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HOISTING AND RIGGING



U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

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Introduction

The U.S. Department of Energy (DOE) *Hoisting and Rigging Standard* is intended to be used by supervisors, line managers, safety personnel, equipment operators, riggers and other personnel responsible for the safety of hoisting and rigging operations at DOE sites. It may be used as either contract document or as a best practices guide at the site's or program office's discretion.

The standard invokes applicable OSHA and national consensus standards but also delineates more stringent provisions necessary to accomplish the extremely complex, diversified, critical, and oftentimes hazardous hoisting and rigging work found within the DOE complex. In doing so, it addresses the following items that are not covered in detail in the referenced industry or OSHA standards:

- Management responsibility and accountability.
- Definition of critical lifts and the additional requirements for making them.
- The need and responsibilities of a person-in-charge for critical lifts.
- The need and responsibilities of a designated leader for ordinary lifts.
- The definition and special requirements for pre-engineered production lifts.
- Special requirements for the testing, inspection, and maintenance of hoisting equipment in hostile environments.

As a Technical Standard, this document is not mandated for use at DOE sites. However, this standard and its predecessor documents have been used for many years by DOE and its contractors as a valuable resource for conducting hoisting and rigging safely and efficiently. Full implementation of the provisions of this standard should dramatically strengthen hoisting and rigging programs throughout the DOE complex and decrease the probability of serious accidents resulting in personnel injury or death or severe property damage.

If this standard is invoked by contract, it is generally recommended that the most recent ASME standards referenced herein also be invoked by contract to accompany the standard. However, there may be circumstances where a site decides to invoke the referenced ASME standards on a periodic basis (e.g., upon award of a site-wide management contract) and not on an ongoing basis (with running updates for each minor site contractor or subcontractor). This decision is left to the site or Program Office's discretion. Accordingly, this standard does not cite the year of referenced ASME standard to facilitate the site's ultimate decision in this regard.

When formally invoked by contract, the use of the word "shall" within this standard connotes a mandatory action, whereas use of the word "should" or "may" connotes a recommended action.

It should be noted that not all hoisting and rigging equipment or operational methods could be covered comprehensively by this standard. Hoisting and rigging equipment fabricated onsite or operated in manner not envisioned by this Standard shall be designed, constructed, operated, inspected and tested in accordance with the design engineer of record and applicable design standards. This Standard does not address elevators, drilling rigs, or the lifting loads with construction equipment not normally intended for lifting purposes (e.g., excavators, payloaders). When using rigging hardware or slings with lifting equipment not covered by this standard, the applicable sections of this standard shall still apply to the rigging hardware and slings.

Also, this Standard does not repeat other DOE nuclear regulations, orders or standards (e.g., 10 CFR 830, “Nuclear Safety Management”) with respect to safety analysis, technical safety requirements, or safety classifications of hoisting equipment. The applicable regulatory documents should be consulted to ensure conformance with these requirements during hoisting and rigging activities.

This standard requires classification of each lift into one of the DOE categories (ordinary, critical, pre-engineered production or personnel) before the lift is planned. Sections 1,2, and 3 of this standard provide the requirements for ordinary, critical and pre-engineered production lifts and personnel lifts are addressed by 29 CFR 1926.1431 and ASME B30.23.

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Section 1 Ordinary Lifts

1.1 General Requirements

- 1.1.1 A designated person shall classify each lift into one of the DOE categories (ordinary, critical, personnel or pre-engineered production) prior to planning the lift.
- 1.1.2 Hoisting and rigging operations for ordinary lifts require a designated leader who shall be present at the lift site during the entire lifting operation. If the lift is being made by only one person, that person assumes all responsibilities of the designated leader. The designated leader shall have the necessary knowledge and experience of the specific type of equipment and assigned lifting operations.
- 1.1.3 Designation may be by written instructions, specific verbal instructions for the particular job, or clearly defined responsibilities within the crew's organizational structure.

1.2 Designated Leader Responsibilities

- 1.2.1 Ensure that personnel involved understand how the lift is to be made.
- 1.2.2 Ensure that personnel involved are current in training and qualification.
- 1.2.3 Survey the lift site for hazardous/unsafe conditions.
- 1.2.4 Ensure that that lifting equipment, rigging and other accessories are properly selected such that their rated capacities are not exceeded.
- 1.2.5 Check all cranes/hoist to ensure that they are still within the inspection interval.
- 1.2.6 Check that basic operating instructions of all lifting equipment, to include required charts, tables, or diagrams, are appropriately posted or otherwise available to the operator.
- 1.2.7 Ensure that a preoperational check of all lifting equipment and rigging is performed to validate compliance with the appropriate sections of this standard.
- 1.2.8 Ensure that equipment is properly set up and positioned.

- 1.2.9 Ensure that hoisting routes minimize exposure to personnel and critical equipment from the hoisted load and that only essential personnel are allowed within the fall zone.
- 1.2.10 Ensure that a signal person is assigned, if required, and is identified to the operator.
- 1.2.11 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 plumb, reposition the slings or equipment so that the lines are plumb before continuing.
- 1.2.12 Direct the lifting operation to ensure that the lift is completed safely and efficiently.
- 1.2.13 Stop the job when any potentially unsafe condition is recognized.
- 1.2.14 Direct operations if an accident or injury occurs.

1.3 Ordinary Lift Planning

The designated leader shall ensure that the following prelift planning issues are addressed, as applicable, prior to the lift (a written plan beyond normal site work planning and control documents is not required, though may be desirable for more complex lifts). Also, for construction lifts involving multiple mobile cranes or temporarily installed overhead cranes, a written lift plan is required (refer 29 CFR 1926.1432).

- 1.3.1 Identify the item to be moved, its intrinsic characteristics (e.g., load integrity, loose materials, liquids), weight, dimensions, its center of gravity, its ability to support imposed lifting forces (both the load and any lift points), and whether it contains any hazardous or toxic materials.
- 1.3.2 Validate the loads path and clearances.
- 1.3.3 Identify lifting equipment and rigging to be used by type and rated capacity.
- 1.3.4 Prepare rigging sketches, as necessary.
- 1.3.5 Evaluate the work area for conditions impacting crane setup operations (e.g., weather, soil bearing capacity, underground utilities, clearances to power lines and other structures).
- 1.3.6 Identify any special or site-specific operating procedures and special instructions.

Section 2

Critical Lifts

2.1 Critical Lift Determination

- 2.1.1 A designated person shall classify each lift into one of the DOE categories (ordinary, critical, personnel or pre-engineered production) prior to planning the lift.
- 2.1.2 A lift shall be classified critical if any of the following conditions are met:
- A. If loss of control of the item being lifted would likely result in the declaration of an emergency as defined by the facility's emergency plan or construction site emergency plan.
 - B. The load item is unique and, if damaged, would be irreplaceable or not repairable and is vital to a system, facility or project operation.
 - C. The cost to replace or repair the load item, or the delay in operations of having the load item damaged would have a negative impact on facility, organizational, or DOE budgets to the extent that it would affect program commitments.
 - D. If mishandling or dropping of the load would cause any of the above noted consequences to nearby installations or facilities.
 - E. For steel erection, a lift shall be designated as a critical lift if:
 - 1. The lift exceeds 75 percent of the rated capacity of the crane or derrick
- OR**
- 2. The lift requires the use of more than one crane or derrick (refer to 29 CFR 1926.751).

- 2.1.3 Further site-specific criteria may be developed to supplement those cited above and may include criteria imposed by site or project safety basis requirements as well as lifting loads which require exceptional care in handling because of size, weight, close-tolerance installation or high susceptibility to damage as well as lifts using multiple pieces of lifting equipment.

- 2.1.4 Though lifting personnel may meet the above criteria, personnel lifts shall not be considered critical lifts and shall be conducted in accordance with 29 CFR 1926.1431 and ASME B30.23.

2.2 Critical Lift Requirements

- 2.2.1 Ensure that the requirements are met for ordinary lifts specified in each section of this standard for each particular equipment category.
- 2.2.2 The operating organization shall appoint a Person-In-Charge (PIC) for critical lifts. A PIC shall be present at the lift site during the entire lifting operation. The PIC shall:
 - A. Have the necessary knowledge and experience of the specific type of equipment and assigned lifting operations.
 - B. Understand the site rules and procedures addressing:
 - 1. Administrative requirements for lifting operations.
 - 2. Personnel assignments and responsibilities commensurate with job requirements.
 - 3. Selection of proper slings, rigging hardware, and lifting equipment.
 - 4. Recognition and control of hazardous or unsafe conditions.
 - 5. Job efficiency and safety.
 - 6. Critical-lift determination and documentation.
- 2.2.3 The PIC shall ensure that a documented pre-job plan or procedure is prepared by qualified person(s) that defines the operation and includes the following:
 - A. Identify the item to be moved, its intrinsic characteristics (e.g., load integrity, loose materials, liquids), weight, dimensions, its center of gravity, its ability to support imposed lifting forces (both the load and any lift points), and whether it contains any hazardous or toxic materials.
 - B. Identification of operating equipment to be used by type and rated capacity (e.g., mobile crane, overhead crane, forklift).

- C. Rigging sketches and/or descriptions that include (as applicable):
 - 1. Identification and rated capacity of slings, lifting bars, rigging accessories, and below-the-hook lifting devices. Calculate and provide the rated capacity of equipment in the configuration in which it will be used.
 - 2. Load-indicating devices.
 - 3. Load vectors.
 - 4. Lifting points.
 - 5. Sling angles.
 - 6. Required lifting equipment movement (e.g., boom and swing angles, trolley and bridge motions).
 - 7. Methods of attachment.
 - 8. Crane orientations.
 - 9. Other factors affecting equipment capacity (e.g., load path sketch, key point heights, floor or soil bearing capacity).
 - D. Operating procedures and special instructions to operators including rigging precautions and safety measures to be followed as applicable.
- 2.2.4 All rigging equipment used in critical lifts (i.e., slings, below-the-hook lifting devices, and rigging hardware) shall be proof load tested in accordance with applicable ASME standards.
 - 2.2.5 Experienced operators who have been trained and qualified to operate the specific equipment to be used shall be assigned to make the lift.
 - 2.2.6 Only designated, qualified signalers shall give signals to the operator. However, the operator shall obey a STOP signal at all times, no matter who gives the signal.
 - 2.2.7 The procedure and rigging sketches shall be reviewed and approved by a qualified person, the responsible manager (or designee) and the responsible oversight organization (such as the safety or engineering departments) before the lift is made.

Subsequent revisions shall be approved per site specific procedures.

- 2.2.8 A pre-lift meeting involving participating personnel shall be conducted prior to making a critical lift. The critical lift plan/procedure shall be reviewed and questions shall be resolved.
- 2.2.9 Prior to executing a critical lift, a qualified person shall verify that the as-installed rigging matches the configuration in the approved lifting plan.
- 2.2.10 If required by the critical lift procedure, a practice lift shall be done before the critical lift. Conditions for a practice lift should closely simulate actual conditions involving: weight, rigging selection and configuration, load movement path, and other relevant factors. Practice lifts should be done by the same crew using the same lifting equipment that will be used in the lift.
- 2.2.11 Although individual plans are generally prepared for critical lifts, multi-use plans may be employed to accomplish recurrent critical lifts. For example, a multi-use plan may be used to lift an item or series of similar items that are handled repeatedly in the same manner. However, if the lifting equipment or rigging must change to accomplish the lift, the critical lift plan must be revised and approved accordingly.

Section 3

Pre-Engineered Production Lifts

3.1 Pre-Engineered Production Lift Determination

- 3.1.1 A designated person shall classify each lift into one of the DOE categories (ordinary, critical, personnel or pre-engineered production) prior to planning the lift.
- 3.1.2 A pre-engineered production lift is defined as a repetitive lift that is performed by production line personnel in the assembly or disassembly of components or systems where detailed lift planning, equipment selection, and lift-specific training may substitute for the qualifications prescribed in Section 5 of this standard. In order for a lift to be designated a pre-engineered production lift, the following criteria shall apply:
 - A. The group of items to be lifted is identical in terms of dimensions, weight, center of gravity, load path, method of attachment to the lifting equipment, and selection of lifting equipment.
 - B. All items can be lifted in adherence to a specific step-by-step procedure that eliminates rigging decisions or calculations by lift personnel. The lifting procedure shall address details of the specific operation including the attachment and detachment of all lifting equipment, fixtures and accessories.

3.2 Specialized Lifting Fixtures for Pre-Engineered Production Lifts

- 3.2.1 Special lifting fixtures shall be designed by a qualified engineer in accordance with the applicable consensus standards. Deviations in design that reflect design factors less than consensus standard requirements shall require documented justification and approval of:
 - A. Representative of a qualified engineering organization.
 - B. Representatives of the responsible oversight organizations.
- 3.2.2 Deviations from the national consensus standard requirements for the inspection, testing, maintenance, modification or repair of specialized lifting fixtures shall also require documented justification and approval of the:
 - A. Representative of a qualified engineering organization.

- B. Representatives of the responsible oversight organizations.

3.3 Procedures

3.3.1 Content

Appropriately trained personnel shall develop and have approved a step-by-step procedure for each pre-engineered production lift. At a minimum, each procedure shall contain the following information:

- A. Identification of the load to be lifted.
- B. Identification of the specific lifting fixtures, slings, and rigging hardware to be used in the operation.
- C. Identification by class and capacity of lifting equipment (e.g., cranes, hoists) to be used.
- D. A requirement to verify that all lifting equipment, fixtures, slings and rigging hardware are operative, up-to-date on required inspections and maintenance, and are in good condition before the operation begins.
- E. Specific instructions for attachment of the lifting fixtures to the load and to the lifting equipment.
- F. Specific step-by-step description of load movements required for the operation.
- G. Specific instructions for removal of the lifting fixtures from both the load and the lifting equipment.

3.3.2 Procedure Verification

Before its first use in the actual production process, the procedure shall undergo a formal verification and validation process using walk-throughs or similar methods to ensure that the steps are appropriate and correct. Any discrepancies found during this process shall be corrected and the process repeated until the procedure is correct.

3.3.3 Approval

- 3.3.3.1 Before the procedure verification process, the procedure shall be reviewed and approved by:

- A. Representative of a qualified engineering organization.
- B. Representatives of the responsible oversight organizations.

3.3.3.2 After each procedure is verified, it shall be reviewed and approved by the following personnel:

- A. Representative of a qualified engineering organization.
- B. Management of the facility where the procedure will be performed.
- C. Management of the production organization performing the procedure.
- D. Representatives of the responsible oversight organizations.

3.3.3.3 Revisions of procedures shall receive the same depth of review and level of approval as the initial versions received.

3.3.4 Changes in Procedures

Any changes to an approved procedure shall be performed according to the process specified above. The change shall be evaluated to determine whether the revised procedure must be revalidated and reverified.

3.3.5 Periodic Review

- 3.3.5.1 Approved procedures should be reviewed at periodic intervals to ensure that their information and instructions are technically accurate and that appropriate human-factor considerations have been included.
- 3.3.5.2 The frequency of reviews should be specified for each procedure; it may vary with the type and complexity of the activity involved.
- 3.3.5.3 Applicable procedures should be reviewed after an incident.

- 3.3.5.4 During each review, procedures should be compared to source documents to verify their accuracy.

3.3.6 Use of Procedure

- 3.3.6.1 A copy of the current issue of the approved procedure shall be in the work area when the operation is performed.
- 3.3.6.2 If a procedure is determined to be deficient, a procedure change shall be initiated before operations continue in accordance with Subsection 3.3.4.
- 3.3.6.3 Deviations from the approved procedure are not permitted except for emergencies.
- 3.3.6.4 During emergency conditions, personnel may return to a safe and stable condition without first initiating a procedure change.

3.4 Training

- 3.4.1 Specialized training shall be conducted for personnel involved in performing pre-engineered production lifts. This training shall be periodically reviewed and approved by the responsible operating and oversight organizations. It shall include:
 - A. Thorough coverage of all aspects the procedure and assigned responsibilities for the lift.
 - B. A demonstration by the individual of operational competence in the performance of all assigned duties associated with the lift.
- 3.4.2 Training on a procedure shall be repeated periodically or when a modification to the procedure results in a significant change in the operation.

Section 4

Hostile Work Environments

4.1 General Requirements

- 4.1.1 This section describes provisions for hoisting and rigging operations in hostile work environments. A position on the use and application of hostile environment plans and their relationship to the requirements of 10 CFR 851, “Worker Safety and Health Program,” has been issued and is available for reference at:
http://www.hss.energy.gov/HealthSafety/WSHP/rule851/Cranes_in_Hostile_Environments.pdf
- 4.1.2 This chapter contains special provisions for hoisting and rigging operations and equipment in hostile environments where standard operating, maintenance, inspection, or test procedures cannot be followed as a result of radiation or radioactive contamination, toxic/hazardous chemicals or gases, or temperature extremes. Hostile environments are environments that have been rendered inaccessible to workers during hoisting or rigging operations due to these health hazards.
- 4.1.3 Hoisting and rigging activities can usually be accomplished where the environment will allow normal operations with access for hands-on equipment contact. In those situations, operations, maintenance, inspections, and tests shall be done in accordance with the balance of this standard or other applicable regulatory requirements.
- 4.1.4 Hoisting and rigging equipment or operations shall be reviewed by a designated person to determine compliance with the requirements of this standard or other applicable regulatory requirements. If it is determined to be impossible or unreasonable for the requirements of the balance of this standard or other regulatory requirements to be met as a result of hostile environmental conditions, a hostile environment plan shall be prepared to document alternative compliance methods and procedures.
- 4.1.5 Alternate compliance methods and procedures shall be consistent with a facility’s safety basis documents (i.e., Documented Safety Analysis and Technical Safety Requirements).

- 4.1.6 The site's radiation protection organization shall be consulted to ensure that all hoisting and rigging operations are conducted consistent with DOE's policy of as-low-as-reasonably achievable (ALARA) radiation exposure per the provisions of 10 CFR 835, "Occupational Radiation Protection."
- 4.1.7 Safety of personnel shall remain the first priority.

4.2 Hostile Environment Plan

- 4.2.1 A hostile environment plan shall be prepared by a designated person and shall cover operations, equipment, inspection, testing, and maintenance. See Exhibit I, Hostile Environment Plan, at the end of this section.
- 4.2.2 At a minimum, the plan shall be reviewed and approved by responsible contractor management at the facility where the crane, hoist, or other equipment is located and by responsible management of the appropriate contractor oversight organization such as safety or quality assurance.
- 4.2.3 The plan shall address only those actions or features that require deviation from the requirements of this standard due to a hostile environment. At a minimum, it shall contain the following information:
 - A. The specific requirements that cannot be met.
 - B. The difference between the requirement and actual conditions.
 - C. Justification for not meeting this standard's requirements.
 - D. A statement of actions or features to be used to compensate for the differences.
 - E. Specific maintenance, inspections, and tests to be performed whenever access is possible.
 - F. Replacement or retirement criteria for equipment that is designed to operate with little or no maintenance.
- 4.2.4 Detailed operation, inspection, testing, and maintenance procedures that state specific requirements and acceptance criteria shall be prepared, based on the hostile environment plan.

- 4.2.5 The responsible manager shall ensure that the approved hostile environment plan is distributed as follows:
 - A. DOE Site Office or equivalent.
 - B. Equipment operators, maintenance organizations, and other organizations or personnel affected by the plan.
 - C. Equipment history file.
- 4.2.6 Hostile environment plans and the equipment history file shall be readily available to affected workers and other appointed personnel.

4.3 Marking and Posting

Equipment used under a hostile environment plan shall be posted with the following information: “Special Maintenance and Operating Instructions Required – see Hostile Environment Plan.”

4.4 Inspections, Testing and Maintenance

- 4.4.1 Lifting fixtures and rigging accessories shall be qualified in accordance with Sections 10, 11, and 12 (“Wire Rope and Slings,” “Rigging Hardware,” and “Below-the-Hook Lifting Devices,” respectively) of this standard prior to being exposed to the hostile environment.
- 4.4.2 Lifting equipment, slings, rigging accessories and fixtures that have been removed from hostile environments shall be inspected and maintained per the applicable provisions of this standard prior to their reuse outside of hostile environments.
- 4.4.3 When it is necessary to use synthetic slings in a radiation area, site specific methodologies shall be developed and implemented to ensure that radiation exposure does not exceed 100,000 rad during the life of the sling.

Exhibit I Hostile Environment Plan

Building:		Location:	
Type crane/hoist:			
(e.g., overhead top-running bridge and trolley, top-running bridge with underhung hoist, jib crane, monorail hoist, overhead hoist)			
Capacity:		(Auxiliary):	
Power method:			
Manufacturer:			
1a. H&R standard requirement that will not be met			
Section number:			
(copy the applicable section):			
1b. Difference between standard requirement and what is to be allowed by this plan:			
1c. Justification for not meeting the standard requirement:			
1d. Actions or features to compensate for differences:			
1e. Actions to be taken (e.g., inspections, maintenance) for lifting equipment, slings, rigging accessories and fixtures that will be removed from hostile environments and subsequently reused to ensure compliance with this Standard, applicable regulatory requirements and manufacturer's recommendations prior to their reuse (if applicable):			
Include information regarding replacement or retirement criteria for this equipment. Include information regarding any special design, maintenance, or test considerations that apply to this equipment.			

Approval		(Signature/Date)	
*Facility Manager:		Date:	
*Manager, Oversight Organization:		Date:	
Other:		Date:	
Other:		Date:	
Other:		Date:	
*Approval is mandatory.			

Section 5

Personnel Qualifications

5.1 General Requirements

- 5.1.1 This section specifies qualification/certification requirements for hoisting and rigging personnel.
- 5.1.2 Managers responsible for work assignments on hoisting and rigging activities shall ensure that assignments do not exceed personnel qualifications.

NOTE: *Hoisting and rigging personnel includes, but is not limited to, crane operators, forklift operators, riggers, signal persons, designated leaders, persons-in-charge, trainees, inspectors, maintenance personnel, assembly/disassembly director, and lift directors.*

5.2 Qualifications

- 5.2.1 Personnel performing hoisting and rigging activities specifically addressed by OSHA and national consensus standards shall be qualified per the OSHA and national consensus standards.
- 5.2.2 Personnel involved in hoisting and rigging activities for which qualification requirements are not specifically addressed by OSHA or national consensus standards shall:
 - A. Be physically qualified to perform the specific job requirements.
 - B. Complete training for the equipment type and/or assigned function.
- 5.2.3 Each site shall develop a requalification program for hoisting and rigging personnel. The requalification program shall reflect the complexity or changing nature of the site's hoisting and rigging operations and shall, at a minimum, comply with requalification requirements of referenced OSHA and ASME standards.

5.3 Certification

- 5.3.1 Hoisting and rigging personnel certified by a nationally recognized certifying organization or a state/local agency recognized by Federal OSHA may be accepted as having met the basic qualification requirements for both construction and general industry hoisting and rigging operations.
- 5.3.2 A practical operating skill evaluation shall be conducted for the specific equipment type and/or assigned function. This evaluation shall be conducted before a work assignment.

5.4 Records

Qualification/certification records for hoisting and rigging personnel shall be kept on file and shall be readily available.

Section 6 Overhead Cranes

6.1 General Requirements

Operation, inspection, maintenance, and testing of overhead and gantry cranes shall comply with ASME B30.2, “Overhead and Gantry Cranes (Top-Running Bridge, Single or Multiple Girder, Top-Running Trolley Hoist)”, B30.11, “Monorail Systems and Underhung Cranes,” and B30.17, “Overhead and Gantry Cranes (Top-Running Bridge, Single Girder, Underhung Hoist,” in addition to applicable OSHA standards. Only equipment built to the appropriate design standards shall be used in DOE installations. The following additions and exceptions to the above cited standards shall also be implemented.

ASME NUM-1, “Rules for Construction of Cranes, Monorails, and Hoists (with Bridge or Trolley or Hoist of the Underhung Type),” or ASME NOG-1, “Rules for Construction of Overhead and Gantry Cranes (Toprunning Bridge, Multiple Girder,” may also be invoked for cranes in nuclear facilities.

6.2 Load Test

New, reinstalled, altered, repaired, and modified cranes shall be load tested prior to initial use. All other provisions of the referenced ASME standard pertaining to load tests apply.

6.3 Maintenance

A preventive maintenance program shall be established and based on the recommendation of the crane manufacturer and the appropriate referenced ASME standards. If equipment maintenance procedures deviate from published manufacturer’s recommendations, alternate procedures shall be approved in advance by the manufacturer or a qualified person and be kept readily available. The maintenance history of the crane should be retained throughout its service life and kept readily available.

6.4 Operation

6.4.1 Identification of Signal Persons

- 6.4.1.1 The signal person shall be clearly identified to the crane operator. Options for improving signaler visibility include high visibility contrasting color on hardhats, gloves, or vests.
- 6.4.1.2 In those cases where the crane operator cannot see the signal person, a second person (relay signal

person) shall be stationed where he or she can see both the signal person and the crane operator and signals can be relayed to the operator. The relay signal person shall also be clearly identified to the crane operator.

- 6.4.1.3 Where voice (direct or two-way radio) communication is used, the signal person shall communicate directly with the operator and not through a third person. Communication devices shall be selected to preclude extraneous communications from third parties.

6.4.2 Moving the Load

- 6.4.2.1 A “dry run” (i.e., without a load or with a mockup load) should be conducted in areas where clearance is limited or if the complexity of the lift is deemed sufficiently complex.
- 6.4.2.2 Work on suspended loads is prohibited under normal conditions. If the responsible manager decides that it is necessary to work on a suspended load, guidelines for safe operation shall be established through consultation with the appropriate safety organization. Suspended loads that must be worked on should be secured against unwanted movement, hooks should be equipped with self-closing safety latches, and the load shall be rigged by a qualified rigger.

Section 7 Hoists

7.1 General Requirements

The operation, maintenance and testing of hoists not permanently mounted on overhead cranes shall comply with B30.16, “Overhead Hoist (Underhung),” and B30.21, “Manually Lever Operated Hoists,” and applicable OSHA standards. Only equipment built to the appropriate design standards shall be used in DOE installations. The following additions and exceptions to the above cited standards shall also be implemented.

7.2 Hoist Hook Markings

Manufacturer’s identification shall be forged, cast or die stamped on a low stress and non-wearing area of the hook. Hooks furnished as an integral part of a hoist or furnished by the original hoist manufacturer as replacement hooks (with appropriate certification) are not required to have manufacturer markings.

7.3 Installation

7.3.1 Procedures

Procedures for hoist installation recommended in the manufacturer’s manual shall be followed.

7.3.2 Support

The supporting structure shall be approved by a qualified person.

7.4 Inspections

Prior to initial use all new, repaired, or modified hoists shall be inspected by a qualified person to ensure compliance with applicable standards. Inspection records shall be kept on file and shall be readily available. For subsequent periodic inspections, an external coded mark on the hoist is an acceptable inspection record in lieu of written records.

7.5 Maintenance

A preventive maintenance program shall be established and be based on the hoist manufacturer's recommendations. If equipment maintenance procedures deviate from the published manufacturer's recommendations, the alternate procedure shall be approved in advance by the manufacturer or a qualified person and be kept readily available.

Section 8

Mobile Cranes

8.1 General Requirements

Operation, inspection, maintenance, and testing of mobile cranes shall comply with the requirements of ASME B30.5, “Mobile and Locomotive Cranes,” and applicable OSHA standards.

8.2 Maintenance

A preventive maintenance program shall be established and based on the recommendation of the crane manufacturer. If equipment maintenance procedures deviate from published manufacturer’s recommendations, alternate procedures shall be approved in advance by the manufacturer or another qualified person and be kept readily available. Dated maintenance records should be kept where readily available to appointed personnel. The maintenance history of the crane shall be retained throughout its service life.

8.3 Identification of Signal Persons

- 8.3.1 The signal person shall be clearly identified to the crane operator. Options for improving signaler visibility include high visibility contrasting color on hardhats, gloves, or vests.
- 8.3.2 In those cases where the crane operator cannot see the signal person, a second person (relay signal person) shall be stationed where he or she can see both the signal person and the crane operator and signals can be relayed to the operator. The relay signal person shall also be clearly identified to the crane operator.
- 8.3.3 Where voice (direct or two-way radio) communication is used, the signal person shall communicate directly with the operator and not through a third person. Communication devices shall be selected to preclude extraneous communications from third parties.

8.4 Moving the Load

- 8.4.1 A “dry run” (i.e., without a load or with a mockup load) should be conducted in areas where clearance is limited or if the complexity of the lift is deemed sufficiently complex.
- 8.4.2 Work on suspended loads is prohibited under normal conditions. If the responsible manager decides that it is necessary to work on a suspended load, guidelines for safe operation shall be established through consultation with the appropriate safety organization. Suspended loads that must be worked on should be secured against unwanted movement, hooks shall be equipped with self-closing safety latches, and the load shall be rigged by a qualified rigger.

Section 9

Forklifts

9.1 General Requirements

Operation, inspection, maintenance, and testing of forklift trucks shall comply with the requirements of ANSI/ITSDF B56.1, “Safety Standard for powered Industrial Trucks – Low Lift and High lift Trucks,” and ANSI/ITSDF B56.6, “Rough Terrain Fork Lift Trucks,” in addition to applicable OSHA standards. The following additions and exceptions to the above cited standards shall also be implemented.

9.2 Front End Attachments

- 9.2.1 When a forklift truck is equipped with an attachment, the rated capacity of the truck/attachment combination shall be established by the truck manufacturer.
- 9.2.2 In the event the truck manufacturer is nonresponsive to a request to rate a forklift truck with an attachment, the attachment may be used if written approval is obtained from a qualified Professional engineer. If the response from the original truck manufacturer is negative, the engineer must perform a safety analysis and address all safety and/or structural issues contained in the manufacturer’s disapproval. Capacity, operation, and maintenance instruction plates, tags, or decals shall be changed or added accordingly.

Section 10

Slings

10.1 General Requirements

The design, manufacture, use, inspection, and maintenance of slings shall comply with OSHA 29 CFR 1910.184, 29 CFR 1926.251, ASME B30.9, “Slings,” as well as manufacturer’s literature, whichever is more stringent. Additions/deletions to these requirements are provided in this section.

10.2 Sling Use in Radiation Areas

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

10.3 Sling Inspection Records

Individual site programs shall describe how inspections are recorded. These records may include an external coded mark on the individual sling tag (e.g., date, annually changed color stripe, etc.) indicating both periodicity and the satisfactory completion of the required inspection, or a written record as acceptable documentation.

Section 11

Rigging Hardware

11.1 Scope

This section provides direction for the use of rigging hardware plus any DOE specific requirements related to rigging hardware. Rigging hardware for the purposes of this chapter includes shackles, eyebolts, eye nuts, links, rings, swivel hoist rings, swivels, turnbuckles, rigging hooks, compression hardware (wire rope clips and wedge sockets), rigging blocks, load-indicating devices, and precision load positioners. Use, inspection, maintenance or repair of rigging hardware shall comply with applicable OSHA standards, ASME B30.26, “Rigging Hardware,” or ASME B30.10, “Hooks,” as well as manufacturer’s requirements, whichever is more stringent. Additions/exceptions to these requirements are provided in this section.

11.2 General Requirements

11.2.1 All manufacturer-provided lift points designed for and installed on engineered or manufactured equipment are considered part of the equipment and are acceptable for their intended use. Manufacturer-supplied lift points shall:

- A. Meet manufacturer’s inspection, testing, and maintenance criteria.
- B. Be inspected by a designated person prior to use.
- C. Be used in accordance with manufacturer’s instructions. In the absence of such information, further qualified technical support may be needed.

11.2.2 Rigging hardware that has been damaged and removed from service shall be made unusable for hoisting and rigging operations before being discarded.

11.3 Precision Load Positioners

Precision load positioners shall be inspected, operated, maintained, calibrated and tested in accordance with the manufacturer’s instructions.

Section 12

Below-the-Hook Lifting Devices

12.1 General Requirements

Below-the-hook lifting devices shall be designed, constructed, installed, inspected, tested, operated and maintained in conformance with ASME B30.20, “Below-the-Hook Lifting Devices.”

12.2 Marking

12.2.1 Product safety labels are not required for site fabricated below-the-hook lifting devices.

12.2.2 Rated load markings are required. However, cases may exist where a lifting device cannot be marked with its rated capacity and weight. This may be due to the security classification of the load to be lifted or other reasons approved by the responsible manager. In these cases, the lifting device shall be marked with an identification number, and its documentation shall describe both its rated capacity and weight.

Section 13

Miscellaneous Lifting Devices

13.1 General Requirements

This section provides requirements for the operation, inspection, testing, and maintenance of miscellaneous lifting devices including portable A-Frames (sometimes referred to as portable gantries); truck mounted cranes with a capacity of 1 ton or less not covered in ASME B30.5, “Mobile and Locomotive Cranes;” and self contained shop cranes as addressed by ASME PALD, “Portable Automotive Lifting Devices.”

To the extent a lifting device is addressed within the ASME PALD, it shall comply with the applicable portion of that standard without respect to whether it is being used to service motor vehicles. Hoists used in conjunction with portable A-Frames shall comply with Section 7 of this standard.

The following additions and exceptions to the above cited standards shall also be implemented.

13.2 Operator Qualifications

Operators of miscellaneous lifting devices shall be trained per Subsection 5.3 of this standard.

13.3 Rated Load Markings, Safety Markings and Operating Instructions

- 13.3.1 Safety markings shall be legible and conform to ANSI Z535.
- 13.3.2 Markings, or decals, etc. must be provided and affixed by the use of durable materials in a location visible to the operator in order to provide a clear understanding of any special warning, capacity information, etc.
- 13.3.3 Small cranes 1 ton or less shall have a durable rating chart with legible letters and figures attached in a location accessible to the operator.
- 13.3.4 Each portable A-frame shall have its rated capacity legibly marked on the structure on each side of the primary beam.
- 13.3.5 The manufacturers name, product serial number, and model number must be permanently and legibly marked on each portable A-Frame.
- 13.3.6 Operating instructions developed by the original manufacturer or supplier shall be maintained and readily available to the operator.

13.4 Modifications

- 13.4.1 Miscellaneous lifting devices may be modified or re-rated provided that the modifications of supporting structures are analyzed thoroughly by a qualified engineer or by the manufacturer of the lifting device.
- 13.4.2 A re-rated lifting device, or one whose load-supporting components have been modified, shall be tested in accordance with Subsection 13.11. The new rated capacity shall be displayed in accordance with Subsection 13.3.

13.5 Load Limits

A miscellaneous lifting device shall not be loaded beyond its rated capacity, except for test purposes as described in Subsection 13.11.

13.6 Operating Controls

Operating controls shall be readily visible and accessible to the operator and shall not subject the operator to pinch points, sharp edges, or snagging hazards.

13.7 Load Hooks

Latch-equipped hooks shall be used for all operations unless the application makes using the latch impractical, unnecessary, or unsafe.

13.8 Wire Rope on small cranes (1 ton or less)

- 13.8.1 Wire rope, (single line capacity) used on small cranes 1 ton or less shall have a minimum design factor of 3.5:1, based upon breaking strength.
- 13.8.2 Small cranes 1 ton or less shall be equipped with properly sized wire rope sheaves in lieu of flat spools.

13.9 Portable A-Frame Assembly

- 13.9.1 Portable A-Frames shall only be assembled by qualified personnel. Manufacturer's instructions shall be adhered to regarding setup and assembly.
- 13.9.2 Portable A-Frame components from different manufacturers shall not be intermixed with components from other A-Frames regardless of similarities in manufacturers or rated capacities.

- 13.9.3 Only manufacture-approved methods attaching a hoist to the A-frame structure such as approved beam clamp or trolley shall be used. Trolleys or beam clamp working load limits shall not exceed the capacity rating of the A-Frame and must be designed to match the type of frame flange. Hoists attached to the A-Frame must have a rated capacity equal to or less than all supporting components. (Down-rating of hoist to A-frame capacity is acceptable with administrative controls and markings in place.)
- 13.9.4 If a new or replacement trolley is installed on a monorail, the qualified person installing the trolley shall ensure by actual operational verification or measurement that the installed trolley stops on the system are compatible with the new trolley, thereby preventing trolley travel past a point where it could fall from the rail. On those systems where a series of monorails may be connected by a bridge or turntable, verification of functional trolley stops on all accessible rails shall be established or administrative controls placed limiting access to a specific work area during the period the trolley is in service.

13.10 Inspections

Equipment shall operate with a smooth, regular motion without any hesitation, abnormal vibration, binding, or irregularity. There shall be no apparent damage, excessive wear, or deformation of any load-bearing part of the equipment. All safety devices, controls, and other operating parts of the equipment shall be checked during each inspection and shall be in good working order.

13.10.1 Initial Inspection

A qualified inspector shall inspect all miscellaneous lifting devices prior to initial use and after load testing. Inspection is also required if the disassembly and reassembly is performed by individuals other than those designated as qualified assemblers. The inspection shall be performed in accordance with manufacturer's requirements. If manufacturer's instructions are not available, an engineering evaluation of the equipment shall be performed to establish necessary inspection procedures. Inspection reports shall be kept on file and shall be readily available. An external coded mark is an acceptable record of inspection in lieu of written records.

13.10.2 Preoperational Check and Periodic Inspections

Preoperational checks and periodic inspections shall be conducted in accordance with the manufacturer's recommendations or as specified by a qualified person.

In the event any required information is missing from equipment labels or illegible, an attempt shall be made via engineering drawings, prints, evaluations, etc. to establish the lifting device's manufacturer, rated capacity and other pertinent data. If this attempt is unsuccessful, the lifting device shall be removed from service until engineering personnel have thoroughly evaluated the design and adequacy of the structure. Engineering calculations must support all conclusions. The lifting device shall be identified, load tested and marked accordingly.

13.11 Load Tests for Portable A-Frames or Truck Cranes (1 Ton or Less)

13.11.1 Prior to initial use, all new portable A-Frames and small truck cranes (1 ton or less) and those upon which load-sustaining parts have been modified, replaced, or repaired shall be load-tested by a qualified inspector or under the direction of that inspector.

13.11.2 Test loads shall not be less than 100 percent or more than 125 percent of the rated capacity, unless otherwise recommended by the manufacturer or a qualified person.

13.11.3 A written report shall be furnished by the inspector showing test procedures and confirming the adequacy of repairs or alterations. Test reports shall be kept on file and shall be readily available to appointed personnel.

13.12 Maintenance Program

A preventive maintenance program based on the manufacturer's recommendations shall be established.

13.13 Replacement Parts

Replacement parts shall be at least equal to the original manufacturer's specification or as approved by a qualified engineer.

13.14 Conduct of Operator

The equipment shall be operated in accordance with manufacturer's instructions.

Section 14

References

It is generally recommended that the most recent ASME standards referenced here be invoked by contract to accompany this standard. However, there may be circumstances where a site decides to invoke the referenced standards on a periodic basis (e.g., upon award of a site-wide management contract) and not on an ongoing basis (with running updates for each minor site contractor or subcontractor.) This decision is left to the site or Program Office's discretion. Accordingly, this standard does not cite the year of referenced ASME standard to facilitate the site's ultimate decision in this regard.

American Society of Mechanical Engineers (ASME):

ASME B30.1, "Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries"

ASME B30.2, "Overhead and Gantry Cranes (Top-Running Bridge, Single or Multiple Girder, Top-Running Trolley Hoist)"

ASME B30.3, "Tower Cranes"

ASME B30.4, "Portal and Pedestal Cranes"

ASME B30.5, "Mobile and Locomotive Cranes"

ASME B30.6, "Derricks"

ASME B30.7, "Base-Mounted Drum Hoists"

ASME B30.8, "Floating Cranes and Floating Derricks"

ASME B30.9, "Slings"

ASME B30.10, "Hooks"

ASME B30.11, "Monorail Systems and Underhung Cranes"

ASME B30.12, "Handling Loads Suspended from Rotorcraft"

ASME B30.13, "Storage and Retrieval Machines"

ASME B30.14, "Side Boom Tractors"

ASME B30.16, "Overhead Hoists (Underhung)"

ASME B30.17, "Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)"

ASME B30.20, "Below-The-Hook Lifting Devices"

ASME B30.21, “Manually Lever Operated Hoists”

ASME B30.22, “Articulating Boom Cranes”

ASME B30.23, “Personnel Lifting Systems”

ASME B 30.24, “Container Cranes”

ASME B30.25, “Scrap and Material Handlers”

ASME B30.26, “Rigging Hardware”

ASME B30.27, “Material Placement Systems”

ASME B30.28, “Balance Lifting Units”

ASME BTH-1, “Design of Below-the-Hook Lifting Devices”

ASME PALD, “Portable Automotive Lifting Devices”

ASME HST-1, “Performance Standard for Electric Chain Hoists”

ASME HST-2, “Performance Standard for Hand Chain Manually Operated Chain Hoists”

ASME HST-3, “Performance Standard for Manually Lever Operated Chain Hoists”

ASME HST-4, “Performance Standard for Electric Wire Rope Hoists”

ASME HST-5, “Performance Standard for Air Chain Hoists”

ASME HST-6, “Performance Standard for Air Wire Rope Hoists”

ASME NQA-1, “Quality Assurance Program Requirements for Nuclear Facilities”

ASME Cranes for Nuclear Facilities:

ASME NUM-1, “Rules for Construction of Cranes, Monorails, and Hoists (With Bridge or Trolley or Hoist of the Underhung Type)”

ASME NOG-1, “Rules for Construction of Overhead and Gantry Cranes (Toprunning Bridge, Multiple Girder)”

Crane Manufacturers Association of America:

CMAA Specification 70, “Specifications for Top Running Bridge & Gantry Type”

Multiple Girder Electric Overhead Traveling Cranes

CMAA Specification 74, “Specifications for Top Running and Under Running”

Single Girder Electric Overhead Traveling Cranes Utilizing Under Running Trolley Hoist

Department of Labor:

29 CFR 1910, “Occupational Safety and Health Standards for General Industry”

29 CFR 1926, “Occupational Safety and Health Regulations for Construction”

Industrial Truck Standards Development Foundation (ITSDF):

ITSDF B56.1, “Safety Standard for Powered Industrial Trucks – Low Lift and High Lift Trucks”

ITSDF B56.5, “Guided Industrial Vehicles”

ITSDF B56.6, “Rough Terrain Fork Lift Trucks”

ITSDF B56.10, “Safety Standard for Manually Propelled High Lift Industrial Trucks”

ITSDF B56.11.4, “Hook-Type Forks and Fork Carriers for Powered Industrial Forklift Trucks”

ITSDF B56.11.7, “Liquid Propane Gas (LPG) Fuel Cylinders (Horizontal or Vertical) Mounting - Liquid Withdrawal - For Powered Industrial Trucks”

Material Handling Industry of America:

ANSI, MH29.1, “Safety Standard for Industrial Scissor Lifts”

CONCLUDING MATERIAL

Review Activity:

National Nuclear Security Administration
Office of Environmental Management
Office of Health, Safety and Security
Office of Nuclear Energy
Office of Science

Preparing Activity:

DOE-HS-11

Project Number:

SAFT-0131

Site Offices:

Ames Site Office
Argonne Site Office
Berkeley Site Office
Brookhaven Site Office
Carlsbad Field Office
Chicago Office
Fermi Site Office
Grand Junction Office
Idaho Operations Office
Kansas City Site Office
Livermore Site Office
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