 48, “Industrial Trucks”

Other SLAC Documents
- Competent and Qualified Persons and Engineers
1 Purpose

The purpose of this procedure is to ensure that all new *hoisting and rigging equipment* and *accessories* purchased or manufactured for SLAC meet specified standards and regulations. It covers purchasing new equipment. It applies to workers (as requesters), equipment custodians, line management, and Purchasing.

**Important**  Unapproved equipment is considered non-conforming and cannot be used at SLAC.

2 Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Person(s)</th>
<th>Action</th>
</tr>
</thead>
</table>
| 1.   | Requester | ▪ Determines equipment need  
      |           | ▪ Consults with hoisting and rigging program manager and hoisting and rigging inspector as needed  
      |           | ▪ Consults regulations for equipment-specific requirements (for instance OSHA, ANSI/ASME standards, and Department of Energy Standard 1090, "Hoisting and Rigging" [DOE-STD-1090])  
      |           | ▪ Defines purchase specifications, including requirement for vendor to supply any documentation needed for the review of conformance (see Hoisting and Rigging: Review of Conformance Form)  
      |           | ▪ Selects vendor |
| 2.   | Purchasing Department | ▪ Places order and specifies documentation that vendor must supply in order to meet SLAC technical standards |
| 3.   | Requester | ▪ Receives equipment and documentation |
| 4.   | Line management | ▪ Designates equipment custodian |
| 5.   | Equipment custodian | ▪ Initiates review of conformance, as required |
| 6.   | Equipment custodian | ▪ After successful completion of review of conformance and initial inspection, places equipment in service |
3 Forms

The following forms and systems are required by this procedure:

- Crane Information Database (CID, contact Facilities and Operations Crane Maintenance). Database for cranes, hoists, and miscellaneous lifting devices
- Rigging Equipment Database (RED, contact hoisting and rigging inspector). Database for hoisting and rigging equipment other than cranes, hoists, and miscellaneous lifting devices
- Hoisting and Rigging: Review of Conformance Form (SLAC-I-730-0A21J-021). Form for documenting the review of conformance required for all new hoisting and rigging equipment (including rigging hooks but excluding other rigging hardware and accessories) and any existing equipment lacking an identification number and SLAC inspection tag

4 Recordkeeping

The following recordkeeping requirements apply for this procedure:

- Facilities and Operations Crane Maintenance maintains records for cranes, hoists, and miscellaneous lifting devices.
- The hoisting and rigging inspector maintains records for other equipment, such as below-the-hook lifting devices.

5 References

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)
- Chapter 41, “Hoisting and Rigging”
  - Hoisting and Rigging: Equipment Requirements (SLAC-I-730-0A21S-035)

Other Documents
- Department of Energy Standard 1090, “Hoisting and Rigging” (DOE-STD-1090), and third-party standards referenced in it
Chapter 41: Hoisting and Rigging

Equipment Requirements

1 Purpose

The purpose of these requirements is to ensure that hoisting and rigging equipment is safe to operate. They cover purchase and fabrication, identification and registration, and inspection, testing, and maintenance of hoisting and rigging equipment. They apply to workers (as operators), equipment custodians, the hoisting and rigging inspector, the crane and hoist inspector, and Facilities and Operations Crane Maintenance.

Note Hoisting and rigging equipment is defined as cranes, hoists, miscellaneous and below-the-hook lifting devices, and wire rope slings and bridles. This definition includes rigging hooks but excludes other rigging hardware and accessories.

2 Requirements

2.1 Purchase and Fabrication

All purchased and SLAC-fabricated hoisting and rigging equipment must meet all applicable standards and regulations (see Chapter 41, “Hoisting and Rigging”, Section 6.1, “External Requirements”). The purchasing of new equipment must follow the process specified in Hoisting and Rigging: Purchasing Procedure.

2.2 Review of Conformance

To ensure new hoisting and rigging equipment meets applicable standards, all such equipment must undergo a review of conformance (Hoisting and Rigging: Review of Conformance Form). This process ensures that the equipment is properly evaluated, tested, inspected, and registered by qualified personnel before being placed into service. An identification number (see Section 2.3) and SLAC inspection tag indicates a review of conformance is on file for existing equipment. If either is missing the relevant records must be checked and a review of conformance completed if none is on file.

2.3 Identification and Registration

For tracking purposes, all hoisting and rigging equipment must be marked with a unique identification number:
For cranes, hoists, and miscellaneous lifting devices, the identification number, referred to as the CRN, is assigned by the crane and hoist inspector when the item is added to the Crane Information Database (CID).

For other hoisting and rigging equipment, the identification number, referred to as the RIG, is assigned by the hoisting and rigging inspector when the item is added to the Rigging Equipment Database (RED).

The identification label, tag, or marking must be durable and legible.

Note: Permanent assemblies (such as wire-rope sling or bridle with rigging hooks) require only a single identification number.

2.4 Inspection

Initial, pre-use/frequent, and periodic inspections are required for all hoisting and rigging equipment. Requirements are summarized below and listed in Table 1 in terms of

- Types of inspection (initial, pre-use/frequent, and periodic) maintenance, and testing (operational and load testing)
- Responsibilities (person who ensures that the inspection was performed and person performing the inspection)

Details on how to conduct the inspections may be found in 8 CCR 5031, the applicable standard from the American Society of Mechanical Engineers (ASME) B30 series (ASME B30), or other standards referenced in Department of Energy Standard 1090, “Hoisting and Rigging” (DOE-STD-1090).

Inspection tags are affixed to equipment upon successful completion of initial and periodic inspections. Only equipment bearing a current SLAC hoisting and rigging inspection tag may be used.

2.4.1 Initial

Before initial use, all new, reinstalled, modified, or repaired hoisting and rigging equipment must be inspected by a qualified inspector. Inspections of repaired and modified cranes may be limited to the provisions affected by the alteration, repair, or modification as determined by a qualified person. Dated and signed inspection reports must be kept on file and be readily available. For new equipment, the initial inspection is performed as part of the review of conformance.

2.4.2 Pre-use / Frequent

A pre-use/frequent inspection must be performed by the operator either at the beginning of each shift that the crane, hoist, or miscellaneous lifting device will be used or, for other equipment, before each use.

2.4.3 Periodic

A qualified inspector or person must perform and document a periodic inspection appropriate for the equipment type on all in service hoisting and rigging equipment.
2.5 Testing

Requirements and procedures for testing hoisting and rigging equipment vary with the type of equipment and may be found in 8 CCR 5020–5028, the applicable standard from the American Society of Mechanical Engineers (ASME) B30 series (ASME B30), or other standards referenced in DOE-STD-1090 and third-party standards referenced in it. Specifically

- All testing must be performed in accordance with the recommendations of the manufacturer or a qualified person.
- Operational tests are required following maintenance or servicing of cranes, hoists, and miscellaneous lifting devices.
- Documented load tests are required:
  - As part of the initial inspection
  - For any hoisting and rigging equipment, including rigging hardware and accessories, used in critical lifts
  - All cranes and hoists where load-bearing parts have been altered or repaired
  - All below-the-hook lifting devices where load bearing parts have been altered or repaired

2.6 Maintenance

All cranes must be maintained according to the schedule in Table 1.

- **Maintenance and repair of cranes, hoists, and miscellaneous lifting devices** is the responsibility of the Facilities Crane Maintenance Group and may only be performed by qualified personnel. Third-party maintenance must be coordinated through the group. All maintenance records and documentation will be maintained by the group.

- **Maintenance and repair of all other hoisting and rigging equipment** is the responsibility of the line organization, and must be coordinated through the hoisting and rigging inspector.

Specific maintenance and repair requirements for hoisting and rigging equipment may be found in 8 CCR 5033, the applicable standard from the American Society of Mechanical Engineers (ASME) B30 series (ASME B30), or other standards referenced in DOE-STD-1090.

2.7 Manufacturer-provided Lift Points

All lift points designed for and installed on engineered or manufactured equipment are considered part of the equipment and are acceptable for their intended use. The load owner must ensure that manufacturer-supplied lift points

- Meet manufacturer’s pre-operational inspection, testing, and maintenance criteria
- Be inspected by a qualified person before initial use
- Be used in accordance with manufacturer’s instructions. In the absence of such information, further qualified technical support may be needed.
2.8 Approval to Use a Forklift as a Hoist

A forklift may only be used as a hoist with an approved attachment in place. To be approved:

- A written procedure for the lift must be developed and approved
- A safety analysis must be performed by a qualified engineer
- A data plate must be affixed to the forklift specifying load analysis

*Note*  Free rigging, or the direct attachment to or placement of rigging equipment (such as slings, shackles, or rings) onto the tines of a powered industrial truck for a below-the-tines (forks) lift, is prohibited at SLAC. Commercially available attachments can only be used if they have passed the review of conformance and are within the rated capacity as specified on the forklift data plate.

See [Hoisting and Rigging: Forklift Attachment Approval Procedure](#).

2.9 Rented Equipment

All rented equipment must conform to applicable Cal/OSHA requirements (specifically, 8 CCR 1500–1962 and 8 CCR 4884–5049).
### Table 1 Inspection, Testing, and Maintenance Requirements

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Responsible Person</th>
<th>Qualified Person</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Inspection</strong>¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranes, hoists, and miscellaneous lifting devices</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Crane and hoist inspector</td>
<td>CID</td>
</tr>
<tr>
<td>Miscellaneous lifting devices (such as portable A-frames)</td>
<td>After disassembly and reassembly</td>
<td>Equipment custodian</td>
<td>Qualified person</td>
<td>Custodian</td>
</tr>
<tr>
<td>Below-the-hook lifting devices</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td>Wire rope and chain slings</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td>Synthetic slings</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>None</td>
</tr>
<tr>
<td>Rigging hardware and accessories for critical lifts</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td>Rigging hardware and accessories</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>None</td>
</tr>
<tr>
<td>Rigging hooks</td>
<td>Initial</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td><strong>Pre-use Inspection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cranes, hoists, and miscellaneous lifting devices²</td>
<td>Each shift used</td>
<td>Operator</td>
<td>Operator</td>
<td>Custodian</td>
</tr>
<tr>
<td>Below-the-hook lifting devices³</td>
<td>Before each use</td>
<td>Operator</td>
<td>Operator</td>
<td>None</td>
</tr>
<tr>
<td>All slings</td>
<td>Before each use</td>
<td>Operator</td>
<td>Operator</td>
<td>None</td>
</tr>
<tr>
<td>Rigging hardware and accessories for critical lifts</td>
<td>Before each use</td>
<td>Operator</td>
<td>Operator</td>
<td>None</td>
</tr>
<tr>
<td>Rigging hardware and accessories</td>
<td>Before each use</td>
<td>Operator</td>
<td>Operator</td>
<td>None</td>
</tr>
<tr>
<td>Rigging hooks</td>
<td>Before each use</td>
<td>Operator</td>
<td>Operator</td>
<td>None</td>
</tr>
</tbody>
</table>

¹ The initial inspection is documented as part of the review of conformance. See Hoisting and Rigging: Review of Conformance Form.

² Use the Hoisting and Rigging: Crane Pre-use / Frequent Inspection Form.

³ See Hoisting and Rigging: Requirements for Below-the-Hook Lifting Devices, Slings, and Rigging Hardware and Accessories.
<table>
<thead>
<tr>
<th>Type</th>
<th>Equipment</th>
<th>Frequency</th>
<th>Responsible Person</th>
<th>Qualified Person</th>
<th>Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodic Inspection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cranes, hoists, and miscellaneous lifting devices</td>
<td>Four times a year (including the annual), with inspections as evenly spaced as possible, but before 750 hours of use</td>
<td>Equipment custodian</td>
<td>Crane and hoist inspector</td>
<td>CID</td>
</tr>
<tr>
<td></td>
<td>Cranes, hoists, and miscellaneous lifting devices</td>
<td>Annually (in any year in which the quadrennial load test is not performed)</td>
<td>Equipment custodian</td>
<td>Crane and hoist inspector</td>
<td>CID</td>
</tr>
<tr>
<td></td>
<td>Cranes, hoists, and miscellaneous lifting devices exceeding three tons lifting capacity</td>
<td>Annually</td>
<td>Equipment custodian</td>
<td>Third-party certifying agency</td>
<td>CID</td>
</tr>
<tr>
<td></td>
<td>Below-the-hook lifting devices</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td></td>
<td>Wire rope and chain slings</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td></td>
<td>Synthetic slings</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Qualified person</td>
<td>Custodian</td>
</tr>
<tr>
<td></td>
<td>Rigging hardware and accessories for critical lifts</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td></td>
<td>Rigging hardware and accessories</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Rigging hooks</td>
<td>Annually (if in use)</td>
<td>Equipment custodian</td>
<td>Hoisting and rigging inspector</td>
<td>RED</td>
</tr>
<tr>
<td>Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational test</td>
<td>All cranes, hoists, and miscellaneous lifting devices</td>
<td>After maintenance or repair</td>
<td>Facilities crane maintenance personnel</td>
<td>Facilities crane maintenance personnel</td>
<td>CID</td>
</tr>
<tr>
<td>Load test</td>
<td>All cranes, hoists, and miscellaneous lifting devices for which a load-bearing part has been altered or repaired</td>
<td>Before initial use and before startup if crane has been idle more than six months, every four years thereafter,</td>
<td>Facilities crane maintenance personnel</td>
<td>Crane and hoist inspector</td>
<td>CID</td>
</tr>
<tr>
<td>Type</td>
<td>Equipment</td>
<td>Frequency</td>
<td>Responsible Person</td>
<td>Qualified Person</td>
<td>Documentation</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Preventive All cranes, hoists, and miscellaneous lifting devices</td>
<td>In most cases every 6–12 months</td>
<td>Facilities crane maintenance supervisor</td>
<td>Facilities crane maintenance personnel</td>
<td>CID</td>
</tr>
</tbody>
</table>
3 Forms

The following forms and systems are required by these requirements:

- Crane Information Database (CID, contact Facilities and Operations Crane Maintenance). Database for cranes, hoists, and miscellaneous lifting devices
- Rigging Equipment Database (RED, contact hoisting and rigging inspector). Database for hoisting and rigging equipment other than cranes, hoists, and miscellaneous lifting devices
- Hoisting and Rigging: Review of Conformance Form (SLAC-I-730-0A21J-021). Form for documenting the review of conformance required for all new hoisting and rigging equipment (including rigging hooks but excluding other rigging hardware and accessories) and any existing equipment lacking an identification number and SLAC inspection tag
- Hoisting and Rigging: Crane Pre-use / Frequent Inspection Form (SLAC-I-730-0A21J-056). Form for documenting the pre-use / frequent inspection required for all cranes, hoists, and miscellaneous lifting devices at the beginning of each shift
- Hoisting and Rigging: Mobile Crane Pre-use Inspection Form (SLAC-I-730-0A21J-030). Form for documenting the pre-use inspection required for all mobile cranes at the beginning of each shift

4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- Facilities and Operations Crane Maintenance maintains records for cranes, hoists, and miscellaneous lifting devices.
- The hoisting and rigging inspector maintains records for other equipment, such as below-the-hook lifting devices.
- The equipment custodian maintains custodian records, including pre-use inspection forms.

5 References

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)
- Chapter 41, “Hoisting and Rigging”
  - Hoisting and Rigging: Purchasing Procedure (SLAC-I-730-0A21C-023)
  - Hoisting and Rigging: Forklift Attachment Approval Procedure (SLAC-I-730-0A21C-020)
  - Hoisting and Rigging: Requirements for Below-the-Hook Lifting Devices, Slings, and Rigging Hardware and Accessories (SLAC-I-730-0A21S-036)

Other SLAC Documents
- Competent and Qualified Persons and Engineers

Other Documents
- Department of Energy Standard 1090, “Hoisting and Rigging” (DOE-STD-1090) and third-party standards referenced in it


This form is used to document the review of conformance required for all new hoisting and rigging equipment (including rigging hooks but excluding other rigging hardware and accessories) and any existing equipment lacking an identification number and SLAC inspection tag. The completed form is to be maintained by the Facilities and Operations Crane Maintenance Group (for cranes, hoists, and miscellaneous lifting devices, CRN) or the hoisting and rigging inspector (for below-the-hook lifting devices and slings, RIG) (see Hoisting and Rigging: Equipment Requirements [SLAC-I-730-0A21S-035]).

1 Hoisting and Rigging Equipment Registration Information

<table>
<thead>
<tr>
<th>Submitted by</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>(person responsible for ensuring that all required signatures, inspections, and approvals are obtained)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment custodian</th>
<th>Dept / group</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Built by</th>
<th>New</th>
<th>Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ SLAC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Manufacturer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment type (use only equipment types listed)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranes, hoists, and miscellaneous lifting devices</td>
<td>Below-the-hook lifting devices and slings</td>
</tr>
<tr>
<td>□ Crane, bridge</td>
<td>□ Hoist, electric</td>
</tr>
<tr>
<td>□ Crane, jib, wall-mounted</td>
<td>□ Hoist, air</td>
</tr>
<tr>
<td>□ Crane, jib, free-standing</td>
<td>□ Hoist, hydraulic</td>
</tr>
<tr>
<td>□ Crane, monorail</td>
<td>□ Hoist, hand chain operated</td>
</tr>
<tr>
<td>□ Crane, gantry, fixed location</td>
<td>□ Hoist, manual lever operated</td>
</tr>
<tr>
<td>□ Crane, gantry, portable</td>
<td>Other</td>
</tr>
<tr>
<td>□ Crane, shop</td>
<td></td>
</tr>
<tr>
<td>□ Cherry picker/engine hoist</td>
<td></td>
</tr>
<tr>
<td>□ Crane, truck mounted</td>
<td></td>
</tr>
<tr>
<td>□ Crane, mobile</td>
<td></td>
</tr>
<tr>
<td>□ Other</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working load limit (WLL)</th>
<th>Device weight (required for below-the-hook lifting devices that weigh 100 pounds or more)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Model no.</th>
<th>Serial no.</th>
<th>Property control no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(use drawing number if SLAC-built)</td>
<td>(if available)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment location</th>
<th>Equipment ID (CRN or RIG)</th>
<th>CRN or RIG to be assigned</th>
</tr>
</thead>
</table>
### 2 Design Certification

<table>
<thead>
<tr>
<th></th>
<th>Manufacturer’s certification <em>(attach documentation that equipment meets applicable standards)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SLAC qualified engineer certification <em>(attach engineering report, including drawings/sketches, calculations, and design factor, and complete the certification below)</em></td>
</tr>
</tbody>
</table>

I certify that the design of this equipment (and the building and supportive structures for any fixed-location cranes) have been evaluated and found to comply with the following applicable standards.

**Applicable standards**

<table>
<thead>
<tr>
<th>Qualified engineer</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

☐ Design certification or documentation is not available; an exemption is requested.

(exemptions are rare but may be granted if the equipment is properly marked with the manufacturer’s identification and it meets all other review of conformance requirements)

**Initial Inspection**

<table>
<thead>
<tr>
<th>Conducted by company</th>
<th><em>(attach documentation)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted by SLAC qualified person</td>
<td><em>(attach documentation or complete certification below)</em></td>
</tr>
</tbody>
</table>

I certify that I performed the initial inspection of this equipment and all applicable inspection requirements were met.

**DOE-STD-1090 sections used**

<table>
<thead>
<tr>
<th>Qualified person</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Load Test**

<table>
<thead>
<tr>
<th>Conducted by company</th>
<th><em>(attach documentation)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducted by SLAC qualified person</td>
<td><em>(attach documentation or complete certification below)</em></td>
</tr>
</tbody>
</table>

I certify that this device was successfully load-tested according to DOE-STD-1090.

**Required test weight**

<table>
<thead>
<tr>
<th>Qualified person</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Design Certification Exemption** *(complete only if an exemption is requested)*

<table>
<thead>
<tr>
<th>Exemption denied</th>
<th></th>
</tr>
</thead>
</table>

I have evaluated this equipment, including the testing and inspection results. It is my professional judgment that this equipment is built to applicable standards.

<table>
<thead>
<tr>
<th>Hoisting and rigging program manager</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Final Review and Approval** *(SLAC inspection tag applied upon successful completion)*

I am qualified to authorize approval of this type of equipment. I have examined the attached documentation and have determined that it meets the requirements of DOE-STD-1090.

<table>
<thead>
<tr>
<th>Hoisting and rigging program manager</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Hoisting and Rigging Equipment Registration Confirmation**

This equipment has been registered: the review of conformance is complete and this equipment can now be placed into service.

<table>
<thead>
<tr>
<th>Database manager</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>
Chapter 41: **Hoisting and Rigging**

**Crane Pre-use / Frequent Inspection Form**

Product ID: 679 | Revision ID: 2426 | Date Published: 11 June 2021 | Date Effective: 11 June 2021

URL: [https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingFormInspectPreuseCrane.pdf](https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingFormInspectPreuseCrane.pdf)

This form is used to document the pre-use / frequent inspection required for all cranes, hoists, and miscellaneous lifting devices at the beginning of each shift (see **Hoisting and Rigging: Equipment Requirements** [SLAC-I-730-0A21S-035]).

<table>
<thead>
<tr>
<th>Crane#</th>
<th>Custodian</th>
<th>Hoist Type</th>
<th>Building#</th>
</tr>
</thead>
</table>

**Requirements**

1. Operators must perform this inspection (from floor level only) before each shift, and submit the form to the equipment custodian.
2. Equipment found unsafe must be removed from service. Report any deficiencies immediately to the custodian.
3. Custodians maintain completed forms.

*Note: cranes over one ton, idle for more than six months, must have a periodic inspection by the crane and hoist inspector before use in addition to this pre-use inspection.*

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hoist Type</th>
<th>Building#</th>
</tr>
</thead>
</table>

1. **Inspection sticker:** check for current annual sticker and all other required safety markings.  
   - = Satisfactory, U = Unsatisfactory, N = Not Applicable

2. **Upper limit switch** (if equipped): lower hook slightly, then raise hook slowly into switch, to check operation.

3. **All operating mechanisms:** check for proper operation of all functions, hoist brake, bridge, trolley, pendant station (if equipped), hoist control chain or lever.

4. **Hoist rope or load chain:** lower hook to above floor level, check visually for any broken wires, kinking, crushing, birdcaging, corrosion. Check load chain for bent, or stretched, cracked, scored, or heat damaged links.

5. **Hook / hook block and supporting hook** (if equipped): check for excessive throat opening, bent/twisted elements, hook swivels freely, safety latch operational, and rope sheaves or chain sprockets for signs of wear or malfunction.

6. **Spooling:** check spooling of wire rope onto all sheaves and drums. Check load chain spooling onto sprockets and into chain bucket (if equipped).

7. **Electric, air, or hydraulic:** check festoons, collectors, pendant controls, lights, strain relief, wiring for exposed conductors, and for any leaky hoses, tanks, or valves.

8. **Hoist support:** fasteners, beams, trolley, gantry structure/wheels, and jib structure, engine hoist components. Hoists must be supported by an approved and engineered anchorage (portable hoists) or beam/gantry equal to or more than hoist capacity.
This form is used to document the pre-use inspection required for all mobile cranes at the beginning of each shift. The operator completes inspection before beginning work, keeps the form on the crane during work, and submits to the equipment custodian once work is completed. The equipment custodian maintains the completed forms (see Hoisting and Rigging: Equipment Requirements [SLAC-I-730-0A21S-035]). Equipment found unsafe must be removed from service. Report any deficiencies immediately to the custodian.

### Visual Inspection

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Pass</th>
<th>Fail</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine fluid level correct (check dip stick or sight glass)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic fluid level correct (check dip stick or sight glass)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic system exhibits no apparent weeping or leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air system exhibits no audible leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tire pressure acceptable and tire not damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescoping boom exhibits no damage to structure, wear pads, boom stops, or cylinder</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire rope free of dirt, excess lube, kinks, and wires and spooled correctly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reeving correct</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wedge sockets and wire rope clips not distorted, cracked, or missing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block not damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ball and hook is free to swivel and rotate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guards are in place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outrigger float(s) secured with pad pin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cab</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handrails in place and not damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator’s manual in vehicle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load chart legible and visible to operator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand signal chart visible to workers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charged fire extinguisher in place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cab glass not cracked and wipers are functional</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Operational Inspection

<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Pass</th>
<th>Fail</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauges and Indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load moment indicator operational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drum rotation indicator functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boom length indicator functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boom angle indicator functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine: hydraulic, air, electrical, oil pressure, temperature, and fuel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational Inspection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct counterweight for the load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main hoist control functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary hoist control functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-two block in place and functioning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swing brake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lights and horns functional</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 41: Hoisting and Rigging

Forklift Attachment Approval Procedure

1 Purpose

The purpose of this procedure is to ensure that any attachment that can affect the capacity or safe operation of a forklift is properly evaluated. It covers approval of attachments for below-the-tine lifts performed with a forklift or other powered industrial vehicle (PIV). It applies to workers (as operators and designated leaders/persons-in-charge), equipment custodians, qualified engineers, manufacturers, line management, and the hoisting and rigging inspector.

2 Procedures

Attachments can only be used if they have passed the review of conformance and are within the rated capacity as specified on the forklift data plate.

Important Free rigging, the direct attachment to or placement of rigging equipment (such as slings, shackles, or rings) onto the tines of a powered industrial truck for a below-the-tines (forks) lift, is prohibited at SLAC.

<table>
<thead>
<tr>
<th>Step</th>
<th>Person</th>
<th>Action</th>
</tr>
</thead>
</table>
| 1.   | Operator, designated leader, or person-in-charge | Develops a written guideline or procedure for each forklift that the attachment will be used on, that includes  
  - Equipment serial numbers  
  - Capacities (pre- and post-attachment installation)  
  - Fork placement  
  - Safe operation guidelines once attachment is in place  
  Submits procedure to hoisting and rigging inspector for approval |
| 2.   | Hoisting and rigging inspector | Approves procedure |
| 3.   | Operator, designated leader, or person-in-charge | Submits approved procedure to line management |
| 4.   | Line management | Seeks approval from manufacturer or qualified engineer:  
  - Requests written approval from the forklift manufacturer to use the purchased attachment as described in the procedure developed in Step 2  
  or |
### 3 Forms

The following forms and systems are required by this procedure:
- None

### 4 Recordkeeping

The following recordkeeping requirements apply for this procedure:
- The equipment custodian maintains the record of approval, safety analysis, and procedure.

### 5 References

- [SLAC Environment, Safety, and Health Manual](SLAC-I-720-0A29Z-001) (SLAC-I-720-0A29Z-001)
- Chapter 41, “Hoisting and Rigging”
– Hoisting and Rigging: Equipment Requirements (SLAC-I-730-0A21S-035)

- Chapter 48, “Powered Industrial Vehicles”

Other Documents

Chapter 41: **Hoisting and Rigging**

Requirements for Below-the-Hook Lifting Devices, Slings, and Rigging Hardware and Accessories

1 Purpose

The purpose of these requirements is to ensure that below-the-hook lifting devices, slings, and rigging hardware and accessories are safe to operate. They cover fabrication, marking, and pre-use inspections. They apply to workers (as operators and riggers) and equipment custodians.

For an overview of required inspections, including initial and periodic inspections conducted by a qualified inspector, see Hoisting and Rigging: Equipment Requirements.

2 Requirements

Operators and riggers are responsible for conducting the pre-use inspections described below. Equipment custodians are responsible for ensuring equipment is marked and fabricated as described below.

2.1 Below-the-Hook Lifting Devices

The following requirements apply to below-the-hook lifting devices, such as spreader bars, lifting yokes, lifting baskets, and lift fixtures.

2.1.1 Structural and Mechanical Lifting Devices

2.1.1.1 Marking

- The rated capacity of each lifting device must be marked on the main structure where it is visible and legible.
- If the lifting device comprises several items, each detachable from the assembly, each lifting device must be marked with its rated capacity.
- At a minimum, a nameplate, name tag, or other permanent marker must be affixed displaying the following data:
  - Manufacturer or contractor’s name if fabricated on-site
  - Lifting device weight, if over 100 pounds
  - Serial number (if available)
  - Rated capacity
A re-rated lifting device must be relabeled with the new rated capacity.

2.1.2 Vacuum Lifting Devices

2.1.2.1 Marking

- The rated capacity, maximum width and length, and minimum thickness of load must be marked on the main structure where it is visible and legible.
- Individual pads or groups of pads, controlled by shutoff valves, must be marked with the rated capacity of each pad or group of pads.
- At a minimum, a nameplate, name tag, or other permanent marker must be affixed to each lifter displaying the following data:
  - Manufacturer’s name
  - Model number or unit identification
  - Weight of lifting device
  - Electric power (when applicable)
  - Pressure and volume of compressed air (when applicable)
  - Rated capacity
  - Proof of initial/periodic inspection label
- Manual shutoff valves on individual pads or groups of pads must be marked to show operating position.
- A label or labels must be affixed to each vacuum lifting device in a readable position that displays the word CAUTION or other legend designed to bring the label to the attention of the operator. The label must also contain information cautioning against
  - Exceeding the rated capacity or lifting loads not specified in the manufacturer’s instruction manual
  - Operating a damaged or malfunctioning unit or a unit with missing parts
  - Operating when vacuum indicators show insufficient vacuum
  - Operating the unit when vacuum pads are not spaced for equal loading
  - Incorrect positioning of the lifting device on the load
  - Lifting people
  - Moving loads above people
  - Removing/obscuring warning labels
  - Operating the lifting device when the rated capacity, lifting-device weight, or safety markings are missing (except in cases where the device cannot, for security or other reasons, be marked).
  - Making alterations or modifications to the lifting device.
  - Lifting loads higher than necessary and leaving suspended loads unattended.

A label must be affixed to each unit that directs the user to consult the manufacturer’s manual if the size or shape of the unit prohibits the inclusion of the above markings.
2.1.3 Magnets (close-proximity-operated)

2.1.3.1 Marking

- At a minimum, a nameplate, name tag, or other permanent marker must be affixed to each lifting magnet, and must display
  - Manufacturer’s name, or if the magnet has been repaired or modified, the name and address of the repairer/modifier
  - Model or unit identification
  - Weight
  - Duty cycle, if applicable
  - Cold current
  - Rated capacity
  - Proof of initial/periodic inspection label

- In addition, battery-powered and external-powered lifting electromagnets and electrically controlled permanent-magnet lifting magnets must be marked with
  - The voltage of the battery or primary power supply
  - The cold current or watts at 68°F (20°C) and rated voltage

- A label or labels must be affixed to each lifting magnet in a readable position that displays the word CAUTION or other legend designed to bring the label to the attention of the operator. The label must also contain information cautioning against
  - Operating when the battery capacity is inadequate
  - For externally powered electromagnets: exceeding magnet duty cycle and disconnecting the magnet with the power on
  - On electrically controlled permanent magnets: operating if the internal control function indicator, where applicable, does not indicate a complete cycle
  - On manually controlled permanent magnets: operating with the control handle not fully in the LIFT position

2.2 Rigging Hooks

2.2.1 Marking

The manufacturer’s identification must be forged, cast, or die-stamped on a low-stress and non-wearing area of the hook.

2.2.2 Inspecting

Rigging hooks must be inspected before each use for

- Cracks, nicks, gouges
- Deformation
Damage from chemicals
- Damage, engagement, or malfunction of latch (if provided)
- Evidence of heat damage
- Wear
- Hook attachment and securing means in working order

If any of these conditions are found, the hook must be removed from service and the equipment custodian contacted.

### 2.3 Slings

#### 2.3.1 Wire-rope Sling

##### 2.3.1.1 Fabricating

Wire rope purchased to fabricate slings must meet the requirements of [DOE-STD-1090](#).

##### 2.3.1.2 Marking

Wire-rope slings must be marked with the following information:

1. Name of trademark of manufacturer
2. Work load limit
3. Diameter or size
4. Purchase order or serial number
5. Inspection due date
6. RIG number

Note: *Sling identification must be maintained by the user so as to be legible during the life of the sling. (Stenciling or stamping on the swages of a sling is not recommended.)*

##### 2.3.1.3 Inspecting

Wire-rope slings must be inspected before each use. Users must carefully note any deterioration that could result in an appreciable loss of original strength and determine whether further use of the sling would constitute a safety hazard. Slings must be immediately removed from service if any of the following conditions are present:

- Missing or illegible sling identification
- Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay
- Wear or scraping of one-third the original diameter of the outside individual wire
- Kinking, crushing, bird caging or any other damage resulting in distortion of the rope structure
- Evidence of heat damage
End attachments that are cracked, deformed, or worn
- Corrosion of the rope or end attachments

2.3.2 Metal-mesh Slings

2.3.2.1 Inspecting

Metal-mesh slings must be inspected before each use. Metal-mesh slings must be removed from service if any of the following defects are present:
- A broken weld or brazed joint along the sling edge
- A broken wire in any part of the mesh
- Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion
- Lack of flexibility due to distortion of the mesh
- Distortion of the female handle so the depth of the slot is increased by more than 10 percent
- Distortion of either end fitting so the width of the eye opening is decreased by more than 10 percent
- A 15 percent reduction of the original cross-sectional area of metal at any point around a handle eye
- Any distortion or twisting of either end fitting out of its plane
- Cracked end fitting
- Evidence of heat damage

2.3.3 Synthetic-web Slings

2.3.3.1 Marking

Each sling must be marked with
- Manufacturer’s name or trademark
- Manufacturer’s code or stock number
- Type of synthetic web material
- Rated loads for the type of hitches used

2.3.3.2 Inspecting

Synthetic-web slings must be inspected before each use. Slings must be removed from service if any of the following defects are visible:
- Acid or caustic burns
- Melting or charring of any part of the surface
- Snags, punctures, tears, or cuts
- Broken or worn stitches
- Wear or elongation exceeding the amount recommended by the manufacturer
2.3.3.3 Using in Radiation Areas

When necessary to use synthetic slings in a radiation area, site-specific methodologies must be developed and implemented to ensure that radiation exposure does not exceed 100,000 rad during the life of the sling.

2.3.4 Synthetic Roundslings

2.3.4.1 Marking

Each polyester roundsling must be permanently marked or labeled showing

- Name or trademark of manufacturer
- Manufacturer’s code or stock number
- Rated capacities for the three basic hitches (vertical, choker, vertical basket)
- Length (reach) – bearing point to bearing point
- Each manufacturer must internally identify its product with name or trademark for traceability

2.3.4.2 Inspecting

Synthetic roundslings must be inspected before each use. Slings must be removed from service if any of the following defects are visible:

- Missing or illegible sling identification
- Acid or caustic burns
- Melting or charring of any part of the surface
- Snags, punctures, tears, cuts or abrasive wear that expose the core yarns
- Broken or worn stitches in the cover which exposes the core yarns
- Wear or elongation exceeding the amount recommended by the manufacturer
- Stretched, cracked, worn, pitted or distortion of fittings
- Knots in any part

2.3.4.3 Using in Radiation Areas

When necessary to use synthetic slings in a radiation area, site-specific methodologies must be developed and implemented to ensure that radiation exposure does not exceed 100,000 rad during the life of the sling.

2.3.5 Alloy Steel-chain Slings

The following applies to slings made from grade 80 and 100 alloy chain manufactured and tested in accordance with National Association of Chain Manufacturers welded steel chain specifications – 1990. If
chain other than this is used, it must be used in accordance with the recommendations of the chain manufacturer.

2.3.5.1 Marking

- Wire-rope slings must be marked with the following:
  - Size
  - Manufacturer’s grade
  - Rated load and angle on which the rating is based.
  - Reach
  - Numbers of legs
  - Sling manufacturer
  - Inspection due date label by hoist and rigging inspector

  This information may be stenciled or stamped on a metal tag or tags affixed to the sling.

- Where slings have more than one leg, ensure that the tag is affixed to the master link.

2.3.5.2 Inspecting

Steel-chain slings must be inspected before each use as follows:

- Conduct a link-by-link inspection for the following defects: nicks, cracks, gouges, wear, bent links, stretched links, shearing of links, cracks in any section of link, scores, abrasions, heat damage, rust, corrosion or markings tending to weaken the links. Reject damaged items.

- Check steel-chain slings for uneven lengths when sling legs are hanging free.

- Check rings and hooks for bends, distortion, cracks in weld areas, corrosion, and scores, heat damage, or markings tending to weaken the links. Reject damaged items.

- Perform inspection on an individual-link basis. If any link does not hinge freely with the adjoining link, remove the assembly from service.

- Remove from service assemblies with deformed master links or coupling links.

- Remove from service assemblies if hooks have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

- Do not straighten deformed hooks or other attachments on the job. Assemblies with such defects must be reconditioned by the manufacturer or discarded.

- Remove from service assemblies with cracked hooks or other end attachments; assemblies with such defects must be reconditioned or repaired before return to service.

- Do not use homemade links, makeshift fasteners formed from bolts, rods, and the like, or other nonstandard attachments. Reject if discovered.

- Do not use makeshift or field-fabricated hooks on steel-chain slings. Reject if discovered.
2.4 Rigging Hardware and Accessories

2.4.1 Shackles

2.4.1.1 Fabricating

- Grade A shackles (regular strength) together with their pins and bolts must be forged from carbon steel.
- Grade B shackles (high strength) together with their pins and bolts must be forged from alloy steel.
- Shackle pins must fit freely (without binding) and seat properly.

2.4.1.2 Marking

Each shackle body must be permanently and legible marked in raised letters by the manufacturer. Raised or stamped letters on the side of the bow must be used to show:

- Manufacturer’s name or trademark
- Size
- Rated capacity, recommended safe working load

2.4.1.3 Inspecting

Shackles must be inspected for the following conditions and removed from service and only returned to service when approved by a qualified person:

- Missing or illegible manufacturer’s name or trademark and/or rated load identification
- Indications of heat damage including weld spatter or arc strikes
- Excessive pitting or corrosion
- Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components
- Excessive nicks or gouges
- A 10 percent reduction of the original or catalog dimension at any point around the body or pin
- Incomplete pin engagement
- Excessive thread damage
- Evidence of unauthorized welding
- Other conditions, including visible damage, that cause doubt as to the continued use of the shackle

2.4.2 Eyebolts

2.4.2.1 Fabricating

- Eyebolts used for hoisting must be fabricated from forged carbon or alloy steel.
2.4.2.2 Marking

- Carbon steel eyebolts must have the manufacturer’s name or identification trademark forged in raised characters on the surface of the eyebolt.
- Alloy steel eyebolts must have the symbol “A” (denoting alloy steel) and the manufacturer’s name or identification mark forged in raised characters on the surface of the eyebolt.

2.4.2.3 Inspecting

Eyebolts must be inspected before each use:
- Visually inspect the hole to ensure that there has been no deformation.
- Check the condition of the threads in the hole to ensure that the eyebolt will secure and the shoulder can be brought down snug.
- Ensure that the shank of the eyebolt is not undercut and is smoothly radiused into the plane of the shoulder or the contour of the ring for non-shouldered eyebolts.
- Destroy eyebolts that are cracked, bent, or have damaged threads.

2.4.3 Turnbuckles

Turnbuckles may be used in sling systems provided that they are engineered, designed, and approved as a part of the sling system. Approved turnbuckles must be marked and identified for use with the sling set for which they were designed and must be load-tested as part of the sling set.

2.4.3.1 Fabricating

- Eyebolts must be fabricated from forged alloy steel.
- Eyebolts must be provided with a jam nut of a type that does not depend upon deformation of the threads for security.

2.4.3.2 Marking

- Manufacturer’s name or trademark and turnbuckle size must be permanently marked on the turnbuckle body.

2.4.3.3 Inspecting

- Turnbuckles must be inspected for damage before each use. Damaged threads, jamb nuts, or bent frame members make the unit unsuitable for use.

2.4.4 Links and Rings

Links and rings are usually designed and manufactured as a part of the lifting hardware for a specific purpose, such as the peak link on multiple-leg slings. However, the rings and links may also be found on the load-attachment end of slings.

2.4.4.1 Fabricating

- Rings must be forged or welded from low alloy steel.
2.4.4.2  Marking
- Rings or links should be marked by the manufacturer with the manufacturer’s name or trademark and ring or link size.

2.4.4.3  Inspecting
- Welded rings or links must be subjected to a non-destructive test

2.4.5  Swivel Hoist Rings

2.4.5.1  Fabricating
- Check that swivel hoist rings for hoisting are be fabricated from forged carbon or alloy steel.

2.4.5.2  Marking
Swivel hoist rings must have the manufacturer’s name or trademark, working load limit, and recommended torque value permanently marked (forged, stamped, or inscribed) by the manufacturer on the swivel hoist ring. Permanently attached metal tag bearing the same information may also be used.

2.4.5.3  Inspecting
Permanently installed hoist rings must be inspected before each use as follows:
- Ensure free movement of bail and swivel.
- Inspect swivel hoist rings thoroughly.
- Inspect the hole to ensure that there has been no deformation.
- Check the condition of the threads in the hole to ensure that the hoist ring will secure and the bushing can be brought down for a snug fit.

Destroy hoist rings that are cracked, bent, have damaged threads, or do not operate freely

2.4.6  Wire-rope Clips (clamps)

2.4.6.1  Marking
- Wire-rope clips must be permanently and legibly marked with the size and manufacturer’s identifying mark.

3  Forms

The following forms and systems are required by these requirements:
- Hoisting and Rigging Equipment Database
  - Rigging Equipment Database (RED, contact hoisting and rigging inspector). Database for hoisting and rigging equipment other than cranes, hoists, and miscellaneous lifting devices
4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- The equipment custodian maintains custodian records.
- The hoisting and rigging inspector maintains inspection records.

5 References

[SLAC Environment, Safety, and Health Manual](SLAC-I-720-0A29Z-001) (SLAC-I-720-0A29Z-001)

- [Chapter 41, “Hoisting and Rigging”](#)
  - [Hoisting and Rigging: Equipment Requirements](SLAC-I-730-0A21S-035) (SLAC-I-730-0A21S-035)

Other Documents

- Department of Energy Standard 1090, “Hoisting and Rigging” ([DOE-STD-1090](DOE-STD-1090)) and third-party standards referenced in it


Chapter 41: **Hoisting and Rigging**

Lift Requirements

Product ID: 677 | Revision ID: 2431 | Date published: 11 June 2021 | Date effective: 11 June 2021
URL: [https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingReqLift.pdf](https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingReqLift.pdf)

1 Purpose

The purpose of these requirements is to ensure that lifts are performed safely. They cover assigning personnel and planning, preparing, and performing lifts. They apply to workers (as operators, riggers, signal persons, and designated leaders/persons-in-charge), supervisors, load owners, ESH coordinators; and the hoisting and rigging program manager.

2 Requirements

Requirements for lifts vary with the type:

- **An ordinary lift** is any that lift that does not meet the requirements of a critical lift.

- **A critical lift** is one for which the application of requirements applicable to ordinary lifts would not adequately eliminate or control the likelihood or severity of the following:
  - Personnel injury or significant adverse health impact (on-site or off-site)
  - Significant release of radioactivity or other hazardous material or other undesirable conditions
  - Undetectable damage that would jeopardize future operations or the safety of a facility
  - Damage that would result in delay to schedule or other significant program impact such as loss of vital data

Any lift that involves more than one crane or motorized lifting device is considered a critical lift.

- **A pre-engineered lift** is a “repetitive lift that is performed by production line personnel in the assembly or disassembly of components or systems” in which the items to be lifted are “identical in terms of dimensions, weight, center of gravity, load path, method of attachment to the lifting equipment, and selection of lifting equipment” and “all items can be lifted in adherence to a specific step-by-step procedure that eliminates rigging decisions or calculations by lift personnel”.

Lifts are classified by the supervisor in charge of the lift.

For guidance on classifying, planning, and performing lifts, see Department of Energy Standard 1090, “Hoisting and Rigging” ([DOE-STD-1090](https://www-group.slac.stanford.edu/esh/eshmanual/references/hoistingReqLift.pdf)).
2.1 Personnel

2.1.1 Two-person Rule

All lifts require at least two persons to be present during lifting operations (that is, when the load is being lifted; two people are not required for pre-use inspections and positioning of equipment). Ordinary lifts may be performed without a second person provided the directorate ESH coordinator and supervisor approve the plan and the hoisting and rigging program manager is notified.

2.1.2 Qualifications

Only qualified persons may perform hoisting and rigging activities. (See Section 4 of Chapter 41, “Hoisting and Rigging”, for training requirements.)

2.1.3 Designated Leader / Person-in-Charge

For ordinary lifts, the supervisor must assign a designated leader. For critical lifts, the supervisor designates a person-in-charge (PIC), who must be someone other than the operator.

2.1.4 Signal Person

For lifts performed with mobile cranes, a signal person is required. Signal persons must

1. Know and understand the type of signals used. If hand signals are used, the signal person must know and understand the Standard Method for hand signals.
2. Be competent in the application of the type of signals used
3. Have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads
4. Must be trained by a qualified evaluator

2.1.5 Professional Rigger

For lifts performed with mobile cranes, a qualified, professional rigger is required.

2.2 Planning

A written lift plan is required for all lifts. The preparer(s) of the plan must, at a minimum, do the following:

- Characterize the load in terms of dimensions, weight, and center of gravity (determined from drawings, calculations, markings or estimates).
  Describing the load is the responsibility of the load owner, who may enlist the assistance of others to help make determinations. The load owner will ensure that the stresses and deflections induced on the load and attachment points during normal hoisting and rigging operations are within acceptable limits. Upon request, the load owner must provide written documentation.
- Characterize the task in terms of lifting, rotation, speeds, and travel directions.
- Evaluate hazards to determine consequences resulting from collision, upset, or dropping the load.
- Determine how to rig the load using good rigging practices. Consult rigging handbooks as necessary to ensure proper rigging techniques are used for the lift.
- Ensure that the attachment points and load can withstand the forces created by the rigging gear attachment.
- Select equipment and rigging based on the type, category of lift, and minimum capacity of lifting equipment (hoist, crane, slings, lifting fixture); and on the identified load, task, and hazards. Ensure that sling angles are considered when determining forces on rigging equipment and the load.
- Include in critical lift plans
  - Specifications for the softeners to be utilized, including dimensions, materials of construction, and any special retaining mechanisms
  - Specifics on rigging configuration, including softener placement location, use of special retaining mechanisms, and use of supplemental sling protection (for example, cut resistant sleeves).
  - An analysis demonstrating that the specified softeners and rigging configuration provide an adequate factor of safety (as determined by the structural/mechanical engineer reviewing the lift plan) for preventing the slings from slipping off the softeners during the lift.

The plan must be documented using a lift planning and control form (for ordinary lifts or critical lifts). (If using an existing procedure, attach it to the form and fill out only the first page.)

Note Approved lift plans may be reused for similar lifts of like material. The location, time, and workers may be different. Plans must be signed only once: by preparers and approvers when being written and approved and by workers after reading the plan. Plans must be revised and reapproved if conditions change.

2.2.1 Approval

For ordinary lifts the supervisor in charge of the lift, or the hoisting and rigging program manager if requested, approves the plan.

For critical lifts, the hoisting and rigging program manager approves the plan, following review by a structural or mechanical engineer.

For the lifting of personnel, written approval from the hoisting and rigging program manager is required. Requests for approval must include detailed documentation.

For pre-engineered lifts, written approval from the hoisting and rigging program manager is required. Requests for approval must include detailed documentation.

Deviations from the approved plan must be reviewed by the original approver.

2.3 Preparing and Testing

The designated leader / person-in-charge must
• Verify that all equipment, fixtures, and accessories are operative, up-to-date on required periodic inspections, and in good condition before the operation begins (see Hoisting and Rigging: Equipment Requirements for details)
• Ensure that all equipment pre-use inspections are completed and forms submitted to the equipment custodian
• Survey the lift site for hazardous or unsafe conditions; clear lift path of obstructions
• Ensure that all personnel are trained on the types of equipment they will be using
• Ensure that all personnel fully understand the requirements of the lift plan and their role in the operation and sign the lift plan

2.4 Performing the Lift

The designated leader / person-in-charge must
• Keep a copy of the plan at the work site and follow the plan
• Provide the task-qualified supervision specified in the planning process
• Vacate all non-essential personnel from the lift area
• Identify the operator
• Ensure a signal person is assigned, if required, and identified to the operator
• Check that basic operating instructions of all lifting equipment are posted or otherwise available to the operator
• Ensure that equipment is properly set up and positioned
• Ensure that the load hook is directly over the center of gravity of the load to the extent possible
• Check load lines after strain is put on them but before the load is lifted clear of the ground; if load lines are not equalized, reposition the slings or equipment so that the lines are equalized before continuing.
• Direct the lifting operation to ensure that the lift is completed safely and efficiently
• Direct operations if an accident or injury occurs

The operator / rigger must
• Follow the lift plan, including specific instructions/procedures for attachment of the rigging gear to the load
• Use proper rigging techniques. Examples include padding sharp corners, orientation of chocker hitches for “rolls”, orientation of hooks, and no binding of hoist rings. Ensure that
  – The load is attached to the hook by means of slings or other suitable and effective means that are rigged to ensure the safe handling of the load
  – Slings are freed of kinks or twists before use
  – Baskets, tubs, skips, or similar containers used for hoisting bulk materials are loaded so as not to exceed their safe carrying capacity
  – The load is well secured and properly balanced in the sling or lifting device before it is lifted more than a few inches
– The hoist rope is not kinked
– Multiple part lines are not twisted around each other

- Ensure the hook is positioned over the load in such a manner as to prevent swinging of the load when lifted
- Slowly raise the crane to take the slack out of the rigging without actually lifting the item. Allow the rigging gear to settle into place, checking for twists and binding. Make sure that padding has remained in place and all slings are protected from sharp edges. Begin to raise the item to verify balance and check the braking system by watching that the load does not sink. If load is not balanced, lower the load and adjust. Repeat as necessary until the load is evenly balanced.
- Wear hard hats and safety-toed shoes for all lifts and when handling the load. Other personal protective equipment (PPE) such as gloves and safety-glasses may be required to mitigate hazards. Any deviation from the mandatory PPE must be authorized by the supervisor.

**Warning**  Personnel must never place any part of their bodies under a suspended load.

### 3 Forms

The following forms and systems are required by these requirements:

- **Hoisting and Rigging: Ordinary Lift Planning and Control Form** (SLAC-I-730-0A21J-022). Form for documenting ordinary lift plans
- **Hoisting and Rigging: Critical Lift Planning and Control Form** (SLAC-I-730-0A21J-058). Form for documenting critical lift plans

### 4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- The approved lift plan must be kept at the job site with other work planning and control documents (see **Chapter 2, “Work Planning and Control”**) for the duration of the lift.

### 5 References

**SLAC Environment, Safety, and Health Manual** (SLAC-I-720-0A29Z-001)

- **Chapter 41, “Hoisting and Rigging”**
  - **Hoisting and Rigging: Equipment Requirements** (SLAC-I-730-0A21S-035)
- **Chapter 2, “Work Planning and Control”**

Other Documents

- Department of Energy Standard 1090, “Hoisting and Rigging” ([DOE-STD-1090](#)) and third-party standards referenced in it
This form is available in the following formats:
1. Adobe Acrobat (pdf) (attached)
2. Microsoft Word (docx)

A generic version, for use by construction subcontractors who do not have their own equivalent form, is also available:
1. Adobe Acrobat (pdf)
2. Microsoft Word (docx)
Chapter 41: Hoisting and Rigging

Ordinary Lift Planning and Control Form

This form is used to document the lift plan required for ordinary lifts. The supervisor in charge of the lift, or the hoisting and rigging program manager if requested, approves the plan. Deviations from the approved plan must be reviewed by the original approver. A copy of the plan must be kept at the work site (see Hoisting and Rigging: Lift Requirements [SLAC-I-730-0A21S-060]).

If the lift is covered by an existing procedure, attach it to the form and fill out only first page.

Approved plans may be reused for similar lifts of like material. The location, time, and workers may be different. Plans must be signed only once: by preparers and approvers when being written and approved and by workers after reading the plan. Plans must be revised and reapproved if conditions change.

<table>
<thead>
<tr>
<th>Job / project name:</th>
<th>Begin date:</th>
<th>End date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location (bldg, floor, grid):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Plan Preparer(s)

<table>
<thead>
<tr>
<th>Name:</th>
<th>Signature:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

### Approval

[The supervisor in charge of the lift, or the hoisting and rigging program manager if requested, approves the plan. Deviations from the approved plan must be reviewed by the original approver.]

<table>
<thead>
<tr>
<th>Supervisor:</th>
<th>Signature:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoisting and rigging program manager:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>One-person lift (Ordinary lifts may be performed without a second person provided the directorate ESH coordinator and supervisor approve the plan and the hoisting and rigging program manager is notified.):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directorate ESH coordinator:</td>
</tr>
</tbody>
</table>

### Authorized Workers

[The designated leader must ensure that all personnel fully understand the requirements of the lift plan and their role in the operation. Workers signatures below attest to this.]

<table>
<thead>
<tr>
<th>Name:</th>
<th>Signature:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
<tr>
<td>Name:</td>
<td>Signature:</td>
<td>Date:</td>
</tr>
</tbody>
</table>
Characterize the Load(s)

This plan covers □ Single load only  □ Variety of similar loads (enter dimensions and weight of largest load covered by the plan)

<table>
<thead>
<tr>
<th>Length:</th>
<th>Width:</th>
<th>Height:</th>
<th>Diameter:</th>
<th>Load weight:</th>
</tr>
</thead>
</table>

Weight determination (choose one)

☐ Marked on load  ☐ Weighed  □ Estimated  □ Other: ________________________________ (describe)

☐ Weight calculated by _________________________ (name, attach calculations)  ☐ Drawing number: ___________________

Characterize the Task (include directions for lifting, rotation, flipping, speeds, and travel)

Evaluate the Hazards (define specific controls)

Plan the Rigging (define specific controls)

On a sketch or photo (see sketch grid on next page), show how the item will be rigged and the type of gear to be used:

1. Show location of shackles, hoist rings, spreader beams, slings, etc
2. Show attachment points (how rigging gear will be attached to load)
3. Show where padding of sharp edges are necessary
4. Provide the weight of heavy equipment such as a lifter or spreader beam, or fork beam (forklift attachment)
5. Show proper orientation of eyebolts
6. Indicate the center of gravity (horizontal and vertical)
| Rigging Sketch or Photo of Rigged Item (Include all information required to determine that the load is properly rigged and that appropriate rigging gear is selected. Include, as applicable, sling angles, eye bolt orientation, padding points, center of gravity, type of sling hitch, and any other pertinent information.) |

Sample form, see URL at top of page
Characterize the Attachment Points (attach photos to illustrate, as necessary)

- Manufacturer-provided lift point
- Sling in choker hitch
- Sling in basket hitch
- Sling in vertical hitch
- Threaded hole (eyebolt or hoist ring)
- Hole diameter: __________  Material type: ________
- Other: ________

Confirm attachment points or hitch methods (load owner completes if plan preparer in doubt)

- The lift points or attachment methods described in this lift plan can withstand the forces created by the rigging gear.

Load owner: ___________________  Signature: ___________________  Date: __________

Define Rigging Gear Requirements

1. List each piece of rigging gear shown on the rigging sketch or photo in the table below (such as: load hook, shackles, slings, eye bolts). If a component weighs more than 10 pounds, include the weight in the weight column.

2. Label the sketch or photo using the corresponding letter for the gear.

3. Draw sling angles and the resulting load reduction factors for slings and eyebolts.

4. Calculate the force on each piece of rigging gear. Show that angles are accounted for in determining forces.

5. Determine the required rigging gear capacity and size. Indicate if this is an exact specification or a minimum.

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight</th>
<th>Capacity / rating / working load limit</th>
<th>Size specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample form, see URL at top of page
Chapter 41: Hoisting and Rigging

Critical Lift Planning and Control Form

This form is used to document the lift plan required for critical lifts. The hoisting and rigging program manager approves the plan following review by a SLAC structural or mechanical engineer. Deviations from the approved plan must be reviewed by the original approver. A copy of the plan must be kept at the work site (see Hoisting and Rigging: Lift Requirements [SLAC-I-730-0A21S-060]).

<table>
<thead>
<tr>
<th>Plan Preparer(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>Name:</td>
</tr>
<tr>
<td>Name:</td>
</tr>
</tbody>
</table>

| Critical Lift Confirmation | (The supervisor responsible for workers confirms lift is critical.) |
|---------------------------|
| Supervisor: | Signature: | Date: |

| Approval | (The hoisting and rigging program manager approves the plan following review by a SLAC structural or mechanical engineer.) |
|----------|
| SLAC mechanical / structural engineer: | Signature: | Date: |
| Hoisting and rigging program manager: | Signature: | Date: |

| Person-in-Charge | (The supervisor must assign a person-in-charge (PIC), who must be someone other than the operator.) |
|------------------|
| Name: | Signature: | Date: |

| Authorized Workers | (The person-in-charge must ensure that all personnel fully understand the requirements of the lift plan and their role in the operation. Workers signatures below attest to this.) |
|--------------------|
| Name: | Signature: | Date: |
| Name: | Signature: | Date: |
| Name: | Signature: | Date: |
| Name: | Signature: | Date: |
| Name: | Signature: | Date: |

<table>
<thead>
<tr>
<th>Characterize the Load(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
</tr>
</tbody>
</table>

Weight determination (choose one)
- [ ] Marked on load
- [ ] Weighed
- [ ] Estimated
- [ ] Other: ____________________________ (describe)
- [ ] Weight calculated by _______________ (name, attach calculations)
- [ ] Drawing number: _______________
## Characterize the Task *(include directions for lifting, rotation, flipping, speeds, and travel)*


## Evaluate the Hazards *(define specific controls)*


## Plan the Rigging *(define specific controls)*

On a sketch or photo (see sketch grid on next page), show how the item will be rigged and the type of gear to be used:

1. Show location of shackles, hoist rings, spreader beams, slings, etc
2. Show attachment points (how rigging gear will be attached to load)
3. Show where padding of sharp edges is necessary
4. Provide the weight of heavy equipment such as a lifter or spreader beam, or fork beam (forklift attachment)
5. Show proper orientation of eyebolts
6. Indicate the center of gravity (horizontal and vertical)
Rigging Sketch or Photo of Rigged Item (Include all information required to determine that the load is properly rigged and that appropriate rigging gear is selected. Include, as applicable, sling angles, eye bolt orientation, padding points, center of gravity, type of sling hitch, and any other pertinent information.)
Characterize the Attachment Points  (*attach photos to illustrate, as necessary*)

- [ ] Manufacturer-provided lift point
- [ ] Sling in choker hitch
- [ ] Sling in basket hitch
- [ ] Sling in vertical hitch
- [ ] Threaded hole *(eyebolt or hoist ring)*

  - Hole diameter: __________________
  - Material type: __________________

- [ ] Other: __________________

Confirm attachment points or hitch methods *(load owner completes if plan preparer in doubt)*

- [ ] The lift points or attachment methods described in this lift plan can withstand the forces created by the rigging gear.

Load owner: __________________
Signature: __________________
Date: __________________

Define Rigging Gear Requirements

1. List each piece of rigging gear shown on the rigging sketch or photo in the table below (such as: load hook, shackles, slings, eye bolts). If a component weighs more than 10 pounds, include the weight in the weight column.
2. Label the sketch or photo using the corresponding letter for the gear.
3. Draw sling angles and the resulting load reduction factors for slings and eyebolts.
4. Calculate the force on each piece of rigging gear. Show that angles are accounted for in determining forces.
5. Determine the required rigging gear capacity and size. Indicate if this is an exact specification or a minimum.
6. Provide certification for the rigging gear that will be used (proof that the rigging equipment has been verified compliant and proof load tested).
7. Specify the softeners to be used, including dimensions, materials of construction, location, and any special retaining mechanisms.
8. Label the sketch or photo using the corresponding letter for the softeners.
9. Draw softener placement location, note use of special retaining mechanisms and supplemental sling protection (cut-resistant sleeves).
10. Demonstrate that the specified softeners and rigging configuration provide an adequate factor of safety (as determined by the structural/mechanical engineer reviewing the plan) for preventing the slings from slipping off the softeners during the lift. Attach analysis.

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight</th>
<th>Force on gear</th>
<th>Capacity / rating / working load limit</th>
<th>Size specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>