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**Level 2 Program Description Document (PDD)**

Revision	Record of Issue/Revision	Affected Pages
8	Revision: Deleted existing Step 5.2.2(2)[f]1 and revised existing Step 5.2.2(2)[f]2 to address Choker hitch configuration lifts.	17

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## **1.0 PURPOSE**

- 1.1** This Program Description Document (PDD) describes the operation, inspection, maintenance, and repair requirements for cranes, hoists, fork trucks, slings, rigging hardware, and hoisting equipment by Fluor BWXT Portsmouth LLC (FBP) at the Portsmouth Site (PORTS).
- 1.2** When using rigging devices/hardware in conjunction with the equipment not covered by this PDD for the purpose of raising, lowering, or otherwise lifting material, the rigging devices/hardware and their use shall comply with the applicable sections of this PDD.
- 1.3** This document implements applicable regulatory requirements. They are listed in Appendix A, *Regulatory Requirements Flow Down*.

## **2.0 SCOPE AND APPLICABILITY**

- 2.1** This PDD supports the objectives of the Department of Energy (DOE) and FBP by controlling hoisting and rigging (H&R) activities in a safe and cost-effective manner.
- 2.2** Occasionally lifting is performed with equipment other than cranes, hoists, and fork trucks. When using any equipment for material handling, follow the equipment manufacturer's instructions.
- 2.3** The following types of equipment are not within the scope of this PDD: elevators, dumbwaiters, escalators, moving walks, conveyor systems, drill and pump setting rigs, tree trimming and tree removal work, manipulators, specially insulated hoists for handling high-voltage lines, door- and hatch-opening equipment, vehicle-mounted elevating and rotating aerial devices, elevating work platforms, aerial lifts, and earth-moving and excavation equipment. Although not within the scope of this PDD, this equipment shall be maintained in a safe condition (reference Occupational Safety and Health Association [OSHA] General Duty Clause). Consult applicable equipment manufacturer information, OSHA, and/or American Society of Mechanical Engineers (ASME) standards to ensure safe condition and use of the equipment.
- 2.4** Excavation equipment, such as a backhoe, may have a hook installed on the bucket. It is acceptable to use such equipment for H&R if the manufacturer provides instructions for such use. The manufacturer's instructions should include load capacity information.
- 2.5** It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements. ASME standards provide the most comprehensive information.
- 2.6** This PDD is intended to be a user's guide to requirements, codes, laws, regulations, standards, and practices that apply to FBP at PORTS. This PDD, or any part of this PDD, is applicable to subcontractors (offsite or onsite) only if required by relevant contract documents.

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### 3.0 PROGRAM DOCUMENTS

#### 3.1 Requirements and Guidance

**NOTE**

29 CFR 1926, Subpart R can be referred to for special H&R requirements relating to steel erection.

**3.1.1** The following ASME B30 standards shall be implemented:

- ASME B30.1 - *Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries*
- 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 - *Winches*
- ASME B30.8 - *Floating Cranes and Floating Derricks*
- ASME B30.12 - *Handling Loads Suspended from Rotorcraft*
- ASME B30.13 - *Storage/Retrieval (S/R) Machines and Associated Equipment*
- ASME B30.14 - *Side Boom Tractors*
- ASME B30.18 - *Stacker Cranes (Top or Under Running Bridge, Multiple Girder with Top or Under Running Trolley Hoist)*
- ASME B30.19 - *Cableways*
- ASME B30.22 - *Articulating Boom Cranes*
- ASME B30.24 - *Container Cranes*
- ASME B30.25 - *Scrap and Material Handlers*
- ASME B30.27 - *Material Placement Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings*

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### 3.1.2 Background

- [1] This PDD supports the objectives of the DOE, and FBP, by controlling H&R activities in a safe and cost-effective manner.
- [2] Occasionally lifting is performed with equipment other than cranes, hoists, and fork trucks; when using any equipment for material handling, follow the equipment manufacturer's instructions.
- [3] This PDD is based on DOE-RL-92-36, *Hanford Site Hoisting and Rigging Manual* which was adapted for use at the PORTS Site.
- [4] Any lack of clarity, errors, omissions, or discrepancies associated with this PDD should be submitted to the FBP H&R Manager.

### 3.1.3 PDD Organization and Content

- [1] This is a “user’s PDD.” It designates responsibilities regarding H&R activities, specifies qualification and training requirements, and stipulates operation, maintenance, and repair requirements for H&R equipment and components. Topics have been grouped to make the PDD user friendly and to minimize “jumping around” within the PDD. While selected design considerations are included in this PDD, primarily as information to operators and inspectors, this PDD is a user’s PDD, not a design PDD.
- [2] This program is based on and incorporates equipment manufacturers’ specifications and limitations for operation, maintenance, and inspection of equipment in addition to related regulations and standards. Where manufacturers’ specifications are not available, operation limitations and maintenance and inspection requirements assigned to the equipment shall be based on determinations of a qualified person competent in this field and such determinations shall be appropriately documented and disseminated to equipment operators and maintenance and test personnel.

### 3.1.4 Mandatory and Advisory Rules

Mandatory rules are characterized by use of the word shall. If a provision is of an advisory nature, it is indicated by use of the word should and is to be considered; its advisability depends on the facts in each situation.

### 3.1.5 PDD Revisions

Any user may prepare written requests for PDD revision. Revision requests shall be submitted to the FBP H&R Manager.

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### **3.1.6 Variances, Exemptions, and Waivers**

Variances and exemptions are frequently referred to as “waivers;” however, it is appropriate to recognize that a waiver is really a variance or an exemption. The difference between a variance and an exemption and their approval processes are as follows:

- [1] A variance is an administrative decision that allows an employer to meet a requirement in a different manner than stated in the requirement or standard. To do this, the employer must show that the level of worker protection is “at least as effective” as that dictated by the requirement or standard.
- [2] An exemption is an administrative decision that frees an employer from complying with a requirement. In other words, if an exemption from a requirement is granted, that requirement would not apply to the specific operation or facility in question.
- [3] Usually, variance or exemption decisions can be made by the FBP H&R Manager.
- [4] Requests for variances or exemptions shall be submitted to the FBP H&R Manager. Upon receipt of the request, the FBP H&R Manager shall evaluate the request.
- [5] Following approval or disapproval, the FBP H&R Manager shall respond to the requestor in writing.

## **3.2 Personnel Qualifications and Training Requirements**

### **3.2.1 General**

- [1] Personnel shall be trained and qualified to a level of proficiency consistent with their assigned tasks. Managers responsible for work assignments shall ensure that work assignments do not exceed personnel qualifications.
- [2] Personnel qualification and certifications will be approved by responsible management to comply with applicable regulatory and consensus standards.
- [3] The contents of training presented in support of the H&R Program will be as specified by applicable regulatory and consensus standards.

### **3.2.2 Site Specific Requirements**

- [1] Training and qualification of personnel associated with H&R will be performed in accordance with applicable Training Department procedures and policies.

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- [2] Personnel are required to successfully complete the following training modules in order to be designated a qualified rigger:
  - 75722 – Basic Rigger/Signal Person Classroom
  - 75723 – Basic Rigger Practical
- [3] Personnel are required to successfully complete the following training modules in order to be designated a qualified signal person:
  - 75722 – Basic Rigger/Signal Person Classroom
  - 75747 – Signal Person Practical
- [4] Personnel are required to successfully complete the following training modules to be designated qualified to perform the rigging task and operate the Ruger manual push crane (or similar equipment of various manufacturers) associated with the setup and placement of the RadPiper Robot(s) and associated equipment.
  - TA6671 Ruger Lift Classroom
  - TA6672 Ruger Practical

#### **4.0 PROGRAM RESPONSIBILITIES**

**NOTE**

This section provides guidance in delineating the responsibilities of personnel and organizations directly involved in H&R activities at PORTS.

##### **4.1 Stop Work Authority**

All personnel have stop work authority if an unsafe act or condition is observed.

##### **4.2 H &R Manager**

- 4.2.1** Evaluates H&R situations and tasks using the lift classification checklist.
- 4.2.2** Coordinates with the requesting organization to plan and schedule the desired lift(s).
- 4.2.3** Request Engineering assistance to evaluate specific situations or technical issues as necessary.
- 4.2.4** Periodically assess line management implementation of the H&R program.



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- 4.2.5** When requested, assist program or line organizations in matters relating to H&R. (This could include H&R surveillances, reviews of critical or major lift procedures or work packages, hostile environment plans, participation in the H&R aspects of Readiness Assessments, Operational Readiness Reviews, etc.)
- 4.2.6** When requested, assist FBP subcontractors in addressing issues related to compliance with, implementation of, or interpretation of this PDD.
- 4.2.7** The FBP H&R Manager shall be responsible for inspection, maintenance, and repair on H&R equipment and shall ensure the following:
- [1]** Equipment is properly inspected, maintained, tested, and repaired by qualified personnel.
  - [2]** Inspection, maintenance, and repair personnel have the tools to safely accomplish their work.
  - [3]** Ensure that records of the maintenance, repair, inspection, and testing are available for audit in a maintenance file.
  - [4]** Responsible inspection, maintenance, and test personnel have access to the following information, as applicable:
    - Operating instructions
    - Maintenance, repair, and parts information furnished by the manufacturer or the responsible maintenance/engineering organization
    - The manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubrication levels, and types of lubricant to be used
    - Maintenance or repair procedures from the manufacturer or responsible maintenance/engineering organization
    - Wiring diagrams
  - [5]** Inspection, maintenance, and repair activities are documented in accordance with the requirements of this PDD.
  - [6]** Personnel responsible for inspection or maintenance are familiar with the applicable contents of all equipment PDDs.
  - [7]** Maintains FBP-SM-PDD-00001, *FBP Hoisting and Rigging Program*, and FBP-DD-PRO-00136, *Hoisting and Rigging Procedure*.
- 4.2.8** Acts as FBP authority for the review and approval of revisions to this PDD. Ensure program and line organizations are kept up to date with the latest PDD changes, bulletins, or important issues applicable to their organizations.

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### **4.3 H&R Supervisors**

The Supervisor responsible for the H&R operation shall ensure that:

- 4.3.1** Qualified personnel are assigned to operate equipment and perform H&R tasks.
- 4.3.2** Equipment is operated safely.
- 4.3.3** Preplanned and approved H&R instructions are used when necessary and always for critical lifts.
- 4.3.4** Equipment found to be unsafe or requiring restrictive use is properly tagged.
- 4.3.5** The equipment custodian is notified of equipment problems.
- 4.3.6** A Designated Lift Leader (DLL) approved by FBP H&R Manager has been assigned to H&R operations that require more than one person.

### **4.4 Designated Person in Charge (PIC) for Critical Lifts**

- 4.4.1** The H&R Manager shall assign a PIC for critical lifts.
- 4.4.2** The PIC for critical lifts shall ensure that :
  - [1]** A critical lift plan is prepared.
  - [2]** The critical lift plan is properly approved before implementing.
  - [3]** A documented pre-lift meeting is held and personnel understand how the job will be done.
  - [4]** Management provides qualified personnel (e.g., operators, riggers, flagman, PIC).
  - [5]** Proper equipment and hardware are identified in the critical lift procedure.
  - [6]** Be present at the lift site during lifting operations.
  - [7]** Involved personnel are familiar with, and follow, the critical lift procedure.
  - [8]** After the critical lift is completed, critical lift documentation is transmitted to Records Management/Document Control (RMDC). The PIC should advise responsible personnel that this documentation is subject to audit for one year.
  - [9]** Examine the work area for hazards or unsafe conditions.
  - [10]** Direct the lifting operations to ensure that the job is done safely and efficiently.

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[11] Ensure that the job is stopped when any potentially unsafe condition is recognized.

#### **4.5 Designated Lift Leader (DLL)**

**4.5.1** A DLL shall be appointed to H&R activities that involve more than one person. Normal forklift truck material handling operations are not considered H&R activities and do not require a DLL. The DLL may be the supervisor, operator, a crew member, or any qualified person.

**NOTE**

A DLL shall be assigned when more than one person is involved in movements such as the boom, swing or hoist, and there is no lifting of loads.

**4.5.2** The DLL shall:

- [1] Ensure that a flagman or signaler, if required, is assigned and identified to the hoist/crane/forklift operator.
- [2] Ensure that management provides qualified personnel and personnel understand how the job is to be done.
- [3] Ensure that the weight of the load is determined, that the proper equipment and hardware are selected and inspected, and that the capacity of the lifting device is not exceeded.
- [4] Ensure that the equipment is properly set up and positioned.
- [5] Examine the work area for hazardous or unsafe conditions.
- [6] Direct the lifting operation to ensure that the job is done safely and efficiently.
- [7] Ensure that the job is stopped when any potentially unsafe condition is recognized.
- [8] Be present at the lift site during lifting operations.
- [9] Stop crane operations if alerted to an unsafe condition affecting those operations.
- [10] Ensure that the preparation of the ground conditions needed to support crane operations has been completed before crane operations commence when mobile cranes are used. If the operator, DLL, or Assembly/Disassembly (A/D) Director have concerns pertaining to ground conditions they shall notify the controlling entity.

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- [11] Ensure swing radius hazards are addressed, when applicable, per OSHA 1926.1424 (see Section 5.15 and OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*) and only authorized personnel are allowed in identified hazard areas.
- [12] Ensure only authorized personnel enter the fall zone to perform or conduct activity that cannot be performed other than when a load is suspended or being landed.
- [13] Use hoisting routes that minimize the exposure of employees to hoisted loads where available.
- [14] Ensure necessary traffic controls are in place to restrict unauthorized access to the crane's work area.
- [15] If an injury or accident occurs, ensure that the emergency is promptly reported. Take charge of the accident scene pending arrival of emergency services personnel.
- [16] Ensure that personnel involved are current in training and qualification.
- [17] Check that basic operating instructions of all lifting equipment, including required charts, tables, or diagrams, are appropriately posted or otherwise available to the operator.
- [18] Ensure that a preoperational check of all lifting equipment and rigging is performed to validate compliance with the appropriate sections of this standard.

#### **4.6 Equipment Operator**

The equipment operator shall perform the following activities:

- 4.6.1** Safely operate equipment.
- 4.6.2** Follow the equipment operating guidelines, and for mobile cranes, the load charts.
- 4.6.3** Perform and document the pre-use and monthly inspection on FBP-SM-PDD-00001-F04, *FBP Monthly Final Crane Inspection Checklist*.
- 4.6.4** Ensure that the load will not exceed the rated capacity of the equipment.
- 4.6.5** Abide by any restrictions placed on the use of the equipment.
- 4.6.6** Ensure inspections are current via inspection sticker other documentation from the equipment custodian.

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#### **4.7 Qualified Rigger**

**4.7.1** The qualified rigger shall perform the following activities:

- [1]** Ensure that the rigging equipment and materials have the required capacity for the job and that all items are in good condition, are currently qualified (inspection is up to date), and are properly used.
- [2]** Verify that rigging equipment and material are in compliance with the procedure, if applicable.

**4.7.2** Assembles and directs riggers to perform H&R activities per the H&R lift plan.

#### **4.8 Rigger**

**4.8.1** A person or person(s) with H&R training may assist a qualified rigger with rigging operations.

**4.8.2** Confirm that the load path is clear of personnel and obstacles.

#### **NOTE**

Duties listed in this Section are considered a summary of an equipment custodian's responsibility. It is important to recognize that more specific, and possibly additional, responsibilities are stated in individual sections.

#### **4.9 Equipment Custodian**

Management shall designate an individual who shall have custodial responsibility for each crane, hoist, lift truck, or other H&R equipment that requires scheduled maintenance, inspection, and record keeping. (The custodian may be thought of as the equipment "owner.") The custodian can be assigned by facility, geographical area, individual equipment item, or other method as deemed appropriate by management. The custodian shall perform the following activities:

**4.9.1** Verify that operating equipment is maintained and maintenance, inspection, and testing of the equipment remain current.

**4.9.2** Verify that equipment is properly tagged and, if necessary, removed from service when discrepancies are found during inspection or operation.

**4.9.3** It is important that equipment users know how to contact the equipment custodian. A method should be devised so that equipment users can easily identify and contact the equipment custodian.

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#### **4.10 Assembly/Disassembly Director (A/D Director)**

The A/D Director is responsible to direct both the assembly and/or disassembly of equipment (cranes) covered under OSHA 29 CFR 1926 Subpart CC and ASME B30 standards. With regard to tower cranes, “erecting and climbing” replaces the term “assembly,” and “dismantling” replaces the term “disassembly.” Regardless of whether the crane is initially erected to its full height or is climbed in stages, the process of increasing the height of the crane is an erection process. See Section 5 of DOE-STD-1090-2011, *Personnel Qualifications and Training Requirements*, Section 5.15, and OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*.

#### **4.11 Facility Manager**

The Facility Manager shall:

- 4.11.1** Ensure that ground preparations necessary to ensure ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer’s specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.
- 4.11.2** Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) that are in the possession of the controlling entity (whether at the site or off-site) or the hazards are otherwise known to that controlling entity.

#### **4.12 Safety Organization**

- 4.12.1** Monitors the H&R activities periodically to verify that safe work practices are being followed.
- 4.12.2** Provides guidance in safe work practices associated with H&R.
- 4.12.3** Assists in the planning of the work control document in recognizing and developing controls to address associated hazards.

#### **4.13 Training Organization**

The responsible training organization shall provide training to ensure that personnel meet requirements of this PDD and shall ensure that the following activities are completed:

- 4.13.1** Training provided is documented.
- 4.13.2** Evaluation methods and standards are established.

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#### 4.14 Other Program and Line Organizations

The program and line organizations shall:

- 4.14.1 Notify the Decontamination & Decommissioning (D&D) and Infrastructure and Site Maintenance (I&SM) Director, the H&R Manager, and Responsible Facility Manager as soon as possible after an H&R incident, preferably before any critique or investigation.
- 4.14.2 Contact the H&R Manager in matters of H&R Manual interpretations or applicability.

### 5.0 LIFT PLANNING AND DOCUMENTATION REQUIREMENTS

#### NOTE

This section includes guidelines, rules, and requirements applicable to categorizing lifts (as ordinary lifts or critical lifts) and describes the planning and documentation required to perform a lift.

#### 5.1 Lift Classifications

#### NOTE

The determination of the category will be documented using Attachment A, FBP-SM-PDD-00001-F01, *Lift Classification Worksheet* and retained as a project record.

- 5.1.1 The H&R Manager or designee shall classify each lift into one of the following FBP categories prior to planning the lift.
  - [1] Ordinary Lifts
  - [2] Special Lifts
  - [3] Pre-Engineered Production Lifts
  - [4] Critical Lifts
- 5.1.2 A lift may be designated as a special lift when any of the following criteria are met, unless otherwise specifically defined in safety basis.
  - [1] A mobile crane is working near power lines or transmission towers
  - [2] A forklift is working near power lines or transmission towers
  - [3] Mobile crane pick and carry operations
  - [4] Two or more cranes (other than a mobile crane) will be used to make one lift

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- 5.1.3** A lift shall be designated as a critical lift when any of the following criteria are met, unless otherwise specifically defined in safety basis.

**NOTE**

All DOE facilities are required to have an emergency plan based on potential accident scenarios resulting in radiological or chemical releases per DOE-O223, *Emergency Plan Implementing Procedure*. Each facility shall determine the potential release quantities in the event of the loss of control. Designate the lift as a critical lift if the potential release could result in a “Site” or “General” emergency. For construction sites apply requirements in 29 CFR 1910 and/or 29 CFR 1926.

- [1] 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.
  - [2] The load item is unique and, if damaged, would be irreplaceable or not repairable and is vital to a system, facility or project operation.
  - [3] 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.
  - [4] If mishandling or dropping of the load would cause any of the above noted consequences to nearby installations or facilities.
  - [5] If the load to be lifted is 80% or more of a mobile crane’s load chart rating in the set-up configuration.
  - [6] If two or more mobile cranes are used to make a lift, other than a tail crane.
  - [7] For steel erection, a lift shall be designated as a critical lift if:
    - [a] The lift exceeds 75 percent of the rated capacity of the crane or derrick.
- OR**
- [b] The lift requires the use of more than one crane or derrick (refer to 29 CFR 1926.751).

**5.2 Ordinary Lifts**

**5.2.1 DLL**

- [1] H&R operations for ordinary lifts require a DLL who shall be present at the lift site during the entire lifting operation.



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- [2] If the lift is being made by only one person, that person assumes all responsibilities of the DLL.
- [3] The DLL shall have the necessary knowledge and experience of the specific type of equipment and assigned lifting operation.
- [4] The DLL may be identified by written instructions, specific verbal instructions for the particular job, or clearly defined responsibilities within the crew's organization structure.

### 5.2.2 Ordinary Lift Planning

- [1] Ordinary lifts are typically planned and approved using FBP-SM-PDD-00001-F02, *FBP Hoisting and Rigging Checklist* (see Attachment B).
- [2] The DLL shall ensure the following pre-lift planning issues are addressed, as applicable, and documented using FBP-SM-PDD-00001-F02, prior to the lift.
  - [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] Validate the loads path and clearances.
  - [c] Identify lifting equipment and rigging to be used by type and rated capacity.
  - [d] Prepare rigging sketches, as necessary.
  - [e] 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).
  - [f] Identify any special or site-specific operating procedures and special instructions. Follow the following requirements and document on FBP-SM-PDD-00001-F02.
    1. Choker configuration lifts shall be only be utilized if chocking through a shackle or manufactured designed end fitting and approved by the H&R SME.
    2. Pick Point shall be from a single point (i.e., free to rotate).
    3. Rigging shall be limited to 75% of the allowable working load limit (rated capacity).

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4. Lift Plans shall be peer reviewed by a qualified/competent person with documented concurrence.
5. Multi-legged hitch lift plans shall document the load angle factor, stress factor on each leg or hitch, and a sketch representing the specific configuration of the planned lift.

- [3] FBP-SM-PDD-00001-F02 must be approved by the H&R Manager or designee prior to the lift.

**NOTE**

The critical lift designation implements administrative and physical controls to minimize the possibility of equipment failure or human error to a hoisting or forklift operation involving a load that poses unacceptable consequences if mishandled.

### **5.3 Critical Lifts**

#### **5.3.1 Critical Lift Requirements**

A Critical lift designation requires:

- [1] Documented step-by-step instructions known as a CRITICAL LIFT PLAN.
- [2] Sign-off approvals by the H&R Manager, Safety, Rigging Engineer, and Program Manager (or designee).
- [3] Independent verification of load weight, load center of gravity, lift attachment points, and lifting hardware minimum capacities (slings, below-the-hook (BTH) lifting devices, shackles, etc.) that will be used for the lift or series of lifts.
- [4] Independent verification of crane(s) or fork lift(s) with minimum capacities identified for configuration to be used.
- [5] Evaluation of hazards associated with the lift that may include, but is not limited to; environmental, ground support, power lines, and physical obstructions.
- [6] Identification of special limiting or stop-work conditions.

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### 5.3.2 Critical Lift Equipment and Hardware

- [1] Before making a critical lift, the PIC shall ensure that for slings, rigging, rigging hardware, and BTH devices the following has been performed: (Exceptions apply to manufacturer-installed rigging hardware.)
  - Equipment (cranes, hoists, forklift trucks, rigging etc.) periodic inspections are current.
  - A pre-use inspection has been performed.
  - Rated-capacity/proof/load tests have been performed.
- [2] The PIC shall confirm through communications with H&R Manager and reviewed documents that personnel performing the lift are currently qualified for the assigned task(s).
- [3] Engineered equipment with manufacturer-installed rigging hardware (eyebolts, swivel hoist rings, etc.) should be purchased with load-test documentation supplied. However, rigging hardware on engineered equipment, installed by the equipment manufacturer, without test documentation, may be used if approved by Engineering and inspected by a qualified inspector before use.

### 5.3.3 Rigging Requirements for Critical Lifts

- [1] The rigging components (slings, rigging hardware, BTH lifting devices) to be used in critical lifts shall be rated-capacity/proof/load tested as specified in applicable ASME Standards.
- [2] Rigging components that have been tested shall be marked or tagged by the user, a third party, or the manufacturer to verify the rated-capacity/proof/load test (see examples in applicable sections for the specific equipment). The manufacturer, the user, or a third party may perform load/proof tests.
- [3] Documentation shall be traceable to the rigging component. Traceability may be accomplished by placing a tag or other permanent marking on the hardware.
- [4] Tags or other permanent marking fulfill documentation requirements without paperwork.
- [5] BTH lifting devices require rated load test documentation be kept by the RMDC organization.
- [6] Each rigging component shall be qualified.

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- [7] Rigging for critical lifts may include the following and shall meet the requirements found in the referenced section (including testing and marking requirements).
- [a] Wire Rope Slings - See Section 5.10, *Slings*, and ASME B30.9 for wire rope sling requirements.
  - [b] Alloy Chain Slings - See Section 5.10, *Slings*, and ASME B30.9 for alloy chain slings requirements.
  - [c] Metal Mesh Slings - See Section 5.10, *Slings*, and ASME B30.9 for metal mesh slings requirements.
  - [d] Synthetic Web Slings - See Section 5.10, *Slings*, and ASME B30.9 for synthetic web slings requirements.
  - [e] Synthetic Rope Slings - See Section 5.10, *Slings*, and ASME B30.9 for synthetic rope slings requirements.
  - [f] Synthetic Round slings - See Section 5.10, *Slings*, and ASME B30.9 for synthetic rope slings requirements.
  - [g] Rigging Blocks - See Section 5.11, *Rigging Hardware*, and ASME B30.26 for rigging block rated load test requirements.
  - [h] Shackles - See Section 5.11, *Rigging Hardware*, and ASME B30.26 for shackles requirements.
  - [i] Eyebolts - See Section 5.11, *Rigging Hardware*, and for eyebolts requirements.
  - [j] Rings, links and swivels - See Section 5.11, *Rigging Hardware*, and ASME B30.26 for rings requirements.
  - [k] Swivel Hoist Rings - See Section 5.11, *Rigging Hardware*, and ASME B30.26 for swivel hoist rings requirements.
  - [l] Turnbuckles - See Section 5.11, *Rigging Hardware*, and ASME B30.26 for turnbuckles requirements.
  - [m] Below-the-Hook Lifting Devices - See Section 5.12, *Below-the-Hook Lifting Devices*, and ASME B30.20 & BTH-1 for requirements and for requirements imposed by ANSI N14.6 when applied.
  - [n] Dynamometers and Precision Load - Position Devices (hydro-set) - Load test at maximum capacity.

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#### 5.3.4 Critical Lift Plan

##### NOTE

Although individual plans are prepared for one-time critical lifts, more general (multi-use) plans may be employed to accomplish recurring critical lifts. For example, a general plan may be used to lift an item or series of similar items that are handled repeatedly in the same manner. Several or multiple lifts of various loads may be contained in one critical lift plan.

- [1] A step-by-step plan or work instructions shall be approved by the H&R Manager, Rigging Engineer, Safety Representative, and Program Manager (or designee).
- [2] Critical lift plans shall be stand-alone documents with all required information and approvals.
- [3] The PIC shall have the critical lift plan at the work location during the lift(s).
- [4] Critical lift plans shall contain documented step-by-step instructions and drawings (see example drawings in Appendixes AB *Rigging Sketch* and B, *Load Path/Crane Capacity Parameters* and Appendix D, the *Critical Lift Plan Development Guide*) containing:
  - [a] Identity of the item(s) to be lifted.
  - [b] Special precautions, if any (such as mats for mobile cranes).
  - [c] Weight of the item and total weight of the load. For mobile cranes, see the manufacturer's instructions regarding components and attachments that must be considered as part of the load.
  - [d] A list that specifies each specific piece of equipment (e.g., crane, hoist, fork truck), accessory, and rigging component (e.g., slings, shackles, spreader bars, yokes) to be used for the lift. This list shall identify each piece of equipment by type, size, and rated capacity.
  - [e] When a lift plan identifies multiple cranes, forklifts, or rigging components that may be used for the lift(s), the plan shall require verification of the specific ones used for the lift(s).
  - [f] Identification of hazards associated with the lift that may include but are not limited to environmental, ground support, physical obstructions, power lines, crush/pinch points/struck-by hazard, etc.
  - [g] Identification of essential personnel that may be permitted in the fall zone to perform work that cannot be done otherwise including but not limited to, necessary special support personnel.

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- [h] Designated checkpoints or hold points and estimated instrument readings, as relevant, so that job progress can be checked against the plan.
- [i] Hold points or sign-off points for personnel assigned to witness the work. Sign-offs (initial/date) in the plan as key steps shall be completed or validated.
- [j] Rigging sketch(es), should include the following: (See example in Appendix B)
  - Dimensions of item to be lifted, including center of gravity
  - Lift point identification
  - Method(s) of attachment and hitch configuration for slings

**NOTE**

When using manufacture supplied and designed rigging hardware that is part of a BTH lifting device (spreader beam slings) where calculations have already been completed as part of the designed requirements lift plan, load angle factors and sling angles are not required so long as it is noted on the lift sketches and or drawings that the lifting device slings were furnished by the lifting device manufacturer. Providing the manufacturer's part number or other reference information is advisable. However, load angle factors (e.g., vertical and horizontal vectors of sling loads) and sling angles for all other slings that are not part of a manufactured supplied device must be shown.

- Capacity and tension on slings, rigging hardware, and lifting devices at the configuration shown

**NOTE**

Even when load angle factors (e.g., vertical and horizontal vectors of sling loads) are minimal, they must be shown to indicate that they have been calculated and addressed.

- Sling angles
- Accessories used (softeners, blocking, etc.)
- Other factors affecting the equipment capacity such as, but not limited to, D/d ratio or temperature when applicable

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**NOTE**

For mobile cranes, many factors affect rated capacity, including boom length, boom angle, and work area (radius). Forklift attachment(s) that effect capacity shall be identified.

- Rated capacity of the cranes or forklifts in the configuration(s) in which it will be used

**NOTE**

For lifts with mobile cranes, include the crane position(s) relative to the load and relative to surrounding obstructions. Where appropriate, floor or soil-loading diagrams shall be included.

- A Pre-identified load-path sketch that shows the load path and height, when applicable
- A note(s) indicating lifting, travel speed, and height limitations, when applicable. This may be noted on the load-path sketch or on a separate sketch.

**[k]** Verification of personnel qualifications.

**[l]** A sign-off to document verification that equipment (cranes and forklifts), rigging, hardware, and BTH lifting device inspections, periodic and pre-use, are current and have been subjected to testing as required in the applicable section.

**[m]** Verification that installed lifting or attachment points have been inspected.

**[n]** Pre-identified stop work conditions such as, but not limited to, weather or other conditions that would require termination of the lift.

**NOTE**

The test shall be performed with the crane set up in the exact configuration as it will be used to perform the lift or series of lifts with no load on the hook.

**[o]** Requirement to perform operational test of functions of the crane through the full range of movements that will be used to perform the lift(s).

**[p]** Documentation of lift and pre-job meeting.

**[q]** Copies of sub-site surveys if applicable to the lifting activity for mobile cranes and forklifts.

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### 5.3.5 Critical Lift Plan Field Revisions

**NOTE**

The field revision shall be initialed and dated by the person(s) making the revision. Text shall not be obliterated by the use of correction fluid, correction tape, scribbling, erasure, or any other method.

- [1] Accomplish Critical lift plan or work instruction field revisions by drawing a single line through the original (deleted) text and inserting the field revision close to the deleted text.
- [2] Field revisions should be approved in the same manner as the original version of the document. Field revisions may be confirmed by telephone and shall be signed and documented.

### 5.3.6 Pre-Lift and Field Revision Review Meetings

Before performing a critical lift and immediately following a field revision, participating personnel shall meet to accomplish the following.

- [1] Review the critical lift plan or field revision.
- [2] Discuss any hazards, controls, hold points, coordination with other work groups, unique conditions, and emergency contingencies.
- [3] Resolve questions before beginning work.

### 5.3.7 Critical Lift Documentation

- [1] As a minimum, documentation of each pre-lift and field revision meeting shall include an attendance roster showing the meeting time, date and a list of attendees.
- [2] The PIC shall retain meeting documentation until the lift is satisfactorily completed.
- [3] When the job is finished, the PIC shall place the critical lift documentation in the Integrated Work Document.
- [4] Documentation of a critical lift shall include the following.
  - [a] The critical lift plan, recording job completion with approval signatures and hold point sign-offs as applicable.
  - [b] The critical lift plan shall include documentation of the pre-lift meeting.
  - [c] Documentation of the pre-lift meeting containing, at a minimum, the meeting date, time, and list of attendees.



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[d] Any additional documentation associated with the lift.

#### 5.4 Special Lifts – Lifts Requiring Special Precautions

5.4.1 This special lift section identifies requirements for performing specific H&R activities and allows elements of critical lift requirements to be adopted at management’s discretion to provide additional administrative and physical controls.

5.4.2 Special precautions may be required under the following conditions:

- [1] A mobile crane is working near power lines or transmission towers.
- [2] A forklift is working near power lines or transmission towers.
- [3] Mobile crane pick and carry operations, follow requirements found in Section 5.15, *Mobile Cranes*.

#### 5.5 Pre-Engineered Lifts

5.5.1 A pre-engineered production lift is a repetitive lift that is performed by personnel in the assembly or disassembly of components or systems where detailed lift planning, equipment selection, and lift-specific training may substitute for the qualification prescribed in Section 3.2 of this PDD. In order for a lift to be designated a pre-engineered production lift, the following criteria shall apply:

- [1] The group of items to be lifted is identical in terms of dimension, weight, center of gravity, load path, method of attachment to the lifting equipment, and selection of lifting equipment.
- [2] All items can be lifted in adherence to a specific step-by-step procedure that eliminated rigging decisions or calculations by lifting personnel. The lifting procedure shall address details of the specific operation including the attachment and detachment of all lifting equipment, fixtures, and accessories.

5.5.2 Specialized Lifting Fixtures for Pre-Engineered Production Lifts

[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.

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[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.

### 5.5.3 Procedures for Pre-Engineered Production Lifts

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:

- [1] Identification of the load to be lifted.
- [2] Identification of the specific lifting fixtures, slings, and rigging hardware to be used in the operation.
- [3] Identification by class and capacity of lifting equipment (e.g., cranes, hoists) to be used.
- [4] 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.
- [5] Specific instructions for attachment of the lifting fixtures to the load and to the lifting equipment.
- [6] Specific step-by-step description of load movements required for the operation.
- [7] Specific instructions for removal of the lifting fixtures from both the load and the lifting equipment.

### 5.5.4 Procedure Verification

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

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### 5.5.5 Review and Approval

- [1] Before the procedure verification process, the procedure shall be reviewed by:
  - [a] Representative of a qualified engineering organization.
  - [b] Representatives of the responsible oversight organizations.
  - [c] Management of the facility where the procedure will be performed.
- [2] After each procedure is verified, it shall be approved by the Management of the production organization performing the procedure.
- [3] Revisions of procedures shall receive the same depth of review and level of approval as the initial versions received.

### 5.5.6 Training for Pre-Engineered Production Lifts

- [1] Specialized training shall be conducted for personnel involved in performing pre-engineered production lifts.
- [2] This training shall be periodically reviewed and approved by the responsible operating and oversight organizations. It shall include:
  - [a] Thorough coverage of all aspects of 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] Training on a procedure shall be repeated periodically or when a modification to the procedure results in a significant change in the operation.

## 5.6 Hooks

### 5.6.1 Scope

**NOTE**

This section applies to the construction, installation, operation, inspection, testing, maintenance, and the safe use of hooks installed on cranes or hoists as prescribed by the ASME standards and the OSHA regulations.

- [1] This section implements required criteria from the following standards:
  - [a] ASME B30.10 - *Hooks*

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[b] OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

[c] OSHA 29-CFR 1910.179 *Overhead and Gantry Cranes*

[d] 29 CFR-1910.180 *Crawler locomotive and truck cranes*

[e] 29 CFR-1910.181 *Derricks*

[2] This section also implements the following criteria from the applicable national standards and/or federal specifications that are mandatory requirements for each item.

[a] ASME B30.10, *Markings*

[b] ASME B30.10, *Construction*

[c] ASME B30.10/29 CFR-1910.180, *Inspection Classification*

[d] ASME B30.10/29 CFR-1910.180, *Frequent Inspection*

[e] ASME B30.10/29 CFR-1910.180, *Periodic Inspection*

[f] ASME B30.10, *Testing*

[g] ASME B30.10, *Maintenance*

[h] ASME B30.10, *Operating Practices*

## 5.6.2 General Requirements

FBP can access ASME via one or more of the following options:

[1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager.

[2] To access OSHA standards go to the following links:

[a] 29 CFR-1910.179, *Overhead and Gantry Cranes*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9830](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9830)

[b] 29 CFR-1910.180, *Crawler Locomotive and Truck Cranes*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9831](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9831)

[c] 29 CFR-1910.181, *Derricks*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9832](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9832)

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[d] 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=14212](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=14212)

### 5.6.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD and the hook manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements.
- [2] When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements. ASME standards provide the most comprehensive information.
- [3] Users should contact the H&Rg Manager for a formal interpretation.
- [4] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

### 5.6.4 Inconsistent Standards

- [1] OSHA requires Monthly Documented Hook Inspections along with other critical items, while ASME B30.10, *Hooks*, does not require monthly inspections to be documented. Therefore follow the OSHA requirements.
- [2] OSHA 29 CFR-1910.179-*Overhead and Gantry Cranes*, set removal criteria for hooks at 15% of normal throat opening or more than 10 degree twist from the plane of the unbent hook, while ASME B30.10 sets hook removal criteria at 5% for throat opening not to exceed ¼ inch and any visibly apparent bend or twist from the plane of the unbent hook. Therefore follow the ASME requirements.

### 5.6.5 PORTS Specific Requirements and Practice

H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the Basis for Interim Operations (BIO) and meeting the requirements of DOE STD 1090 2011.

## 5.7 Fork Trucks

### 5.7.1 General Requirements

- [1] Fork truck operations shall be conducted in accordance with applicable ASME/ANSI standards and as described in FBP-OS-PRO-00057, *Powered Industrial Trucks*.

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- [2] Normal forklift truck material handling operations are not considered H&R activities and do not require a DLL.

#### 5.7.2 Site Specific Requirement

- [1] Direct rigging from the fork tines of a fork truck is prohibited at the PORTS site.
- [2] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

### 5.8 Shop Cranes

#### NOTE

This section applies to the construction, installation, operation, inspection, testing, maintenance, and the safe use of self-contained hydraulic and pneumatic-hydraulic shop cranes as prescribed by the ASME standards and the OSHA regulations. Shop cranes are characterized by a pair of laterally spaced legs, an upright mast, a pivoting boom with a boom extension and hook, and a hydraulic unit. This section implements required criteria from OSHA 29 CFR 1926 Subpart CC, and the ASME Portable Automotive Lifting Devices (PALD) standard.

#### 5.8.1 Scope

The following criteria and the applicable national standard and/or federal specification identify the mandatory requirements for each item.

ASME PALD -- General Requirements

- [a] Product Marking and Identification
- [b] Product Instructions and Safety Messages
- [c] Operation, Maintenance, and Inspection
- [d] Quality Assurance
- [e] Shop Cranes
  - Scope, Classification, and Illustration
  - Design
  - Safety Markings and Messages

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- Design Qualification Testing
- Attachment and Adapters

### 5.8.2 General Requirements

Access standards via one of the following options:

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager.
- [2] To access OSHA 29 CFR 1926, Subpart CC, *Cranes & Derricks in Construction*, refer to: <http://www.osha.gov/doc/cranesreg.pdf>

### 5.8.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD and the hook manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements.
- [2] When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements. ASME standards provide the most comprehensive information.
- [3] Users should contact the H&R Manager for a formal interpretation.
- [4] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

### 5.8.4 Inconsistent Standards

No inconsistencies between standards have currently been identified.

### 5.8.5 Site Specific Requirements and Practices

H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

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## 5.9 Wire Rope

### 5.9.1 Scope

#### NOTE

This section specifies inspection and replacement requirements and acceptance criteria for wire rope on mobile cranes, overhead cranes, monorail cranes, jib cranes, and hoists that are used in lifting service.

- [1] Wire rope slings are not included in this section. For wire rope slings, see Section 5.10.
- [2] Wire rope that has been removed from a crane or hoist shall not be used to fabricate slings.

### 5.9.2 General Requirements

Must meet the requirements of the Equipment Manufacturer, ASME B30.2; B30.5; B30.11; B30.21, and follow the applicable OSHA regulations. If there is a discrepancy between the OSHA and ASME the most stringent will be followed.

## 5.10 Slings

#### NOTE

This section applies to the fabrication, attachment, use, inspection, and maintenance of slings used for lifting purposes. The proper and safe use of slings is governed by the ASME standards and the OSHA regulations. This section implements required criteria from the following standards: ASME B30.9-Slings, OSHA 29 CFR-1910.184, *Slings*, and OSHA 29 CFR-1926.251, *Rigging Equipment for Material Handling*.

### 5.10.1 Scope

Users can access standards via one of the following options:

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager
- [2] 29 CFR-1910.184, *Slings*  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9834](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9834)
- [3] 29 CFR-1926.251, *Rigging Equipment for Material Handling*  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10686](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10686)



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### 5.10.2 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD and the Slings manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements. ASME standards provide the most comprehensive information.
- [2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

### 5.10.3 Site Specific Requirements and Practices

#### [1] Prohibited Sling Applications

Slings with eyes formed by folding back the rope (not a Flemish eye loop) and secured with one or more metal sleeves pressed (not forging) over the wire rope junction have historically been used by the site. However, they shall not be fabricated or requisitioned for lifting service anymore and will be phased out of service.

- [2] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

## 5.11 Rigging Hardware

### NOTE

This section provides requirements that apply to the construction, installation, operation, inspection, and maintenance of detachable rigging hardware used for lifting purposes in conjunction with equipment described in other sections of this PDD. This hardware includes shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, dynamometers, load leveling devices, and rigging blocks. The proper and safe use of rigging hardware is governed by the ASME standards and the OSHA regulations. This section implements required criteria from this PDD and the following standards: ASME B30.26, *Rigging Hardware* and OSHA 29 CFR 1926.251, *Rigging Equipment for Material Handling*.

### 5.11.1 Scope

This section implements the following criteria and the applicable national standards and/or federal specifications that are mandatory per ASME B30.26, *Rigging Hardware*.

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### 5.11.2 General Requirements

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager
- [2] To access the OSHA standard go to the following link:

29 CFR 1926.251, *Rigging Equipment for Material Handling*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10686](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10686)

### 5.11.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD, and the Rigging Hardware manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.
- [2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

### 5.11.4 Site Specific Requirements

- [1] Manufacturer-Installed Lift Points
  - [a] All manufacturer-installed lift points shall be inspected and evaluated by a qualified person before use for cracks, deformation, excessive wear, or damage.
  - [b] When questions arise regarding the use of manufacturer-installed lift points, engineering shall be consulted.
- [2] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.
- [3] Proof Testing
 

Rigging hardware used in critical lifts shall be proof tested (load tested) in accordance with the requirements of ASME B30.26, and be traceable to the proof test.

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## 5.12 Below-The-Hook (BTH) Lifting Devices

### NOTE

This section provides requirements that apply to the marking, construction, installation, inspection, testing, maintenance, and operation of BTH Lifting Devices for attaching loads to various hoists. The proper and safe use of BTH Lifting Devices is governed by the ASME standards and the OSHA regulations. This section implements required criteria from this PDD and the following standards: ASME B30.20, *Below-the-Hook Lifting Devices*, ASME BTH-1, *Design of Below-the-Hook Lifting Devices*, ANSI N14.6, *Radioactive Materials – Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4500 kg) or more*, and OSHA 29 CFR 1926.251, *Rigging Equipment for Material Handling*.

### 5.12.1 Scope

This section implements required criteria from this PDD and the following standards:

- [1] ASME B30.20 ,*Below-the-Hook Lifting Devices*
- [2] ASME BTH-1, *Design of Below-the-Hook Lifting Devices*
- [3] ANSI N14.6, *Radioactive Materials – Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4500 kg) or more*

### 5.12.2 General Requirements

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager
- [2] To access OSHA standards go to the following links:

29 CFR 1926.251, *Rigging Equipment for Material Handling*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10686](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10686)

### 5.12.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, DOE/RL-92-36 and the BTH Lifting Device manufacturer’s requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.
- [2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

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- [3] In accordance with design requirements, the responsible engineer may invoke ANSI N14.6 to a below the-hook device. ANSI N14.6 invokes criteria similar to, but not identical to ASME B30.20 and ASME BTH-1.

#### 5.12.4 PORTS Specific Requirements

[1] Load Testing

ASME B30.20 states load testing should be performed for BTH lifting devices. All new, repaired or altered BTH lifting devices shall be load and operational tested to the provisions of ASME B30.20. The testing shall be documented as defined in ASME B30.20 and the BTH device tagged and traceable to the load test.

- [2] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

### 5.13 Hoists Jib Cranes and Monorail Systems

**NOTE**

This section applies to the marking, construction, installation, inspection, testing, maintenance and operation of the following:

- [1] Underhung cranes and monorail systems.
- [2] Hand chain-operated chain hoists and electric and air-powered chain and wire rope hoists.
- [3] Ratchet and pawl and friction brake type manually lever operated chain, wire rope, and web strap hoists used for lifting, pulling, and tensioning applications.

#### 5.13.1 Scope

- [1] The proper and safe use of hoists, jib cranes, and monorails is governed by the ASME standards and OSHA regulations. This section implements required criteria from this PDD and the following standards:

[a] ASME B30.11, *Monorails and Underhung Crane*

[b] ASME B30.16, *Overhead Hoists (Underhung)*

[c] ASME B30.21, *Manually Lever Operated Hoists*

[d] OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

[e] OSHA 29 CFR 1910.179, *Overhead and Gantry Cranes*

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- [2] The responsible engineer may invoke ASME NUM-1, *Rules for Construction of Cranes, Monorails, and Hoists (with Bridge or Trolley or Hoist of the Underhung Type)*, for cranes used at nuclear facilities. ASME NUM-1 applies to the design, manufacture, testing, inspection, shipment, storage, and erection of monorails and hoists (with bridge, trolley, or hoist of the underhung type).
- [3] This section implements required criteria from this PDD and the following standards:
  - [a] ASME B30.11, *Monorails and Underhung Cranes*
  - [b] ASME B30.16, *Overhead Hoists (Underhung)*
  - [c] ASME B30.21, *Manually Operated Lever Hoists*

#### 5.13.2 General Requirements

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager
- [2] To access OSHA standards go to the following links:
  - [a] 29 CFR 1910.179, *Overhead and Gantry Cranes*  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9830](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9830)
  - [b] 29 CFR 1926.554, *Overhead Hoists*  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10764](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10764)

#### 5.13.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD, and the hoist or jib crane or monorail manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.
- [2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

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#### 5.13.4 Site Specific Requirements and Practices

- [1] Working on or under a suspended load is prohibited, except when the load can be supported by blocking or cribbing, can be securely braced, or can be supported substantially by some other means that would prevent the load from moving.
- [2] Some loads being lifted and set in place may require special handling control measures such as inspecting, landing, setting, or controlling the load, that may require personnel to position their hands or other body parts under the load when no other method is feasible. These special handling control activities **MUST BE APPROVED** by management and industrial safety **PRIOR TO BEING PERFORMED**.
- [3] Manual Lever Operated Wire Rope Hoists  
  
Wire rope ratchet and pawl lever-operated hoists will not be used for lifting service.
- [4] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

#### 5.14 Overhead And Gantry Cranes

**NOTE**

This section applies to the marking, construction, installation, inspection, testing, maintenance and operation of the following overhead and gantry cranes, including semi-gantry, cantilever gantry, wall cranes, bridge cranes, and others having the same fundamental characteristics. These cranes may be top-running, under-running, single- or double-girder. Hoist units and trolleys are most commonly electric powered, but can be air powered or hand-chain operated. These cranes may be cab operated, pulpit operated, floor operated, or remotely operated. Such cranes are grouped together because all have trolleys and similar travel characteristics.

##### 5.14.1 Scope

- [1] The proper and safe use of overhead and gantry cranes is governed by the ASME standards and the OSHA regulations. This section implements required criteria from this PDD and the following standards:
  - [a] ASME B30.2, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)*
  - [b] ASME B30.17, *Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)*

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[c] OSHA 29 CFR 1910.179, *Overhead and Gantry Cranes*

[d] OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

- [2] The responsible engineer may invoke Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder) ASME NOG-1 for crane used at nuclear facilities. ASME NOG-1 applies to the design, manufacture, testing, inspection, shipment, storage, and erection of overhead and gantry cranes (Top Running Bridge, Multiple Girder).
- [3] The responsible engineer may invoke Rules for Construction of Cranes, Monorails, and Hoists (with Bridge or Trolley or Hoist of the Underhung Type) ASME NUM-1 for cranes used at nuclear facilities. ASME NUM-1 applies to the design, manufacture, testing, inspection, shipment, storage, and erection of monorails and hoists (with Bridge or Trolley or Hoist of the Underhung Type).
- [4] This section implements the following criteria and the applicable national standards and/or federal specifications that are mandatory requirements for each item.
- [a] ASME B30.2, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)*
- [b] ASME B30.17, *Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist)*

#### 5.14.2 General Requirements

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager
- [2] To access OSHA 29 CFR 1910.179, *Overhead and Gantry Cranes*, go to the following link:  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9830](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9830)
- [3] To access OSHA 29 CFR 1926, Subpart CC, *Cranes & Derricks in Construction*, refer to:  
<http://www.osha.gov/doc/cranesreg.pdf>

#### 5.14.3 Implementation

- [1] FBP shall be compliant to OSHA, ASME, this PDD and the overhead or gantry crane manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.

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- [2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

**5.14.4 Site Specific Requirements and Practices**

- [1] Except in the circumstance described in the paragraph below, working on or under a suspended load is prohibited, except when the load can be supported by blocking or cribbing, can be securely braced, or can be supported substantially by some other means that would prevent the load from moving.
- [2] Some loads being lifted and set in place may require special handling control measures such as inspecting, landing, setting, or controlling the load, that may require personnel to position their hands or other body parts under the load when no other method is feasible. These special handling control activities **MUST BE APPROVED** by management and industrial safety **PRIOR TO BEING PERFORMED**.
- [3] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

**5.15 Mobile Cranes**

**NOTE**

This section applies to the construction and characteristics, inspection, testing, maintenance, and operation of crawler cranes, locomotive cranes, wheel-mounted cranes, and other crane types that retain the same fundamental characteristics. This scope includes only cranes of the above type that are powered by internal combustion engines or electric motors. The proper and safe use of these crane types is governed by the ASME standards and the OSHA regulations.

**5.15.1 Scope**

This section implements required criteria from this PDD and the following standards:

- [1] ASME B30.5, *Mobile and Locomotive Cranes*
- [2] OSHA 29 CFR 1910.180, *Crawler Locomotive and Truck Cranes*
- [3] OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*



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### 5.15.2 General Requirements

[1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager

[2] To access OSHA standards go to the following links:

[a] 29 CFR 1910.180 *Crawler Locomotive and Truck Cranes*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9831](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9831)

[b] 29 CFR 1926.1400 Subpart CC, *Cranes & Derricks in Construction*

<http://www.osha.gov/doc/cranesreg.pdf>

### 5.15.3 Implementation

[1] FBP shall be compliant to OSHA, ASME, this PDD, and the mobile or locomotive crane manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.

[2] It is not the intent of this PDD to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to current requirements.

### 5.15.4 Site Specific Requirements and Practices

[1] Follow fall protection requirements as specified in the FBP Fall Protection Program, when performing assembly/disassembly, maintenance, repair, or inspection of mobile cranes.

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**[2] Ground and Bearing-Pressure Considerations**

It is important to ensure that no underground installations exist that could be compromised, such as electrical vaults, conduit banks, tanks, and piping. When crane load foundations and bearing pressure are a concern to crane stability and underground installation integrity, site utility layout, crane manufacturer's ground-loading information, crane configuration, and load and travel path information shall be evaluated and analyzed by Engineering. Engineering shall determine if ground scans, soil stability tests, and structural analysis of underground structures are necessary. If analysis is performed, a documented plan to ensure crane stability and integrity of underground installations shall be provided to the supervisor of the lift operation and discussed with involved or affected personnel.

**[a]** The equipment shall not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met.

**[b]** This section does not apply to cranes designed for use on railroad tracks when used on railroad tracks that are part of the general railroad system of transportation that is regulated pursuant to the Federal Railroad Administration under 49 CFR part 213 and that comply with applicable Federal Railroad Administration requirements.

**[3] Adverse Weather**

Adverse weather conditions such as, but not limited to wind, wind gusts, rain, snow, and extreme temperatures, that may inhibit the operator's or the equipment's ability to safely handle loads, shall be evaluated by supervision and the crane operator prior to any lifting operation. Limitations and conditions imposed by the equipment manufacturer for adverse weather shall be implemented. Mobile crane operations shall be suspended when lightning is within 8 miles of the work location.

**[4] On-Rubber and Pick-and-Carry Operations**

Mobile crane pick-and-carry and on-rubber operations may be performed when the crane manufacturer has an approved operating chart for that specific purpose. Manufacturer's requirements and conditions for on-rubber or pick-and-carry pre-operational checks shall be followed, such as, but not limited to, axle oscillation lockout system pre-checks and proper tire inflation validation. This information can be found in the operators or crane maintenance service manual provided with the crane. These requirements shall be addressed in the work planning process or other implementing documents and addressed in pre-job meetings.

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**[5] Rigging Requirements**

A minimum of one tag line should be utilized to ensure the loads can be controlled during a lift of movement.

**[6] Swing Radius–Pinch Point Clearance and Swing Radius Hazards**

When the crane is in operation, maintain a minimum clearance of 30 inches (76 centimeters) between the swing radius of the crane superstructure or counterweights and any stationary object.

**[7] Leaving the Equipment Unattended**

**[a]** The operator shall not leave the controls while the load is suspended, except where all of the following are met:

- The operator remains adjacent to the equipment and is not engaged in any other duties.
- The competent person determines that it is safe to do so and implements measures necessary to restrain the boom hoist and telescoping, load, swing, and outrigger or stabilizer functions.
- Barricades or caution lines, and notices, are erected to prevent all employees from entering the fall zone. No employees, including those listed in 29 CFR 1926.1425(b)(1) through (3), 29 CFR 1926.1425(d), or 29 CFR 1926.1425(e), are permitted in the fall zone.

**[b]** The provisions in 29 CFR 1926.1417(e)(1) do not apply to working gear (such as slings, spreader bars, ladders, and welding machines) where the weight of the working gear is negligible relative to the lifting capacity of the equipment as positioned, and the working gear is suspended over an area other than an entrance or exit.

**[8] Boom Free Fall Prohibitions**

The use of mobile cranes as defined in ASME B30.5, in which the boom is designed to free fall (live boom), is prohibited.

**[9] Unavailable Operation Procedures**

Where the manufacturer procedures are unavailable, the employer shall develop and ensure compliance with all procedures necessary for the safe operation of the equipment and attachments. Procedures for the operational controls shall be developed by a qualified person. Procedures related to the capacity of the equipment shall be developed and signed by a Registered Professional Engineer (RPE) familiar with the equipment.

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[10] H&R operations involving liquid UF<sub>6</sub> will be conducted in accordance with applicable site procedures and processes compliant with the safety and hazards analysis and associated controls of the BIO and meeting the requirements of DOE STD 1090 2011.

[11] Mobile Crane Pre-Operational Checks

- [a] All FBP and contracted personnel who provide oversight and/or perform operations which involve the use of mobile crane equipment for the PORTS D&D Project shall use FBP-SM-PDD-00001-F03, *FBP Mobile Crane Pre-Operational Checklist*, (Attachment C) in addition to all existing procedural checklists or checklists contained in the operational manual.
- [b] Projects or activities which utilize mobile cranes are required to receive approval from the FBP H&R Manager.
- [c] Operators shall ensure that the FBP-SM-PDD-00001-F03 is completed, maintained in the crane during operation and turned in to the supervisor at the end of operations.

**5.16 Personnel Lifting**

**NOTE**

This section applies to the construction and characteristics, inspection, testing, maintenance and operation of personnel lifting systems. This section establishes the design criteria, equipment characteristics, and operational procedures which are required when material handling equipment, as defined by ASME B30.23, *Personnel Lifting Systems*, is used to lift personnel. The proper and safe use of these personnel lifting systems is governed by the ASME standards and the OSHA regulations.

**5.16.1 Scope**

This section implements required criteria from DOE/RL-92-36 and the following standards:

- [1] ASME B30.23, *Personnel Lifting Systems*
- [2] OSHA 29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

**5.16.2 General Requirements**

- [1] For ANSI/AMSE – Contact the Engineering Manager or H&R Manager

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[2] To access OSHA standards go to the following link:

29 CFR 1926 Subpart CC, *Cranes & Derricks in Construction*

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10760](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10760)

### 5.16.3 Implementation

[1] The use of equipment to hoist employees is prohibited except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions. This paragraph does not apply to work covered by OSHA 29 CFR 1926 Subpart R, *Steel Erection*.

[2] FBP shall be compliant to OSHA, ASME, this PDD, and the personnel lifting system manufacturers' requirements. It is the responsibility of the user of this PDD to implement all of the requirements from listed sources. When two standards set forth inconsistent requirements, the user shall adhere to the standard containing the most stringent requirements.

### 5.16.4 Inconsistent Standards

ASME B30.23, *Personnel Lifting Systems*, provides more comprehensive documentation than OSHA 29 CFR 1926.1431, *Hoisting Personnel*.

### 5.16.5 Site Specific Requirements And Practices

[1] Personnel lifting shall be approved by the Program Director prior to conducting the operation.

[2] Follow ASME B30.23, *Personnel Lifting Systems Standards*.

## 5.17 H&R in Hostile Environments

### 5.17.1 Normal Operations

H&R activities can usually be accomplished where the environment will allow normal operations with access for hands-on equipment contact. In such situations, operations, maintenance, inspections, and tests shall be done in accordance with regular provisions of this PDD.

### 5.17.2 Special Provisions

While hostile environments as specified in DOE Standard 1090 are not anticipated, the applicable requirements for Hostile Environments will be implemented if such conditions are encountered.

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## 6.0 DEFINITIONS/ACRONYMS

### NOTE

The following specialized terms and acronyms are used regarding H&R operations and equipment. Not all of these terms are used in this PDD but have been included for general information.

### 6.1 Definitions

- 1) **Acceleration Stress** — Additional stress imposed by an increase in the load velocity.
- 2) **Assembly/Disassembly (A/D) Director** — An individual who meets this subpart's requirements for an A/D Director, irrespective of the person's formal job title or whether the person is non-management or management personnel.
- 3) **Administrative or Regulatory Authority** — Governmental agency, or the employer in the absence of governmental jurisdiction.
- 4) **Albert's Lay** — Synonymous with **lang lay**.
- 5) **Alternate Lay** — Lay of wire rope in which the strands are alternately regular lay and lang lay.
- 6) **Alternator/Generator (eddy current brake)** — When used in conjunction with an eddy current brake, it provides stator excitation in the event of simultaneous loss of power and mechanical brake failure. Provides for a safe lowering of a suspended load after power failure.
- 7) **Angle Indicator, boom** — An accessory that measures the angle of the boom base section to the horizontal.
- 8) **Angle of Loading** — Inclination of a leg or branch of a sling as measured from the horizontal or vertical plane.
- 9) **Annual Condition Report** — An annual report of the current condition of a crane. This report is prepared by a qualified person using maintenance and inspection records from the crane history file to compare the current condition with the original condition and the condition reported in previous years. Operation and performance histories are compared with original performance specifications and actual performance as reported in previous years to identify trends or equipment degradation.
- 10) **Anti-Two-Block Device** — A device which, when activated, disengages all crane functions whose movement can cause two-blocking. See **two-block damage prevention feature** and **two-block warning feature**.
- 11) **Appointed Person** — Person assigned specific responsibilities for an activity.

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- 12) **Armored Rope** — See **steel-clad rope**.
- 13) **Articulating Crane** — A crane whose boom consists of a series of folding, pin connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.
- 14) **Assembly/Disassembly** — The assembly and/or disassembly of cranes covered under this standard, with the exception of overhead cranes covered by ASME B30.2, B30.11, and B30.17.
- 15) **Assist Crane** — A crane used to assist in assembling or disassembling a crane.
- 16) **Attachment, forklift truck** — A device other than conventional forks or load backrest extension, mounted permanently or removable on the elevating mechanism of a forklift truck for handling the load. Popular types are fork extensions, clamps, rotating devices, side shifters, load stabilizers, rams, and booms.
- 17) **Audible Signal** — A signal made by a distinct sound or series of sounds. Examples include, but are not limited to, sounds made by a bell, horn, or whistle.
- 18) **Authorized** — Approved by a duly constituted administrator or regulatory authority.
- 19) **Authorized Service Center** — An independent service facility designated by the manufacturer to repair and test equipment of their manufacture.
- 20) **Auxiliary Hoist** — Supplemental hoisting unit usually smaller and faster than the main hoist.
- 21) **Axis of Rotation** — The vertical axis around which the crane superstructure rotates. Also called center of rotation (obsolete) and swing axis.
- 22) **Back-Hitch Gantry** — A fixed- or adjustable-height structure that forms part of the upper structure of a mobile crane, to which the lower spreader (carrying live boom-suspension ropes) is anchored.
- 23) **Back Stay** — Guy used to support a boom or mast or that section of a main rope, as on a suspension bridge or cableway leading from the tower to the anchorage.
- 24) **Bail** — (a) The U-shaped member of a bucket or load usually used as a lifting point; or (b) A U-shaped portion of a socket, or other fitting used on wire rope.
- 25) **Ballast** — Weight added to a crane base to create additional stability; it does not rotate when the crane swings.
- 26) **Barrel** — The lagging or body part of a rope drum in a drum hoist.
- 27) **Base** — The mounting flanges or feet used to attach a hoist to its supporting structure or foundation.

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- 28) **Base Mounting** — The structure forming the lowest element of a crane or derrick; it transmits loads to the ground or other supporting surface. For mobile cranes, this is synonymous with carrier or crawler mounting. For tower cranes, the term includes a travel base, knee frame base, or fixed base (footing).
- 29) **Base Section** — The lowermost section of a telescopic boom; it does not telescope but contains the boom foot pin mountings and the boom-hoist-cylinder upper end mountings.
- 30) **Basic Boom** — The minimum length of sectional latticed boom that can be mounted and operated, usually consisting of a boom base and tip section only.
- 31) **Basket of Socket** — The conical portion of a socket into which a splayed rope end is inserted and secured with zinc.
- 32) **Bearing Life (rated life)** — The number of revolutions or the number of hours at a constant speed that 90 percent of an apparently identical group of bearings will complete or exceed before the first evidence of fatigue develops; i.e., 10 out of 100 bearings will fail before rated life. **Minimum life** and **L10 life** are also used to mean rated life.
- 33) **Becket Line** — That part of the rope in a multi-ply reeving system that is dead-ended on one of the blocks.
- 34) **Becket Loop** — A loop of small rope or strand fastened to the end of a large wire rope to facilitate installation.
- 35) **Bird Cage** — A colloquial term describing the appearance of wire rope forced into compression. The outer strands form a “cage” and, at times, displace the core.
- 36) **Bleeding Line** — A condition caused when wire rope is overloaded, forcing the lubricant in the cable to be squeezed out and run excessively.
- 37) **Block** — A term applied to a wire rope sheave (pulley) enclosed inside plates and fitted with some attachment such as a hook or shackle.
- 38) **Blocking** (also referred to as “cribbing”) — Wood or other material used to support equipment or a component and distribute loads to the ground. It is typically used to support lattice boom sections during assembly/disassembly and under outrigger and stabilizer floats.
- 39) **Boom Angle** — The angle above or below horizontal of the longitudinal axis of the base boom section.
- 40) **Boom Angle Indicator** — A device which measures the angle of the boom relative to horizontal.
- 41) **Boom (crane)** — A member, in compression, hinged to the rotating superstructure and used for supporting the hoisting tackle and load.



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- 42) **Boom Base** — The lowermost section of a sectional latticed boom having the attachment or boom foot pins mounted at its lower end; also called boom butt or butt section.
- 43) **Boom Foot Mast** — A component of some mobile-crane boom suspensions. It consists of a frame hinged at or near the boom foot to increase the height of the inboard end of the fixed-boom suspension ropes, thereby increasing the angle the suspension ropes make with the boom while being itself controlled by the boom-hoist ropes. Its purpose is to reduce the axial compressive force on the boom; also called hi-light gantry.
- 44) **Boom Guy Line** — A fixed-length rope forming part of the boom-suspension system; also called **hog line, boom stay, standing line, or stay rope**.
- 45) **Boom Head** — The portion of a boom that houses the upper load sheaves.
- 46) **Boom Hoist** — The rope drum(s), drive(s), and reeving controlling the luffing motion of the boom.
- 47) **Boom-Hoist Cylinder** — Hydraulic ram used instead of a rope boom suspension, the most common means of derricking telescopic booms.
- 48) **Boom Hoist Limiting Device** — Includes boom hoist disengaging device, boom hoist shutoff, boom hoist disconnect, boom hoist hydraulic relief, boom hoist kick-outs, automatic boom stop device, or derricking limiter. This type of device disengages boom hoist power when the boom reaches a predetermined operating angle. It also sets brakes or closes valves to prevent the boom from lowering after power is disengaged.
- 49) **Boom Hoist Line** — Wire rope that operates the boom hoist system of equipment such as derricks, cranes, deadlines, and shovels.
- 50) **Boom Inserts** — Center sections of a sectional latticed boom usually having all four chords parallel.
- 51) **Boom Length Indicator** — Indicates the length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.
- 52) **Boom Line** — A wire rope for supporting or operating the boom on equipment such as derricks, cranes, draglines, and shovels.
- 53) **Boom Pendant** — A non-operating rope or strand with end terminations to support the boom.
- 54) **Boom Stay** — A fixed-length rope forming part of the boom-suspension system; also called **boom guy line, hog line, standing line, or stay rope**.
- 55) **Boom Stop** — A device intended to limit the maximum angle to which the boom can be raised.

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- 56) **Boom Tip Section** — The uppermost section of a sectional latticed boom, which usually includes the weldment mounting the upper load sheaves as an integral part; also called boom point, head section, or **tapered tip**.
- 57) **Boom Suspension** — A system of rope fittings, either fixed or variable in length, that supports the boom and controls the boom angle.
- 58) **Brake** — A device used for retarding or stopping motion by friction or power means.
- 59) **Brake, drag** — A brake that provides retarding force without external control.
- 60) **Brake, eddy current** — A device for controlling load speed in the hoisting or lowering direction by placing a supplementary load on the motor. This loading results from the interaction of magnetic fields produced by an adjustable or variable direct current in the stator coils and induced currents in the rotor.
- 61) **Brake, holding or parking** — A brake that automatically sets and prevents motion when power is off.
- 62) **Brake, mechanical load** — A friction device, usually using multiple discs or shoes, for controlling load speed in the lowering direction only. The brake prevents the load from overhauling the motor.
- 63) **Braking, counter torque** — See **counter torque**.
- 64) **Breaking Strength** — The measured tensile load required to cause failure of cable, chain, wire rope, or any other load-bearing element.
- 65) **Bridge Crane** — See **cranes, types of**.
- 66) **Bridge Travel** — Horizontal travel of the crane parallel with bridge runway rails.
- 67) **Bridge Trucks** — An assembly consisting of wheels, bearings, axles, and structural framework that supports the end reactions of the bridge girders.
- 68) **Bridle Sling** — Sling composed of multiple wire rope legs with a fitting that attaches to the lifting hook.
- 69) **Bright Rope** — Wire rope made of wires that are not coated with zinc or tin.
- 70) **Brooming** — Unlaying and straightening of strands and wires in the end of wire ropes during the process of installing a wire rope socket.
- 71) **Bull Pole** — A pole, generally of steel pipe, which is mounted to project laterally from the base of a derrick mast. It is used to swing the derrick manually.
- 72) **Bull Ring** — The main, large ring of a sling to which sling legs are attached; also called a **master link**.

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- 73) **Bull Wheel** — A horizontally mounted circular frame fixed to the base of a derrick mast to receive and guide the ropes used for swinging.
- 74) **Bumper (buffer)** — An energy-absorbing device that reduces impact when two moving cranes or trolleys come into contact or when a moving crane or trolley reaches the end of its permitted travel.
- 75) **Butt Section** — The lowermost section of a sectional latticed boom having the attachment or boom foot pins mounted at its lower end; also called boom butt.
- 76) **Cab** — Operator's compartment on a crane.
- 77) **Cab, normal** — Operator's compartment from which a crane is controlled.
- 78) **Cab, skeleton** — Operator's compartment used for occasional cab operation of a normally floor- or remote-operated crane.
- 79) **Cable** — A term loosely applied to wire ropes, wire strand, and electrical conductors. **Wire rope** is the preferred term for H&R application.
- 80) **Cable Crowd Rope** — Wire rope used to force the bucket of a power shovel into the material being handled.
- 81) **Cable-Laid Wire Rope** — A wire rope consisting of several independent wire ropes wrapped around a fiber or wire rope core.
- 82) **Cableway** — Aerial conveying system for transporting single loads along a suspended track cable.
- 83) **Cab-Operated Crane** — See **cranes, types of**.
- 84) **Camber** — The slight curvature given to beams and girders to compensate for deflections caused by loading.
- 85) **Capstan** — A spool-shaped revolving drum, manually or power-operated, used for pulling fiber or synthetic rope. Also called a **winch head**.
- 86) **Carrier (trolley)** — A unit that travels on the bottom flange of a monorail track or a bridge girder to transport a load.
- 87) **Center of Gravity** — The center of gravity of any object is the point in the object around which its weight is evenly distributed. If you could put a support under that point, you could balance the object on the support.
- 88) **Certified Welder** — A person holding a certificate as proof that qualified test welds have been performed and passed in accordance with the governing welding code.
- 89) **Cheek Plate(s)** — The stationary plate that support(s) the pin (axle) of a sheave or load.

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- 90) **Cheek Weights** — Overhauling weights attached to the side plates of a lower load block.
- 91) **Choker** — Sling, wire rope with eyes spliced on each end, which is used to lift load.
- 92) **Choker Hitch** — Sling with one end passing under the load and through a loop end attachment on other end of sling.
- 93) **Class (of load)** — See **critical service** and **critical lift**.
- 94) **Clearance** — The horizontal or vertical distance from any part of the crane to a point of the nearest obstruction.
- 95) **Clevis** — A U-shaped fitting with holes in each end through which a pin or bolt is run.
- 96) **Clip** — Fitting for clamping two parts of wire rope.
- 97) **Closed Cell** — For the purposes of this PDD, access to closed cells is limited during some operating cycles. See **hot cell**.
- 98) **Closed Socket** — Wire rope end fitting consisting of integral basket and bail.
- 99) **Closing Line** — Wire rope that closes a clamshell or orange-peel bucket, and then operates as a hoisting rope.
- 100) **Clutch** — An electromagnetic, hydraulic, pneumatic, or positive mechanical device for engagement or disengagement of power.
- 101) **Coil** — Circular bundle of wire or fiber rope not packed on a reel.
- 102) **Collector** — Contacting device mounted on bridge or trolley for collecting current from conductor system.
- 103) **Come-Along** — Lever-operated chain or wire rope devices designed for pulling, not lifting; also called **pullers**. Unlike hoists, the tension is held by a releasable ratchet. Much smaller and lighter than hoists of equal capacity, they are not intended nor allowed for lifting, but are suited for activities such as skidding machinery.
- 104) **Commercial Motor Vehicle** — A motor vehicle or combination of motor vehicles used in commerce to transport passengers or property if the motor vehicle:
  - a. Has a gross combination weight of 11,794 kg (26,001 lb) or more inclusive of a towed unit with a gross vehicle weight rating of more than 4536 kg (10,000 lb), or
  - b. Has a gross vehicle weight rating of 11,794 kg (26,001 lb) or more, or

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- c. Is designed to transport 16 or more passengers, including the driver, or
  - d. Is of any size and is used in the transportation of materials found to be hazardous for the purposes of the Hazardous Materials Transportation Act and which requires the motor vehicle to be placarded under 49 CFR 172, Subpart F, *Hazardous Materials Regulations*.
- 105) Competent Person** — One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
- 106) Conductors (bridge or runway)** — Electrical conductors located along the bridge girder(s) or runway to provide power and/or control circuits to the crane and trolley.
- 107) Conical Drum** — Grooved hoisting drum of tapering diameter.
- 108) Construction Worksite** — The area within the limits necessary to perform the work described in the construction procurement or authorization document. It includes the facility being constructed or renovated along with all necessary staging and storage areas as well as adjacent areas subject to project hazards.
- 109) Construction** — Combination of erection, installation, assembly, demolition, or fabrication activities involved to create a new facility or to alter, add to, rehabilitate, dismantle, or remove an existing facility. It also includes the alteration and repair (including dredging, excavating, and painting) of buildings, structures, or other real property, as well as any construction, demolition, and excavation activities conducted as part of environmental restoration or remediation efforts.
- 110) Continuous Bend** — Reeving of wire rope over sheaves and drums so that it bends in one direction, as opposed to reverse bend.
- 111) Control Braking Means** — A method of controlling hoisting or lowering speed of the load by removing energy from the moving load or by imparting energy in the opposite direction.
- 112) Controlled Load Lowering** — Lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.
- 113) Controller** — A device or group of devices that serve to govern, in some predetermined manner, the power delivered to the motor to which it is connected.
- 114) Controller, spring return** — A controller which, when released, will return automatically to a neutral position.

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- 115) **Controlling Entity** — An employer that is a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility to DOE for the construction of the project – its planning, quality and completion.
- 116) **Control Panel** — An assembly of magnetic or static electrical components that govern the flow of power to or from a motor in response to signals from a master switch, push-button station, or remote control.
- 117) **Core** — Core member of wire rope about which the strands are laid. It may be fiber, a wire strand, or an independent wire rope.
- 118) **Corrosion** — Chemical decomposition by exposure to moisture, acids, alkalis, or other destructive agents.
- 119) **Corrugated** — A term used to describe the grooves of a sheave or drum when worn so as to show the impression of a wire rope.
- 120) **Counter Jib** — A horizontal member of a tower crane on which the counterweights and usually the hoisting machinery are mounted; also called **counterweight jib**.
- 121) **Counter Torque** — A method of control by which the power to the motor is reversed to develop torque in the opposite direction to the rotation of the motor. See **braking, counter torque**.
- 122) **Counterweight Jib** — Also called **counter jib**.
- 123) **Counterweights** — Weights added to a crane upper structure to create additional stability. They rotate with the crane as it swings.
- 124) **Cover Plate** — The top or bottom plate of a box girder or junction box.
- 125) **Crane** — A machine for lifting and lowering a load vertically and moving it horizontally with the hoisting mechanism as an integral part of the machine. The term is applicable to fixed and mobile machines and to powered or manually driven machines.
- 126) **Crane Classification** — The Crane Manufacturers Association of America (CMAA) has established six service classes to enable the purchaser to specify the most economical class of crane for a particular installation. It is not economical either to under specify or to over specify when choosing a service class. Specifying a crane with too light a service class will reduce cost but may result in excessive maintenance. A crane with too high a service class may decrease maintenance costs but at an excessive initial investment. See **crane service**.

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**127) Crane Service — Class A (Standby or Infrequent Service)**

- a. **Class A1 (Standby Service)** — This service class covers cranes used in installations such as power houses, public utilities, turbine rooms, nuclear reactor buildings, motor rooms, nuclear fuel handling and transformer stations, where precise handling of valuable machinery at slow speeds with long idle periods between lifts is required.
- b. **Class A2 (Infrequent Use)** — These cranes are used in installations such as small maintenance shops, pump rooms, testing laboratories, and similar operations where the loads are relatively light, speeds are slow, and a low degree of control accuracy is required. The loads may vary anywhere from no load to full rated load with a frequency of a few lifts per day or month.

**128) Crane Service--Class B (Light Service)** — This service covers cranes that may be used in repair shops, light assembly operations, service buildings, or light warehousing, where service requirements are light, and the speed is slow. Loads may vary from no load to occasional full rated loads with two to five lifts per hour, averaging 3 meters (10 feet) per lift.

**129) Crane Service—Class C (Moderate Service)** — This service covers cranes that may be used in machine shops or paper-mill machine rooms, where service requirements are moderate. In this type of service, the crane will handle loads that average 50 percent of the rated capacity with 5 to 10 lifts per hour, averaging 4.6 meters (15 feet), not over 50 percent of the lifts at rated capacity.

**130) Crane Service--Class D (Heavy Service)** — This service covers cranes that may be used in heavy machine shops, foundries, fabricating plants, steel warehouses, container yards, or lumber mills, and standard-duty bucket and magnet operations where heavy-duty production is required.

In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour averaging 4.6 meters (15 feet), not over 65 percent of the lifts at rated capacity.

**131) Crane Service—Class E (Severe Service)** — This type of service requires a crane capable of handling loads approaching a rated capacity throughout its life. Applications may include magnet, bucket, magnet/bucket combination cranes for scrap yards, cement mills, lumber mills, fertilizer plant, or container handling, with 20 or more lifts per hour at or near the rated capacity.

**132) Crane Service--Class F (Continuous Severe Service)** — This type of service requires a crane capable of handling loads approaching rated capacity continuously under severe service conditions throughout its life. Applications may include custom-design specialty cranes essential to performing the critical work tasks affecting the total production facility. These cranes must provide the highest reliability with special attention to ease of maintenance features.

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133) **Cranes, types of —**

- a. **Automatic Crane** — A crane that, when activated, operates through a preset cycle or cycles.
- b. **Bridge Crane** — A crane with a single- or multiple-girder movable bridge, carrying a movable trolley or fixed hoisting mechanism, and traveling on an overhead fixed runway structure.
- c. **Cab-Operated Crane** — A crane controlled by an operator in a cab located on the bridge or trolley.
- d. **Cantilever Gantry Crane** — A gantry or semi gantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.
- e. **Crawler Crane** — A crane consisting of a rotating superstructure with power plant, operating machinery, and boom, mounted on a base, equipped with crawler treads for travel. Its function is to hoist, lower, and swing loads at various radii.
- f. **Double-Girder Crane** — A crane having two bridge girders mounted between, and supported from, the end trucks.
- g. **Floating Crane** — A rotating superstructure, power plant, operating machinery, and boom mounted on a barge or pontoon. The power plant may be installed below decks. The cranes function is to handle loads at various radii.
- h. **Floating Cranes/Derricks** — Equipment designed by the manufacturer (or employer) for marine use by permanent attachment to a barge, pontoons, vessel or other means of flotation.
- i. **Floor-Operated Crane** — A power-operated crane that is controlled by an operator from the floor or an independent platform or walkway located in the crane-way, using power control switches or push-buttons on a pendant.
- j. **Gantry Crane** — A crane similar to an overhead bridge crane, except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway, usually 3 meters (10 feet) or more below the bottom of the bridge.



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- k. **Hammerhead Tower Crane** — A lifting machine consisting of a mast with an upper, rotating member to which a jib boom is attached that extends horizontally from the rotating member, with a counter-weighted jib boom extending from the rotating member in the opposite direction, neither of which jib booms are arranged or rigged for luffing. The main jib boom carries a trolley on which the lower load block is suspended. The counterweight jib boom contains the counterweight for the main jib and working load, and sometimes provides the mounting for the hoisting and trolley travel motors and drums.
- l. **Interlocking Crane** — A crane with an interlock mechanism on one or both ends, enabling it to be mechanically locked to another crane, fixed transfer section, or spur track for the purpose of transferring a carrier from one to another.
- m. **Jib Crane** — A fixed crane with a vertical rotating member supported at the bottom (also at the top in some types), from which an arm extends to carry the hoist trolley. Jib cranes are most commonly mounted on a vertical column, supplied as part of the jib crane or mounted on existing structural members (e.g., a wall-mounted jib crane).
- n. **Locomotive Crane**--A crane consisting of a rotating superstructure with power plant, operating machinery and boom, mounted on a base or car equipped for travel on a railroad track. It may be self-propelled or propelled by an outside source. Its function is to hoist and swing loads at various radii.
- o. **Manually Operated Crane** — A crane whose hoist mechanism is driven by pulling an endless chain, or whose travel mechanism is driven in the same manner or by manually moving the load.
- p. **Mobile Crane** — A lifting device incorporating a cable suspended latticed boom or hydraulic telescopic boom designed to be moved between operating locations by transport over the road.
- q. **Monorail Crane** — A crane or hoist attached to a trolley that runs on the flanges of a structural beam.
- r. **Overhead Crane** — A crane with a single or multiple girder movable bridge, carrying a movable trolley or fixed hoisting mechanism, and traveling on an overhead fixed runway structure.
- s. **Polar Crane** — A bridge or gantry crane that travels on a circular runway.
- t. **Portal Crane** — A type of crane consisting of a rotating upper structure, hoist machinery, and boom mounted on top of a structural gantry which may be fixed in one location or have travel capability. The gantry legs or columns usually have portal openings in between to allow passage of traffic beneath the gantry.

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- u. **Power-Operated Crane** — A crane whose mechanism is driven by electricity, air, hydraulic, or internal combustion engine, as opposed to hand-operated movements.
- v. **Pulpit-Operated Crane** — A crane operated from a fixed operator station not attached to the crane.
- w. **Remotely Operated Crane** — A crane controlled by any method other than with a pendant, rope, or attached cab.
- x. **Semi-Gantry Crane** — A gantry crane with one end of the bridge rigidly supported by leg(s) that run on a fixed rail or runway and the other end supported by end trucks that run on an elevated rail or runway.
- y. **Sideboom Crane** — A track-type or wheel-type tractor having a boom mounted on the side of the tractor, used for lifting, lowering or transporting a load suspended on the load hook. The boom or hook can be lifted or lowered in a vertical direction only.
- z. **Single-Girder Crane** — A crane having one bridge girder mounted between, and supported from the end trucks.
- aa. **Storage Gantry Crane** — A gantry-type crane of long span usually used for bulk storage of material. The bridge girders or trusses are rigidly or non-rigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.
- bb. **Tower Crane** — A type of lifting structure which utilizes a vertical mast or tower to support a working boom (jib) in an elevated position. Loads are suspended from the working boom. While the working boom may be of the fixed type (horizontal or angled) or have luffing capability, it can always rotate to swing loads, either by rotating on the top of the tower (top slewing) or by the rotation of the tower (bottom slewing). The tower base may be fixed in one location or ballasted and moveable between locations. Mobile cranes that are configured with luffing jib and/or tower attachments are not considered tower cranes under this section.
- cc. **Truck Crane** — A crane consisting of a rotating superstructure with a power plant, operating machinery, and boom on a truck-type mounting equipped with a power plant for travel. Its function is to hoist, lower, and swing loads at various radii. Some variations of this use a single engine in the truck that also is the power source for the superstructure, or use a single engine in the superstructure, which is also the power source for the truck.
- dd. **Wall-Mounted Jib** — See cranes, types of, **jib crane**.
- ee. **Wall Crane** — A crane having a jib, with or without a trolley, supported from a side wall or line of columns of a building. It is a traveling-type crane and operates on a runway attached to the side wall or line of columns.

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**ff. Wheel-Mounted Crane (wagon crane)** — A crane consisting of a rotating superstructure with power plant, operating machinery and boom, mounted on a base or platform equipped with axles and rubber-tired wheels for travel. The base may be propelled by an engine in the superstructure, or with a separate engine controlled from the superstructure. Its function is to hoist, lower, and swing loads at various radii.

- 134) Craneway** — The area in length and width served by a crane.
- 135) Crawler Frames** — Part of the base mounting of a crawler crane attached to the car body and supporting the crawler treads, the track rollers, and the idler sprockets. Crawler frames transmit crane weight and operational loadings to the ground; also called **side frames**.
- 136) Creep Speed** — A very slow, constant, continuous, fixed rate of motion of the hoist, trolley, or bridge, usually established at 1 to 10 percent of the normal full-load speed.
- 137) Critical Diameter** — Diameter of the smallest bend for a given wire rope that permits the wires and strands to adjust themselves by relative movement while remaining in normal position.
- 138) Critical Item** — In accordance with this PDD: A part, component, assembly, or piece of equipment whose dropping, upset, or collision could cause/result in the following:
- a. Damage that would result in serious economic consequences.
  - b. Damage that would result in unacceptable delay to schedule or other significant deleterious programmatic impact (such as loss of vital data).
  - c. Undetectable damage that would jeopardize future operations or safety of a facility.
  - d. Significant release of radioactive or other hazardous material to the environment or create an undesirable condition.
  - e. Personnel injury or significant adverse health impact, either onsite or offsite.
- Large, costly items should be considered critical. Items that require special care in handling because of size, weight, installation in close-tolerance receptors, fragility, high susceptibility to damage or other unusual factors should be considered critical. Implicit in this definition is the possibility of handling items, which are themselves not critical in nature, over other items that are critical, thus making the lift involved “critical.”
- 139) Critical Lift** — A hoisting operation in which a critical item will be hoisted or moved, or in which a noncritical item will be hoisted or moved in an area where critical items could be affected.

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- 140) **Critical Load** — In accordance with ANSI N14.6: Any lifted load whose uncontrolled movement or release could adversely affect any safety-related system when such system is required for unit safety or could result in potential off-site exposures comparable to the guideline exposures outlined in Code of Federal Regulations, Title 10, Part 100.
- 141) **Critical Load** — In accordance with ASME NOG-1: Any lifted load whose uncontrolled movement or release could adversely affect any safety-related system when such system is required for unit safety or could result in potential off-site exposures in excess of the limit determined by the equipment purchaser.
- 142) **Critical Service** — The use of equipment or tackle for hoisting, rigging, or handling of critical items, or other items in, around, or above spaces containing critical items.
- 143) **Crossover Points** — In multiple-layer spooling of rope on a drum, those points of rope contact where the rope crosses the preceding rope layer.
- 144) **Custodian** — An individual designated as having custodial responsibility for equipment. The custodian takes “ownership” of assigned equipment and ensures that required maintenance, inspections, and tests remain current. The custodian will have quick access to the equipment history file.
- 145) **Cylindrical Drum** — Hoisting drum of uniform diameter.
- 146) **D/d RATIO** — A term regarding wire rope. D = Diameter of curvature around which the rope is bent. d = diameter of rope.
- 147) **Dead End** — The point of fastening of one rope end in a running rope system, the other end being fastened at the rope drum.
- 148) **Dead-Line** — The end of the rotary drilling line fastened to the anchor or dead-line clamp.
- 149) **Deadman** — An object or structure, either existing or built for the purpose, used as anchorage for a guy rope.
- 150) **Deceleration Stress** — Additional stress imposed on rigging resulting from a decrease in load velocity.
- 151) **Deflection** — (a) The sag across a span of a load member caused by the imposed live and/or dead loads, which is usually measured at mid-span as the distance along a straight horizontal line drawn between the supports; (b) any deviation from a straight horizontal line.
- 152) **Derrick** — An apparatus for lifting or lowering loads, consisting of a mast or equivalent member held at the head by guys or braces, with or without a boom, for use with hoists and ropes.

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- 153) **Design Factor** — The conservatism used in design calculations. As a function of design, this factor can be based upon the point of equipment failure, such as crane tipping, and brake stopping capacity, or based upon strength of materials, ultimate, nominal, or yield. Consensus standards and this PDD express design factors as a ratio (for example: 5:1, 3:1, 3.5:1) or as a single number (for example: 5, 3, or 3.5, understood to mean the “X” to 1). Although “design factor” is sometimes referred to as a “safety factor”, “design factor” is the preferred term. An inexperienced person may incorrectly assume this factor of design conservatism will make up for such conditions as shock loading, poor rigging, improper equipment selection, and overload conditions.
- 154) **Designated** — Selected or assigned by the employer or employer’s representative as being qualified to perform specific duties. See **appointed person**.
- 155) **Diameter (wire rope)** — The diameter of wire rope is the diameter of the circle that will contain the rope.
- 156) **Direct Geared** — A hoist with drum(s) geared directly to its power source.
- 157) **Directly Under the Load** — A part or all of an employee is directly beneath the load.
- 158) **Dismantling** — Includes partial dismantling (such as dismantling to shorten a boom or substitute a different component).
- 159) **Dog Leg** — Permanent short bend or kink in wire rope caused by improper use.
- 160) **Dragline** — Wire rope used to pull an excavating or drag bucket. Also used as an expression of a particular type of mobile crane using a drag bucket during excavation.
- 161) **Drifting** — Pulling a suspended load laterally to change its horizontal position.
- 162) **Drift Point** — A point on a travel motion controller that releases the brake while the motor is not energized. This allows for coasting before the brake is set.
- 163) **Drive** — An assembly consisting of motors, couplings, gear, and gear case(s) that is used to propel a bridge, trolley, or hoist.
- 164) **Drive Girder** — Girder on which the bridge drive, cross shaft, walk, railing, and operator’s cab are mounted.
- 165) **Drum** — (a) A cylindrical-flanged barrel of uniform (cylindrical drum) or tapering (conical drum) diameter on which cable is wound for operation or storage, which may be smooth or grooved; (b) the cylindrical member around which rope is wound for lifting or lowering the load or boom, or swinging the boom supporting structure.
- 166) **Drum Capacity, rope** — The length of a specific diameter of rope that can be wound on a drum.

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- 167) **Drum Hoist** — A hoisting mechanism incorporating one or more rope drums; also called a hoist, winch, or hoisting engine.
- 168) **Drum Rotation Indicator** — A device on a crane or hoist which indicates in which direction and at what relative speed a particular hoist drum is turning.
- 169) **Dummy Cab** — See cab, skeleton.
- 170) **Dynamic Loading** — Loads introduced into the machine or its components by forces in motion.
- 171) **Dynamic Lowering** — A method of control by which the hoist motor is so connected in the lowering direction, that when it is over-hauled by the load, it acts as a generator and forces current through resistors. (NOTE: Feeding back into the line is regenerative braking.)
- 172) **Efficiency (wire rope)** — Ratio of a wire rope's measured breaking strength and the aggregate strength of all individual wires tested separately, which is usually expressed as a percentage. The breaking strength of wire ropes seldom exceeds 90 percent of the aggregate strength of all the wires, the average being about 82.5 percent.
- 173) **Elastic Limit** — Limit of stress above which a permanent deformation takes place within the material. This limit is approximately 55 to 65 percent of breaking strength of steel wire ropes.
- 174) **Electrical Contact** — Occurs when a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.
- 175) **Encroachment** — Where any part of the crane, load line or load (including rigging and lifting accessories) breaches a minimum clearance distance that this subpart requires to be maintained from a power line.
- 176) **End Control** — The operator-control position is located at the end opposite the load end of the truck.
- 177) **End Penetration** — The treatment of the end of a length of wire rope designed primarily as an aid for pulling the rope through a reeving system or tight drum opening. These are not designed for use as a method for making a permanent connection.
- 178) **End Termination** — The treatment at the end or ends of a length of wire rope, which is usually made by forming an eye or attaching a fitting, designed to be the permanent end termination on the wire rope that connects it to the load.
- 179) **End Tie** — A structural member, other than the end truck, that connects the ends of the girders to maintain the squareness of the bridge.

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- 180) **End Truck** — An assembly consisting of structural members such as wheels, bearings, and axles that supports the bridge girder(s) or the trolley cross member(s).
- 181) **Endless Rope** — Rope whose two ends are spliced together.
- 182) **Equalizer** — Device used to compensate for unequal length or stretch of a hoist rope and connects two or more systems to a single running block.
- 183) **Equalizing Thimble** — Special type of fitting used as a component part of some wire rope slings.
- 184) **Equalizing Sheave** — The sheave at the center of a rope system over which no rope movement occurs other than equalizing movement. It is frequently overlooked during crane inspections, with disastrous consequences. It can be a source of severe degradation.
- 185) **Examination** — The process of nondestructive testing performed to ensure freedom from harmful hidden defects that could result in catastrophic failure.
- 186) **Exposed** — Applies to hazardous objects not guarded or isolated (capable of being contacted inadvertently).
- 187) **Extender** — A device that increases a jack's closed length.
- 188) **Extra flexible Wire Rope** — See **extra pliable wire rope**.
- 189) **Extra improved Plow Steel Rope** — See **grades, rope**.
- 190) **Extra pliable Wire Rope (also called extra flexible)** — Wire rope made with either 8 strands of 19 wires each, or 6 strands of 37 wires each, with a fiber core. The wires in this rope are smaller than those used in standard rope and consequently are not as suitable to withstand abrasion.
- 191) **Eye or Eye Splice** — A loop with or without a thimble formed in the end of a wire rope.
- 192) **Factor of Safety** — See **design factor**.
- 193) **Fail-Safe** — A provision designed to automatically stop or safely control any motion in which a malfunction occurs.
- 194) **Falls** — See **parts of line**.
- 195) **Fall Zone** — The area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.
- 196) **Fatigue** — The phenomenon leading to fracture under repeated or fluctuating stresses having a maximum value less than the tensile strength of the material.

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- 197) **Fiber Cores** — Cords or rope made of vegetable or synthetic fiber used in the core of a wire rope.
- 198) **Fiddle Block** — A block consisting of two sheaves in the same plane held in place by the same cheek plates.
- 199) **Filler Wire** — Small auxiliary wires in a strand used for spacing and positioning other wires.
- 200) **Fitting** — Any accessory used as an attachment for wire rope.
- 201) **Flange Point** — A point of contact between rope and drum flange where the rope changes layers.
- 202) **Flat Rope** — Wire rope made of parallel alternating right-lay and left-lay ropes sewn together by relatively soft wire.
- 203) **Flattened Strand Rope** — A wire rope of either oval or triangular shaped strands that presents a flattened rope surface.
- 204) **Fleet Angle** — The maximum angle between a rope and the line perpendicular to the drum on which it winds.
- 205) **Fleeting Sheave** — Sheave mounted on a shaft parallel to the rope-drum shaft and arranged so that it can slide laterally as the rope spools, permitting close sheave placement without excessive fleet angle.
- 206) **Flemish Eye** — A type or method of making a wire rope eye splice. Same as a “Molly Hogan.”
- 207) **Floating Crane** — See **cranes, types of**.
- 208) **Floor-Operated Crane** — See **cranes, types of**.
- 209) **Footblock** — A steel weldment or assembly serving as the base mounting for a guy derrick, gin pole, or boom derrick.
- 210) **Foot-Walk** — A walkway with handrail and toeboards, attached to the bridge or trolley for access purposes.
- 211) **Forklift Truck** — A high-lift, self-loading truck, equipped with load carriage and forks for transporting and tiering loads.
- 212) **Free Fall (of the load line)** — Only the brake is used to regulate the descent of the load line (the drive mechanism is not used to drive the load down faster or retard its lowering).
- 213) **Front-End Attachment** — See **attachment, fork-lift truck**



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- 214) **Gage Points** — Permanent marks on a hook are used to determine any change in the throat-opening dimension.
- 215) **Galvanized Rope** — Wire rope made of galvanized wire.
- 216) **Galvanized Strand** — Strand made of galvanized wire.
- 217) **Gantry Crane** — See **cranes, types of**.
- 218) **Generator** — See **alternator/generator**.
- 219) **Girder, auxiliary (outrigger)** — An additional girder, either solid or latticed, arranged parallel to the bridge girder(s) for supporting the footwalk, control panels, or operator’s cab to reduce the torsional forces such loads might otherwise impose.
- 220) **Girder, bridge** — The principal horizontal beam(s) of the crane, which supports the trolley, is supported by the end trucks, and is perpendicular to the runway.
- 221) **Girder, drive (Girder “A”)** — The bridge girder to which the bridge motor and gear-case(s) are attached. For cranes having a drive on each girder, it is the girder to which the control panels and/or the cab are attached.
- 222) **Girder, idler (Girder “B”)** — The bridge that does not have the bridge drive attached, but usually carries the bridge conductors.
- 223) **Girder, runway** — A horizontal beam attached to the building columns or wall and supporting a runway rail on which the crane travels.
- 224) **Gooseneck Boom** — A boom with an upper section projecting at an angle to the longitudinal centerline of the lower section.
- 225) **Grades, rope** — Classification of wire rope by its breaking strength. Listed in order of increasing breaking strengths: iron, traction, mild plow steel, plow steel, improved plow steel, and extra-improved plow steel.
- 226) **Grooved Drum** — Drum with a grooved surface that accommodates and guides the rope.
- 227) **Grooves** — Depressions in the periphery of a sheave or drum used for positioning and supporting a rope.
- 228) **Ground Conditions** — The ability of the ground to support the equipment (including slope, compaction, and firmness).
- 229) **Gudgeon Pin** — The pin at the top of a derrick mast forming pivot for the spider or for the mast of a stiff-leg derrick.
- 230) **Guy or Guy Line** — Strand or rope, usually galvanized steel, for holding a structure in position.

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- 231) **Hammerhead Boom** — A boom tip arrangement in which both the boom suspension and the hoist ropes are greatly offset from the boom longitudinal centerline to provide increased load clearance.
- 232) **Handling Fixture** — A cradle, handling structure, shipping fixture, or container designed specifically to support or facilitate component lifting or handling during fabrication, loading, shipping, storage, installation, or use.
- 233) **Haulage Rope** — Wire rope used for pulling cars on a track.
- 234) **Hazardous (classified) Location** — Locations where fire or explosion hazards may exist. Locations are classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts or fibers which may be present and the likelihood that a flammable or combustible concentration or quantity is present.
- a. **Class I** — Locations in which flammable gases or vapors are, or may be, present in the air in quantities sufficient to produce explosive or ignitable mixtures.
  - b. **Class II** — Locations that are hazardous because of the presence of combustible dust.
  - c. **Class III** — Locations where easily ignitable fibers or flyings are present but not likely to be suspended in quantities sufficient to produce ignitable mixtures.
- 235) **Hoist** — A lifting device for raising or lowering loads. Its service area is vertical over its mounting. Hoists may be attached to fixed or moveable structures by an upper hook or bracket and can be either power or manually operated; (b) A power-operated component of a crane or monorail system that provides torque to raise a load or lower it at a controlled speed and hold a load stationary; (c) A power-driven drum or drums capable of lifting and lowering loads.
- 236) **Hoisting** — The act of raising, lowering or otherwise moving a load in the air with equipment covered by this standard. As used in this standard, “hoisting” can be done by means other than wire rope/hoist drum equipment.
- 237) **Hoist, direct geared** — A hoist with a drum(s) geared directly to its power source.
- 238) **Hoist, drum** — A hoist with hoisting drum(s) and with or without a swinger.
- 239) **Hoist, friction drum** — A hoist with drum(s) controlled by friction clutches and brakes and provided with drum ratchets and pawls.
- 240) **Hoist, lever-operated** — A lever-operated, manual device used to lift, lower, or pull a load and to apply or release tension. (See **come-along**.)

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- 241) **Holding Line** — Wire rope on a clamshell or orange-peel bucket that holds the bucket while the closing line is released to dump the load.
- 242) **Hook, Rigging** — A hook used as part of tackle. Any hook used in H&R that is not the “primary hook” or main “load hook.”
- 243) **Hook Latch** — A mechanical device to bridge the throat opening of a hook.
- 244) **Hot Cell** — A shielded enclosure where the shielding media is composed of concrete, steel, lead or other special materials, specifically designed to protect operating personnel from undue amounts of nuclear radiation. For the purpose of this PDD, access to hot cells is minimal or very rarely allowed and most work functions are performed remotely.
- 245) **Idler** — Sheave or roller used to guide or support a rope. It is also used as a slang expression for an **equaling sheave**.
- 246) **Improved Plow Steel Rope** — See **grades, rope**.
- 247) **Inching** — See **jog**.
- 248) **Inching Drive (micro drive)** — A mode of crane operation (usually limited to hoists) that disengages the main drive motor by means of a clutch mechanism and engages a single, non-variable motor drive at a very low or creep speed.
- 249) **Independent Wire Rope Core (IWRC)** — Wire rope used as the core of a larger rope.
- 250) **Insulating Link/Device** — An insulating device listed, labeled, or accepted by a Nationally Recognized Testing Laboratory in accordance with 29 CFR 1910.7.
- 251) **Internally Lubricated** — Wire rope or strand in which all wires are coated with lubricant.
- 252) **Iron Rope** — See **grades, rope**.
- 253) **Jack** — A portable hand- or power-operated mechanism with a base and load point designed for controlled linear movement.
- 254) **Jack, double-acting hydraulic** — A jack that is extended and retracted under hydraulic pressure.
- 255) **Jack, mechanical** — A jack using any means other than fluid to move the load.
- 256) **Jib** — An extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles in the vertical plane of the boom.
- 257) **Jib Crane** — See **cranes, types of**.

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- 258) **Jib Stop** — (also referred to as a jib backstop); The same type of device as a boom stop but is for a fixed or luffing jib.
- 259) **Jog (inch)** — To move the hook, trolley, or bridge in a series of short, discontinuous increments by momentary operation of a controller.
- 260) **Kink** — Permanent distortion of wires and strands resulting from sharp bends.
- 261) **L10 life** — See **bearing life**.
- 262) **Laced Blocks** — Passing wire rope through a set of blocks by starting from an outside sheave and following in rotation. Will usually tilt travel block when running empty.
- 263) **Lagging** — External wood covering on a reel to protect the wire rope, strand, or grooved drum.
- 264) **Lang Lay Rope** — Wire rope in which the wires in the strands and the strands in the rope are laid in same direction. Synonymous with **Albert’s Lay**.
- 265) **Latch, hook** — A device used to bridge the throat opening of a hook.
- 266) **Latticed Boom** — A boom constructed of four longitudinal corner members, called chords, assembled with transverse and/or diagonal members, called lacings, to form a trusswork in two directions. The chords carry the axial boom forces and bending moments, while lacings resist the shears.
- 267) **Lay (wire rope)** — (a) The manner in which the wires in a strand or the strands in a rope are helically laid, or (b) the distance measured parallel to the axis of the rope (or strand) in which a strand (or wire) makes one complete helical convolution about the core (or center). In this connection, lay is also referred to as “lay length” or “pitch”.
- 268) **Lead Line** — That part of a rope tackle leading from the first or fast sheave to the drum.
- 269) **Lefthand End** — A reference to parts or dimensions on the viewer’s left of the centerline of span, established when facing the drive girder side of the crane.
- 270) **Left Lay** — (a) strand--strand in which cover wires are laid in a helical pitch, similar to left-hand screw; (b) rope--rope in which strands are laid in a helix having a left-hand pitch, similar to left-hand screw.
- 271) **Level Luffing** — An operating technique whereby the crane or derrick hook does not significantly change elevation as the boom is raised or lowered.
- 272) **Lift** — (a) Any sequence of operations in which a hoisting device raises an object above the ground, floor, or support, and then places it on the ground, floor, or support; (b) maximum safe vertical distance through which the hook can travel; (c) the hoisting of a load.

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- 273) **Lift Beam** — See **spreader beam**.
- 274) **Lift, ordinary** — Any lift not designated as a critical lift.
- 275) **Lifting Devices** — Devices that are not reeved onto the hoist ropes, such as hook-on buckets, magnets, grabs, load-spreader bars, and other supplemental units used for ease of handling certain types of loads. The weight of these devices is to be considered part of the working load.
- 276) **Lifting Eye** — A point of attachment on the item to be lifted, having a looped head designed to accommodate a hook or shackle. Also called a **slinging eye**.
- 277) **Limiting Devices** — A device that is operated by some part of a power-driven machine or equipment to control motions of the machine or equipment.
- 278) **Limit Switch** — An electrical device that is operated by the bridge, trolley, or hoist motion to disconnect the circuit, to establish a new circuit, or to provide a warning.
- 279) **Line** — Rope used for supporting and controlling a suspended load.
- 280) **Line Pull** — The pulling force attainable in a rope leading off a rope drum or lagging at a particular pitch diameter (number of layers).
- 281) **Line Speed** — The speed attainable in a rope leading off a rope drum or lagging at a particular pitch diameter (number of layers).
- 282) **Load** — The total superimposed weight or force to be overcome by the H&R equipment.
- 283) **Load-Bearing Parts** — Any part of a material-handling device in which the induced stress is influenced by the hook load. A primary load-bearing part is one, where the failure of which could result in dropping, upset, or uncontrolled motion of the load. Load-bearing parts which, if failed, would result in no more than stoppage of the equipment without causing dropping, upset, or loss of control of the load, are not considered to be primary load-bearing parts.
- 284) **Load Block, lower** — The assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by hoisting ropes.
- 285) **Load Block, upper** — The assembly of sheaves, pins, and frame suspended from the hoisting platform or from the boom in mobile cranes.
- 286) **Load Center (forklifts)** — The horizontal longitudinal distance from the intersection of the horizontal load-carrying surfaces and vertical load engaging faces of the forks (or equivalent load positioning structure) to the center of gravity of the load.
- 287) **Load, critical** — See **critical load**.

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- 288) **Load, dead** — The load(s) on a portion of the crane, which remain(s) in a fixed position relative to the member being considered.
- 289) **Load Float** — A control system that enables stepless operation of a hoist in either the lifting or lowering direction for a range of about 0 percent to 5 percent of full-rated speed, as well as permitting the load to be suspended stationary for a very short time with the holding brake(s) released.
- 290) **Load Jib** — The horizontal live load supporting member of a hammerhead-type tower crane having the load falls supported from a trolley that traverses the jib; also called **saddle jib**.
- 291) **Load, live** — A load that moves or varies relative to the member being considered. For the trolley, the live load consists of the rated load plus the weight of the block. For the bridge, the live load consists of the rated load plus the weight of the trolley.
- 292) **Load Moment (or rated capacity) Indicator** — A system which aids the equipment operator by sensing (directly or indirectly) the overturning moment on the equipment, i.e., load multiplied by radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.
- 293) **Load Moment (or rated capacity) Limiter** — A system which aids the equipment operator by sensing (directly or indirectly) the overturning moment on the equipment, i.e., load multiplied by radius. It compares this lifting condition to the equipment's rated capacity, and when the rated capacity is reached, it shuts off power to those equipment functions which can increase the severity of loading on the equipment, e.g., hoisting, telescoping out, or luffing out. Typically, those functions which decrease the severity of loading on the equipment remain operational, e.g., lowering, telescoping in, or luffing in.
- 294) **Load Point** — The point of load application.
- 295) **Load Point, auxiliary** — Any point of load application other than the load point.
- 296) **Load Point, integral auxiliary** — Any non-removable point of load application other than the load point.
- 297) **Load Rating, auxiliary** — Rated load of the jack, as determined by the manufacturer, when load is applied at the auxiliary load point.
- 298) **Load Radius** — Normally, the horizontal distance from the axis of rotation to the center of gravity of a lifted load. In mobile crane practice, this is more specifically defined as the horizontal distance from the projection to the ground of the axis of rotation before loading to the center of a loaded but vertical hoist line.
- 299) **Load, rated** — The maximum static vertical load for which a crane or an individual hoist is designed. See **rated capacity**.

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- 300) **Load Rating** — Rating in pounds established by the manufacturer.
- 301) **Load, safe working (SWL)** — The maximum load a piece of equipment (or tackle) can handle without exceeding the rated capacity (the rated capacity of the lowest capacity item used in the lift). See **load, rated**.
- 302) **Load, working** — The external load, in pounds applied to the crane. For mobile cranes and derricks, the weight of load-attaching equipment is included as part of the working load (e.g., load blocks, hooks, shackles, and slings). In permanently installed cranes such as overhead, gantry, and monorail cranes and hoists, the weight of the load block and hook is not part of the working load.
- 303) **Locked coil strand** — Smooth-surfaced strand composed of shaped wires laid in concentric layers around a center of round wires.
- 304) **Lowest service temperature (LST)** — A predetermined temperature below which all lifting equipment, assemblies, or fixtures should not be used.
- 305) **Luffing** — Changing the boom angle. Also called **booming in (out)**, or **topping**.
- 306) **Luffing Jib Limiting Device** — Similar to a boom hoist limiting device, except that it limits the movement of the luffing jib.
- 307) **Machine Resisting Moment** — The moment of the deadweight of the crane or derrick, less boom weight, about the tipping fulcrum; hence, the moment that resists overturning; also called **machine moment** or **stabilizing moment**.
- 308) **Magnet** — An electromagnetic device carried on a crane hook that picks up loads magnetically.
- 309) **Magnetic Controls** — Controls in which acceleration and deceleration are controlled as a master switch or pushbutton is moved from neutral to the forward or reverse positions. A combination of electromagnetically operated contactors and relays that actuate sequentially to vary the motor torque by changing the resistance.
- 310) **Magnetic Particle Examination** — A nondestructive test that reveals defects in ferromagnetic materials via detection of leakage fields at discontinuities in magnetic flow paths.
- 311) **Main Hoist** — The hoist mechanism provided for lifting the machine's maximum-rated load.
- 312) **Main Switch** — A switch controlling the entire power supply to the hoist.
- 313) **Man Trolley** — A trolley having an operator's cab attached.
- 314) **Manufacturer/Builder** — The builder/constructor of equipment.
- 315) **Marine Worksite** — A construction worksite located in, on or above the water.

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- 316) **Marlin Spike** — Tapered steel pin used in splicing wire rope.
- 317) **Mast** — The upright member of a derrick.
- 318) **Mast Cap** — See **spider**.
- 319) **Master Link** — Forged or welded steel link used to support all members (legs) of an alloy-steel chain or wire rope sling (includes bull ring, pear link, oblong link, and weldless sling link). Also called bull-ring.
- 320) **Master Switch** — A manual or automatic device that governs the operation of contactors and/or auxiliary devices of an electric control and provides for shutdown of all electric power to a crane or hoist.
- 321) **Material Elevator** — A mechanism consisting of a tower with vertical members, which guide a platform that is lifted and lowered by means of a hoist.
- 322) **Micro Drive** — See **inching drive**.
- 323) **Mild Plow** — See **grades, rope**.
- 324) **Milking** — The progressive movement of strands along the axis of the rope, resulting from the ropes movement through a restricted passage such as a tight sheave.
- 325) **Minimum Life** — See **bearing life**.
- 326) **Molly Hogan** — A type or method of making a wire rope eye splice. Same as a “flemish eye”.
- 327) **Monorail** — Usually a series of continuous beams with curves, switches, and stops that carry loads over a predetermined route or routes.
- 328) **Monthly** — Once each calendar month. A maintenance/inspection program should accomplish monthly tasks at approximately the same time each calendar month. To manage such programs, tasks should be scheduled as “due” on a particular date. If a task cannot reasonably be performed on the scheduled “due” date, it should promptly be rescheduled for a date during the same calendar month.
- 329) **Mousing** — A method of bridging the throat opening of a hook to prevent the release of load lines and slings, under service or slack conditions, by wrapping with soft wire, rope, heavy tape, or similar materials.



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- 330) Multi-Purpose Machine** — A machine that is designed to be configured in various ways, at least one of which allows it to hoist (by means of a winch or hook) and horizontally move a suspended load. For example, a machine that can rotate and can be configured with removable forks/tongs (for use as a forklift) or with a winch pack, jib (with a hook at the end) or jib used in conjunction with a winch. When configured with the forks/tongs, it is not covered by this subpart. When configured with a winch pack, jib (with a hook at the end) or jib used in conjunction with a winch, it is covered by this subpart.
- 331) Narrow-Aisle Truck** — A self-loading truck primarily intended for right-angle stacking in aisles narrower than those normally required by counterbalance trucks of the same capacity.
- 332) Nationally Recognized Accrediting Agency** — An organization that, due to its independence and expertise, is widely recognized as competent to accredit testing organizations. Examples of such accrediting agencies include, but are not limited to, the National Commission for Certifying Agencies and the American National Standards Institute
- 333) Nil-Ductility Transition Temperature** — The maximum temperature at which a standard drop-weight specimen breaks when tested in accordance with ASTM E-208.
- 334) National Lubricating Grease Institute (NLGI) Grade number** — A grade number defining the consistency of grease in accordance with methods prescribed by the National Lubricating Grease Institute.
- 335) Nominal Strength, wire rope** — Nominal wire rope strengths as calculated by a standardized industry-accepted procedure.
- 336) Nonconductive** — Because of the nature and condition of the materials used, and the conditions of use (including environmental conditions and condition of the material), the object in question has the property of not becoming energized (that is, it has high dielectric properties offering a high resistance to the passage of current under the conditions of use).
- 337) Nondestructive Examination (NDE)** — A name applied to a variety of tests which make use of indirect means to locate material discontinuities (e.g., radiography, dye penetrant, magnetic particle, ultrasonic).
- 338) Nonrotating Wire Rope** — See **rotation-resistant rope**.
- 339) Non-spinning Wire Rope** — See **rotation-resistant rope**.

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- 340) **Normal Operating Conditions** — Those conditions during which a crane or carrier is being operated and is performing functions within the scope of the original design. For a cab-operated crane, the operator is at the operating control devices in the cab and no other person is on the crane. For a floor-operated crane or carrier, the operator is at the operating control devices, which are suspended from the crane but operated with the operator off the crane, and no person is on the crane. For a remote-operated crane or carrier, the operator is at the operator control devices, which are not attached to any part of the crane, and no person is on the crane.
- 341) **Offset Angle** — The angle between the longitudinal centerline of a jib and the longitudinal centerline of the boom on which it is mounted.
- 342) **Open Socket** — Wire rope fitting consisting of a basket and two ears with a pin.
- 343) **Operating Sectors** — Portions of a horizontal circle about the axis of rotation of a mobile crane providing the limits of zones where over-the-side, over-the-rear, and over-the-front ratings are applicable.
- 344) **Operational Aids** — Devices that assist the operator in the safe operation of the crane by providing information or automatically taking control of a crane function. These include, but are not limited to, the devices listed in § 1926.1416 (“listed operational aids”).
- 345) **Operational Controls** — Levers, switches, pedals and other devices for controlling equipment operation.
- 346) **Operator** — A person who is operating the equipment.
- 347) **Outriggers** — Extendable arms attached to a crane base mounting, which include the means for relieving the wheels (crawlers) of crane weight; used to increase stability.
- 348) **Overhauling Weight** — Weight added to a load fall to overcome resistance and permit unspooling at the rope drum when no live load is being supported; also called **headache ball, cheek weights**.
- 349) **Overhead Crane** — See **cranes, types of**.
- 350) **Overhead Guard** — A framework fitted to a truck over the head of a riding operator.
- 351) **Overload** — Any load in excess of the safe working load or rated capacity of the equipment or tackle.
- 352) **Overtravel** — Movement beyond maximum travel for which the jack was designed.

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- 353) **Overturning Moment** — The moment of the load plus the boom weight about the tipping fulcrum. Wind and dynamic effects can be included when appropriate.
- 354) **Parking Brake** — A device to prevent the movement of a stationary vehicle.
- 355) **Parts of Line** — A number of running ropes supporting a load or force, also called parts or **falls**.
- 356) **Pawl (dog)** — A device for positively holding a member against motion in one or more directions.
- 357) **Paying Out** — Adding slack to a line or relieving load on a line by letting (spooling) out rope.
- 358) **Pendants** — Both wire and bar types. Wire type: a fixed length of wire rope with mechanical fittings at both ends for pinning segments of wire rope together. Bar type: instead of wire rope, a bar is used. Pendants are typically used in a latticed boom crane system to easily change the length of the boom suspension system without completely changing the rope on the drum when the boom length is increased or decreased.
- 359) **Pendant Control Station** — Controls suspended from an overhead crane, gantry crane, or overhead hoist for operating the unit. (Commonly called the pendant.)
- 360) **Peening** — Permanent distortion of outside wire in a rope caused by pounding.
- 361) **Periodic Inspection** — Daily to yearly inspections.
- 362) **Person in Charge (PIC)** — A qualified individual assigned to all H&R operations to ensure that the lifting operation is properly performed.
- 363) **Pitch Diameter** — The distance, measured through the center of a drum or sheave, from center to center of a rope passed about the periphery of the drum or sheave.
- 364) **Pivoted Luffing Jib** — A tower crane jib that in general has pivot points somewhere in the middle area; also called **articulated jib**.
- 365) **Plow Steel** — See **grades, rope**.
- 366) **Plug** — To operate a controller in such a manner that the motor line voltage polarity or phase sequence is reversed before the motor rotation has stopped, thereby developing a counter torque that acts as a retarding force.
- 367) **Plugging** — Stopping the forward motion of the bridge or trolley travel by reversing the controller to the opposite direction.

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- 368) **Plugging relay** — A current relay that senses current in the motor secondary circuit of an alternating current (ac) motor and limits reverse torque of the motor until the motor rotation has stopped. In a direct current control panel, the relay performs the same function by establishing a sensing circuit at the motor armature (also known as the anti-plugging relay.)
- 369) **Polar Crane** — See **cranes, types of**.
- 370) **Power-Controlled Lowering** — A system or device in the power train, other than the load holding brake, that can control the lowering speed of the load hoist mechanism.
- 371) **Power Lines** — Electric transmission and distribution lines.
- 372) **Powered Industrial Truck** — A mobile, power-driven vehicle used to carry, push, pull, lift, stack, or tier material.
- 373) **Power-Operated Crane** — See **cranes, types of**.
- 374) **Pre-Engineered Lift** — A noncritical lift that management has designated as requiring additional controls by having a qualified individual or engineer independently pre-identify load weight, load center of gravity, lift attachment points, and minimum lifting hardware (slings, BTH lifting devices, shackles, etc.) capacities that will be used for the lift or series of lifts. Pre-identified information shall be provided to the personnel involved in the lift.
- 375) **Preece Test** — A recognized standard of testing the galvanized coating on wire.
- 376) **Preformed Strand** — Strand in which the wires are permanently shaped, before fabrication in the strands, to the helical form they assume in the strand.
- 377) **Preformed Wire Rope** — Wire rope in which the strands are permanently shaped, before fabrication into the rope, to the helical form they assume in the wire rope.
- 378) **Pressure Gripping Lifters, friction type** — Lifters that grip the load without significant or harmful permanent deformation of the load surfaces.
- 379) **Pressure Gripping Lifters, indentation type** — Lifters that carry the load by applying sufficient force to permanently indent the sides of the load.
- 380) **Prestressing** — Stressing a wire rope or strand before use under such a tension and for such a time that the construction stretch is largely removed.
- 381) **Preventive Maintenance** — A periodic or scheduled program that provides lubrication, adjustments, inspection, and testing as required to keep equipment in safe, operable working conditions.
- 382) **Primary Load-Bearing Part** — See **load-bearing parts**.

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- 383) **Proof Load** — The load applied in performance of a proof test.
- 384) **Proximity Alarm** — A device that provides a warning of proximity to a power line and that has been listed, labeled, or accepted by a Nationally Recognized Testing Laboratory in accordance with 29 CFR 1910.7.
- 385) **Pullers** — Also called **come-along**.
- 386) **Pulpit-Operated Crane** — See **cranes, types of**.
- 387) **Qualified** — A person, who by possession of a recognized degree, certificate, or professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project.
- 388) **Qualified Engineer** — A person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.
- 389) **Qualified Evaluator** — A person who has demonstrated that he/she is competent in accurately assessing whether individuals meet the Qualification Requirements.
- 390) **Qualified Inspector** — One whose competence is recognized by the cognizant manager and whose qualification to perform specific inspection activities has been determined verified and attested to in writing.
- 391) **Qualified Operator** — One whose competence to operate equipment safely and effectively (including the ability to accurately spot and control loads) has been demonstrated by extensive experience or operational tests and whose name has been posted on the Qualification List in the work area by the cognizant manager.
- 392) **Qualified Person** — A person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.
- 393) **Qualified Rigger** — a rigger who meets the criteria for a qualified person.
- 394) **Qualified Safety Representative** — A person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.
- 395) **Rail, bridge** — The track supported by the bridge girder(s) on which the trolley travels.
- 396) **Rail, runway** — The track supported by the runway beams on which the crane travels.

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- 397) **Rail sweep** — A mechanical device attached to the end truck of a bridge or trolley, located in front of the leading wheels, to remove foreign objects from the rail.
- 398) **Radius (reach)** — For mobile equipment, the horizontal distance from the theoretical intersection of the axis of rotating and the vertical center of the hoist line(s).
- 399) **Range Control Limit Device** — A device that can be set by an equipment operator to limit movement of the boom or jib tip to a plane or multiple planes.
- 400) **Range Control Warning Device** — A device that can be set by an equipment operator to warn that the boom or jib tip is at a plane or multiple planes.
- 401) **Range Diagram** — A diagram showing an elevation view of a crane with circular arcs marked off to show the luffing path of the tip for all boom and jib lengths and radial lines marking boom angles. A vertical scale indicates height above ground, while a horizontal scale is marked with operating radii. The diagram can be used to determine lift heights, clearance of the load from the boom, and clearances for lifts over obstructions.
- 402) **Ratchet** — A toothed member, attached to or a part of the drum, for engagement with the pawl.
- 403) **Rated Capacity (rated load)** — (a) The maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use. (b) For a truck equipped with load carriage and forks or attachments it is the weight established by the manufacturer at a required load center that a given truck can transport and stack to an established height.
- 404) **Rated Life** — See **bearing life**.
- 405) **Rated Load (hydraulic jacks)** — -Maximum load, applied at a specified point, for which the jack is designed and built by a manufacturer for its specified travel.
- 406) **Rated Load, lifting (mechanical jacks)** — Maximum load, applied at a specified point, which the jack was designed to lift with the specified operating lever.
- 407) **Rated Load, sustaining (mechanical jacks)** — Maximum load, applied at a specified point, which the jack was designed to sustain.
- 408) **Rated Lope (line) Pull** — The manufacturer's recommended load in pounds (kilograms) applied to the rope attached to the hoist drum.
- 409) **Reach** — Distance from the axis of rotation of a crane or derrick, sometimes used synonymously with radius.

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- 410) **Rerate** — To change the rated load (capacity). The rated load may be increased or decreased.
- 411) **Reel** — The flanged spool on which wire rope or strand is wound for storage or shipment.
- 412) **Reeve** — The pattern that a rope forms between sheaves in a hoisting system.
- 413) **Reeved Blocks** — Passing rope through a set of blocks, as opposed to laced blocks, and in such a manner that there are no lines crossed or rubbing each other.
- 414) **Reeving** — A rope system in which the rope travels around drums and sheaves in a prescribed manner.
- 415) **Reeving Diagram** — A diagram showing the path of the rope through a system of sheaves (blocks).
- 416) **Regenerative** — A method of control in which the electrical energy generated by the motor is fed back into the power system.
- 417) **Regular-Lay Rope** — Wire rope in which the wires in the strands and the strands in the rope are laid in opposite directions.
- 418) **Remote-Operated Crane** — See **cranes, Types of**.
- 419) **Repetitive Pickup Point** — When operating on a short cycle operation, the rope being used on single layer and being spooled repetitively over a short portion of the drum.
- 420) **Reverse Bend** — Reeving of a wire rope over sheaves and drums so that it bends in opposite directions.
- 421) **Reverse Lay** — See **alternate lay**.
- 422) **Revolving Superstructure** — On a mobile crane, the entire rotating structure less the front end attachment; also called **upper superstructure**.
- 423) **Rigger** — See **qualified rigger** and **rigging specialist**.
- 424) **Rigging** — The act of attaching hoisting equipment to the load.
- 425) **Rigging Hook** — See **hook, rigging**.
- 426) **Rigging Specialist** — A qualified rigger or recognized rigging authority with at least 5 years H&R experience selected by the employer to advise or supervise H&R activities. (See **qualified rigger**.)
- 427) **Right-Hand End** — A reference to parts or dimensions on the viewer's right of the centerline of span, established when facing the drive-girder side of the crane.

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- 428) **Right-Lay** — (a) Strand in which the cover wires are laid in a helix having a right-hand pitch, similar to a right-hand screw; (b) Rope in which the strands are laid in a helix having a right-hand pitch, similar to a right-hand screw.
- 429) **Rocker Beam** — Beam used for hoisting flimsy trusses or long flimsy loads. Also used to equalize the weight and to keep a load, such as tank plate, from buckling.
- 430) **Rollers** — Relatively small-diameter cylinders or wide-faced sheaves for supporting or guiding ropes.
- 431) **Rooster** — One or more struts at the top of a boom or mast, such as a jib strut, a tower-crane top tower, or the struts at the top of the mast of a mobile crane tower attachment.
- 432) **Rope** — Refers to wire rope unless otherwise specified.
- 433) **Rope Drum** — That part of a drum hoist that consists of a rotating cylinder with side flanges on which hoisting rope is spooled in or out (wrapped).
- 434) **Rotation-Resistant Rope** — A wire rope consisting of an inner layer of strands laid in one direction, covered by a layer of strands laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.
- 435) **Running Wire Rope** — A rope that moves over sheaves or drums.
- 436) **Running Sheave** — A pulley-type device that changes location in relation to the hoisting device.
- 437) **Runway (overhead cranes)** — An assembly of rails, girders, and brackets that form a structural support on which a crane operates.
- 438) **Saddle Jib**--The horizontal live-load supporting member of a hammerhead-type tower crane having the load falls supported from a trolley that traverses the jib; also called **load jib**.
- 439) **Safety Factor** — See **design factor**.
- 440) **Safe Working Load (SWL)** — See **rated capacity**.
- 441) **Sag** — See **deflection**.
- 442) **Seale** — A strand construction having one size of cover wires with the same number of one size of wires in the inner layer and each layer having the same length and direction of lay. Most common construction is one center wire, nine inner wires, and nine cover wires.
- 443) **Seize** — To bind securely the end of a wire rope or strand with seizing wire or strand.



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- 444) **Seizing Strand** — Small strand, usually of seven wires, made of soft-annealed-iron wire.
- 445) **Seizing Wire** — A soft-annealed-iron wire.
- 446) **Serve** — To cover the surface of a wire rope or strand with a wrapping of wire.
- 447) **Service, normal** — That service which involves operation with randomly distributed loads within the rated load limit, or uniform loads of less than 65 percent of the rated load for not more than 15 percent of the time for manually operated hoists and 25 percent of the time for electric- or air-powered hoists, of a single work shift.
- 448) **Service, heavy** — that service which involves operation within the rated load limit which exceeds normal service.
- 449) **Service, severe** — that service which involves normal or heavy service with abnormal operating conditions.
- 450) **Shackle**--A type of clevis normally used for lifting.
- 451) **Shaft, cross (squaring shaft) (drive shaft)** — The shaft(s) extending the length of the bridge, used to transmit torque from the motor to a wheel(s) at each end of the bridge.
- 452) **Shall** — Word indicating that the rule is mandatory and must be followed.
- 453) **Sheave** — A wheel or pulley with a circumferential groove designed for a particular size of wire rope; used to change direction of a running rope.
- 454) **Shock Loading** — Term used to call attention to the application of any sudden, unplanned loading of equipment that would jeopardize the safety of the lift. Typical examples that could result in shock loading are: (a) rapid travel of the burden block without alteration of speed before all slack is removed from the sling(s), (b) unplanned shifting of the load while suspended, (c) fracture of a lifting system component resulting in the application of unknown loading on remaining components.
- 455) **Should** — Word indicating that the rule is a recommendation, the advisability of which depends on the facts in each situation.
- 456) **Side Frames** — Part of the base mounting of a crawler crane attached to the carbody and supporting the crawler treads, the track roller, and the drive and idler sprockets. Crawler frames transmit crane weight and operational loadings to the ground; also called **crawler frames**.
- 457) **Side Pull** — That portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.
- 458) **Side Loading** — A loading applied at any angle to the vertical plane of the boom.

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- 459) **Siemens-Martin Strand** — A grade of galvanized strand.
- 460) **Single Galvanized Strand** — Strand made in the common grade or wiped galvanized wire. See **common strand**.
- 461) **Site Supervisor** — Exercises supervisory control over the work site on which a crane is being used and over the work that is being performed on that site.
- 462) **Slewing** — A crane or derrick function wherein the boom or load-supporting member rotates about a vertical axis (axis of rotation); also called **swing**.
- 463) **Slinging Eye** — See **lifting eye**.
- 464) **Slings** — Wire ropes, chains, or synthetic fabric made into forms, with or without fittings, for handling loads.
- 465) **Slings, braided** — A very flexible sling composed of several individual wire ropes braided into a single sling.
- 466) **Slings, endless and grommet wire rope** — A wire rope made endless from one continuous length of cable-laid rope with the ends joined by one or more metallic fittings.
- 467) **Slings, four-leg bridle** — Sling made with four single-rope legs, secured to a single lifting ring.
- 468) **Slings, three-leg bridle** — Slings made with three single-rope legs, secured to a single lifting ring.
- 469) **Slings, two-leg bridle** — Slings with single-rope legs, equalizing double-rope legs, or multiple-part rope legs.
- 470) **Slip (motor)** — The difference between theoretical, or synchronous, speed and actual speed in an induction motor. Under standard conditions, an induction motor never reaches synchronous speed, at which zero torque is developed.
- 471) **Smooth Coil Strand**--Strand composed entirely of round wires.
- 472) **Snatch Block** — A single- or double-sheave block arranged so one or both cheek plates can be opened, permitting the block to be reeved without having to use a free rope end.
- 473) **Socket** — Type of wire rope fitting. See **closed sockets, open sockets, and wedge sockets**.
- 474) **Softeners** — Anything used to protect the load or the rigging from damage while making a lift. Also, prevents load from slipping.
- 475) **Span** — The horizontal distance center-to-center of runway rails.

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- 476) **Special Flexible** — See **extra flexible** and **extra pliable**.
- 477) **Special Hazard Warnings** — Warnings of site-specific hazards (for example, proximity of power lines).
- 478) **Special-Rated Capacity** — The maximum hook load that a piece of hoisting equipment or the maximum working load that an industrial truck or piece of rigging tackle is permitted to carry, based on its present condition and the operational conditions as determined by an engineering evaluation, load test, or both. The special-rated capacity may be equal to, but not greater than, the rated capacity of equipment established by the manufacturer.
- 479) **Spider** — A fitting mounted to a pivot (gudgeon pin) at the top of a derrick mast, providing attachment points for guy ropes; also called **Mast cap**.
- 480) **Spiral Groove** — A continuous helical groove that follows a path on and around a drum face, similar to a screw thread.
- 481) **Splicing** — Interweaving of two ends of ropes to make a continuous or endless length without appreciably increasing the diameter. Also, making a loop or eye in the end or a rope by tucking the ends of the strands.
- 482) **Spooling (rope)** — Winding of rope on a cylindrical drum in evenly spaced, uniform layers.
- 483) **Spotter** — An assigned person(s) whose sole responsibility is to provide a warning or stop signal during vehicle or equipment operation prior to violation of proximity restrictions or per-determined distance limitations to structures or hazards such as power and communication lines, overhead obstructions, buildings, telephone poles, ground penetrations and etc. (Spotters for mobile cranes require the use of a qualified signalman/flagman as a spotter).
- 484) **Spreader Bar** — A frame, forming part of the boom suspension, supporting sheaves for the live suspension ropes and attached to the fixed suspension ropes (pendants); also called **bridle**, **spreader**, **live spreader**, or **flating harness**.
- 485) **Spreader Beam** — A fixture made of rigid parts, such as pipe, wide-flange, I-beam, channel, plate, etc., to assist in rigging a load.
- 486) **Stabilizers** — Devices for increasing stability of a crane; they are attached to the crane base mounting but are incapable of relieving the wheels (crawlers) of crane weight.
- 487) **Stabilizing moment** — The moment of the dead-weight of the crane or derrick, less boom weight, about the tipping fulcrum; hence, the moment that resists overturning; also called **machine moment** or **machine resisting moment**.
- 488) **Stainless Steel Rope** — Wire rope made of low-carbon corrosion-resistant steel.

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- 489) **Standby** — A crane or derrick that is not in regular service, but one that is used occasionally or intermittently as required.
- 490) **Standing Line** — A fixed-length line that supports loads without being spooled on or off a drum; a line of which both ends are dead; also called **stay rope** or **pendant**.
- 491) **Standing Rope** — See **guy line**.
- 492) **Standing Rope (pendant)** — A supporting rope that maintains a constant distance between the points of attachment to the two components connected by the rope.
- 493) **Static Base** — Tower-crane support (base mounting) where the crane mast is set on or into a foundation.
- 494) **Static Controls** — Controls that provide a function similar to that of magnetic controls. The accelerating resistors and contactors are replaced with thyristors, silicon-controlled rectifiers (SCRs), and similar static electronic devices. Operating characteristics are similar to those that might be obtained from magnetic control having an infinite number of accelerating contacts between the first and final control points.
- 495) **Statically Determinate Load** — The load or stress in a member that, when determined by arithmetic means, is mathematically accurate.
- 496) **Statically Indeterminate Load** — A load or stress that is determined arithmetically and which has a range of values which cannot be accurately determined mathematically.
- 497) **Stay Rope** — A fixed-length rope forming part of the boom suspension system; also called **boom guy line**, **hog line**, **boom stay**, **standing line**, or **pendant**.
- 498) **Steel-Clad Rope** — Rope with individual strands spirally wrapped with flat steel wire.
- 499) **Stirrup** — The U-bolt or eyebolt attachment on a bridge socket.
- 500) **Stop** — A member to physically limit the travel of a trolley or bridge. This member is rigidly attached to a fixed structure and normally does not have energy-absorbing ability.
- 501) **Strand, wire rope** — A plurality of round or shaped wires helically laid about an axis.
- 502) **Strength Margin** — The ratio of structural failure load (or stress) to actual or permitted load (or stress).

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- 503) **Structural competence** — The ability of the equipment and its components to support the stresses imposed by operating loads without the stresses exceeding specified limits.
- 504) **Superstructure** — The rotating upper frame structure of a mobile crane and the operating machinery mounted thereon.
- 505) **Supporting materials** — Blocking, mats, cribbing, marsh buggies (in marshes/wetlands), or similar supporting materials or devices.
- 506) **Swaged Fittings** — Fittings in which wire rope is inserted and attached by a cold-forming method.
- 507) **Swing** — Rotation of the superstructure of a mobile crane or derrick boom for movement of loads in a horizontal direction about the axis of rotation.
- 508) **Swing Axis** — The vertical line about which a crane or derrick swings; also called **center of rotation** (obsolete) or **axis of rotation**.
- 509) **Swing Mechanism** — The machinery involved in providing rotation of the superstructure or derrick boom.
- 510) **Swingers** — (a) Attached — Reversible drum unit arranged to rotate or swing a derrick mast and boom, or some other structure which supports a load lifting or lowering boom, which is attached to and receives its power from a hoist; (b) Independent — Unit directly geared to its own power for rotating or swinging a derrick mast and boom; (c) Rope — Unit provided with one or two reversible drums for winding the rope used for rotating or swinging a bull wheel of a boom supporting structure.
- 511) **Switch** — A device for making, breaking, or changing the connections in a control circuit. It is also a device for changing directions of a trolley from one monorail system (track) to another.
- 512) **Switch, emergency stop** — A manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.
- 513) **Switch, limit** — A switch that is operated by some part or motion of a power-driven machine or equipment to open or close the electrical circuit associated with the machine or equipment.
- 514) **Switch, main** — A switch controlling the entire power supply to the crane, often called the **disconnect switch**.

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- 515) Synchronous Speed** — The synchronous speed of an alternating current (ac) motor is directly proportional to the supply frequency and inversely proportional to the number of poles. For example, the synchronous speed of a four pole motor operating at 60 Hz is determined by the following equation:
- Synchronous Speed = 120 X Frequency ÷ # of Poles** therefore:  
**120 x 60 ÷ 4 = 1800 r/min.**
- 516) Tackle** — Those pieces of rigging such as slings, spreader bars, chokers shackles, thimbles, eyebolts, rings, or other handling fixtures used for attachment of the load to the crane or hoist.
- 517) Tag Line** — A rope (usually fiber) attached to a lifted load for purposes of controlling load.
- 518) Tailing Crane** — The crane controlling the base end of the object in a multi-machine operation in which a long object is erected from a horizontal starting position to a vertical final position.
- 519) Taking Up** — The process of removing slack from a line or drawing (spooling) in on a line; loading a line by drawing in on it.
- 520) Tapered Tip** — The uppermost section of a sectional latticed boom, which usually includes the weldment mounting the upper load sheaves as an integral part; also called **boom point**, **head section**, or **boom tip section**.
- 521) Technical Approver** — An individual assigned to review critical lift plans who has technical knowledge and experience applicable to the requirements of this PDD, mandatory standards, and equipment identified in the critical lift plan.
- 522) Test Load** — A load that is periodically applied to hoisting equipment to ensure that it has the ability to safely handle the rated capacity of the equipment. The test load is usually some percentage of the rated load capacity--100 percent to 150 percent of rated load.
- 523) Thimble** — Grooved-metal fitting designed to prevent crushing or overstressing wire rope at the terminal end which is used to protect the eye of a wire rope or sling.
- 524) Third-Party Inspection** — An inspection made by an independent party who is a crane and hoist specialist. See **qualified inspector**.
- 525) Tiller Rope** — A very flexible operating rope, commonly made by cable laying six 6 x 7 ropes around a fiber core.
- 526) Tilt Up or Tilt Down Operation** — Raising/lowering a load from the horizontal to vertical or vertical to horizontal.
- 527) Tinned Wire** — Wire coated with tin.

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- 528) **Tipping Fulcrum** — The horizontal line about which a crane or derrick will rotate should it overturn; the point(s) on which the entire weight of a crane or derrick will be imposed during tipping.
- 529) **Tipping Lift** — Refer to **boom hoist**.
- 530) **Tipping Load** — The load for a particular operating radius that brings the crane or derrick to the point of incipient tipping.
- 531) **Topping** — See **derrick**.
- 532) **Torque, locked-rotor** — The minimum torque which an induction motor will develop at rest, for all angular positions of the rotor, with rated voltage applied at rated frequency. Not applicable to wound-rotor (slipping motors).
- 533) **Torque, motor breakdown** — The maximum torque that an induction motor will develop with rated voltage applied at rated frequency without an abrupt drop in speed.
- 534) **Torque, motor full-load** — The torque developed by an electric motor (ac or direct current [dc]) to produce its rated horsepower at rated full-load speed.
- 535) **Torque, motor pull-up** — The minimum torque developed by an induction motor during the period of acceleration from rest to the speed at which breakdown torque occurs. For induction motors with 8 percent or greater slip, the pull-up torque, the breakdown torque, and the starting torque are all equal and occur at zero speed.
- 536) **Traction Steel** — A grade of wire rope used in elevator service. See **grades, rope**.
- 537) **Tram** — The practice of placing punch marks on a hook for gauging use.
- 538) **Transit** — Moving or transporting a mobile crane from one job site to another.
- 539) **Travel** — (a) Movement of a mobile or wheel-mounted crane about a job site under its own power; (b) Linear extending or retracting movement of a jack.
- 540) **Travel Base** — The base mounting for a wheel-mounted (traveling) tower crane.
- 541) **Tread Diameter** — The diameter of a sheave or grooved rope drum measured at the base of the groove. The diameter of a smooth barrel on a rope drum.
- 542) **Trolley** — A unit that travels on the bridge rails consisting of frame, end trucks, drive supporting the hoisting mechanism, rope, and load block that supports the load, or a unit that travels on the lower flange of a beam or monorail system supporting a hoist.
- 543) **Trolley Girts** — Structural members that are supported on the trolley trucks and contain the upper sheave assemblies.

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- 544) **Trolley Travel** — The trolley movement.
- 545) **Trolley Truck** — An assembly consisting of wheels, bearings, axles, and structural framework that supports the hoist mechanism.
- 546) **Turnbuckle** — Device attached to wire rope chain or rods for making limited adjustments in length, which consists of a barrel and right-hand and left-hand threaded bolts.
- 547) **Two-Block Damage Prevention Feature** — A system that will stall when two-blocking occurs without causing damage to the hoist rope or crane machinery components. See **anti-two-block device**.
- 548) **Two-Block Warning Feature** — A warning device to alert the operator of an impending two-blocking condition. See **anti-two-block device**.
- 549) **Two-Blocking** — The condition in which the lower load block or ball assembly comes in contact with the upper load block or boom-point sheave assembly.
- 550) **Ultimate Strength** — The maximum conventional stress, tensile, compressive, or shear that a material can stand without failure.
- 551) **Unavailable Procedure** — Procedures that are no longer available from the manufacturer, or have never been available, from the manufacturer.
- 552) **Upperworks** — The revolving frame of equipment on which the operating machinery (and many cases the engine) are mounted along with the operator's cab. The counterweight is typically supported on the rear of the upper structure and the boom or other front end attachment is mounted on the front.
- 553) **Vangs (vangs lines)** — Tackle attached to each side of a derrick boom near the outer end, and to the base or pontoon at a lateral distance, by means of which the boom is rotated (slewed) from one side to the other.
- 554) **Verification**--A procedure, instruction, report, or document that is checked for validity and signed by one or more parties. The person designated to sign verifies that a specific action has been performed in accordance with specified requirements, usually based on personal observation, certified records, or a direct report.
- 555) **Wall Crane** — See **cranes, Types of, - jib crane**.
- 556) **Warrington** — A wire rope strand construction in which one layer of wires, usually the outer, is composed of alternating large and small wires.
- 557) **Weather Crane** — To swing with the wind when out of service to expose a minimum area to the wind.
- 558) **Web Plate** — The vertical plate(s) connecting the upper and lower flanges or cover plates of a girder.



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- 559) **Wedge Socket** — Wire rope fitting in which the rope end is secured by a wedge.
- 560) **Wheel Load** — Load placed on a bridge or trolley wheel.
- 561) **Wheel Load, bridge** — The vertical force (without impact) produced on any bridge wheel by the sum of the rated load, trolley weight, and bridge weight, with the trolley so positioned on the bridge as to give maximum loading.
- 562) **Wheel Load, trolley** — The vertical force (without impact) produced on any trolley wheel by the sum of the rated load and the trolley weight.
- 563) **Wheelbase** — The distance from center to center of the outermost wheels of the bridge or trolley, measured parallel to the rail.
- 564) **Whip line (runner or auxiliary line)** — A separate hoist rope system usually of a lighter load capacity than provided by the main hoist.
- 565) **Winch Head (gypsy head)** — A rotatable cylindrical drum with curved end flanges, used for load handling by means of fiber rope coiled about its barrel with hand tension applied to the non-load end. Also called a capstan.
- 566) **Windlass** — A base-mounted machine, usually power-operated, used for hauling in or paying out rope or chain.
- 567) **Wire Rope** — A flexible rope constructed by laying steel wires into various patterns of multi-wired strands around a core system to produce a helically wound rope.
- 568) **Wire (round)** — A single, continuous length of metal, cold drawn from a rod.
- 569) **Wire (shaped)** — A single, continuous length of metal either cold drawn or cold rolled from a rod.
- 570) **Wrap** — One circumferential turn of wire rope around a rope drum barrel.

## 6.2 Acronyms

- 1) **AC** — Alternating current
- 2) **ACI** — American Concrete Institute
- 3) **A/D** — Assembly/Disassembly
- 4) **AISC** — American Institute of Steel Construction
- 5) **ASM** — American Society of Metals
- 6) **ASME** — American Society of Mechanical Engineers
- 7) **BTH** — Below the hook

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- 8) **DC** — Direct current
- 9) **DLL** — Designated Lift Leader
- 10) **H&R** — Hoisting and rigging
- 11) **NLGI** — National Lubricating Grease Institute
- 12) **PDD** — Program Description Document
- 13) **PIC** — Person in charge

## 7.0 REFERENCES

### NOTE

The following specialized terms and acronyms are used regarding H&R operations and equipment. Not all of these terms are used in this PDD but have been included for general information.

1. 29 CFR 1910, *Safety and Health Regulations for General Industry*
  - 1910.179, *Overhead and Gantry Cranes*
  - 1910.180, *Crawler Locomotive and Truck Cranes*
  - 1910.181, *Derricks*
  - 1910.184, *Slings*
2. 29 CFR 1926, *Safety and Health Regulations for Construction*
  - 1926.106, Working Over or Near Water
  - 1926.251, Rigging Equipment for Material Handling
  - 1926.1432, Multiple Crane/Derrick Lifts - Supplemental Requirements
  - 1926 Subpart R, Steel Erection
  - 1926 Subpart CC, *Cranes and Derricks in Construction*
3. ANSI, American National Standards Institute, New York, New York:
  - N14.6, American National Standard for Radioactive Materials, *Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More*
4. ASME, American Society of Mechanical Engineers, New York, New York:
  - B30.1, *Jacks, Industrial Rollers, Air Casters, and Hydraulic Gantries*

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- B30.2, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)*
- B30.3, Tower Cranes
- B30.4, Portal, and Pedestal Cranes
- B30.5, Mobile and Locomotive Cranes
- B30.6, Derricks
- B30.7, Winches
- B30.8, Floating Cranes and Floating Derricks
- B30.9, Slings
- B30.10, Hooks
- B30.11, Monorails and Underhung Cranes
- B30.12, Handling Loads Suspended from Rotorcraft
- B30.13, Storage/Retrieval (S/R) Machines and Associated Equipment
- B30.14, Side Boom Tractors
- B30.18, *Stacker Cranes (Top or Under Running Bridge, Multiple Girder with Top or Under Running Trolley Hoist)*
- B30.19, Cableways
- B30.22, Articulating Boom Cranes
- B30.24, Container Cranes
- B30.25, Scrap and Material Handlers
- B30.27, *Material Placement Systems Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings*
- B30.16, *Overhead Hoists (Underhung)*
- B30.17, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Underhung Hoist)*
- B30.20, Below-the-Hook Lifting Devices
- B30.21, Manually Lever Operated Hoists

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- B30.22, Articulating Boom Cranes
  - B30.23, Personnel Lifting Systems
  - ASME BTH-1, Design of Below-the-Hook Lifting Devices
  - NOG-1, *Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)*
  - NUM-1, *Rules for Construction of Cranes, Monorails, and Hoist (with bridge or trolley or hoist of the underhung type)*
  - PALD - 2005, *Portable Automotive Lifting Devices, part 9, Shop Cranes*
5. DOE/RL-92-36, Hanford Site Hoisting and Rigging Manual
  6. DOE STD 1090, *Hoisting and Rigging* (2011)
  7. FBP-BS-PL-00004, *Training Program Plan*
  8. POEF-FBP-002, *Technical Safety Requirements for Former Uranium Enrichment Facilities (FUEF) At the Portsmouth Gaseous Diffusion Plant, Piketon, OH*

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**Appendix A**  
**REGULATORY REQUIREMENTS FLOW DOWN**

29 CFR 1910, *Safety and Health Regulations for General Industry*

29 CFR 1926, *Safety and Health Regulations for Construction*

DOE/RL-92-36, *Hanford Site Hoisting and Rigging Manual*

DOE STD 1090, *Hoisting and Rigging* (2011)

TITLE:

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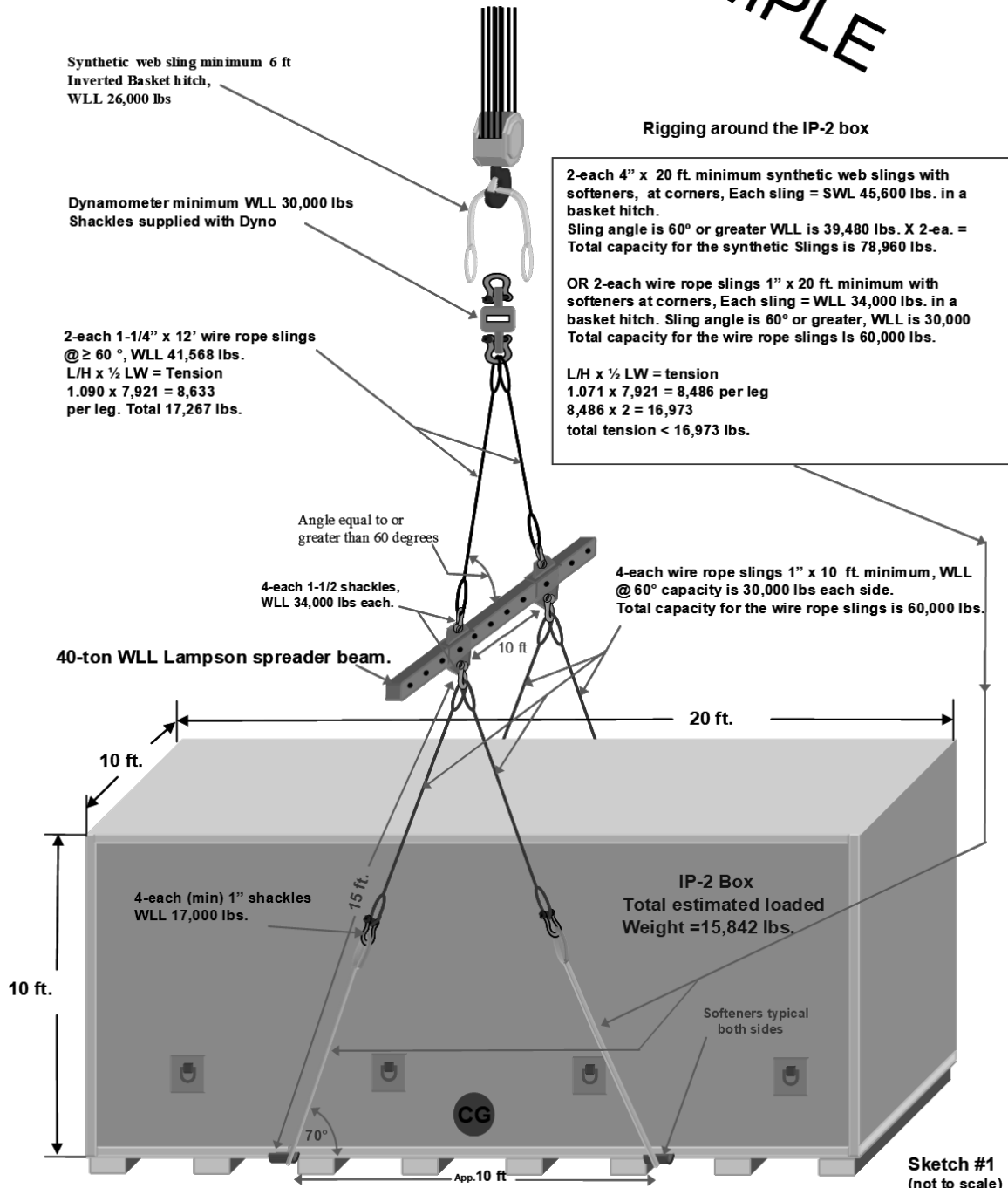
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### Appendix B RIGGING SKETCH

Exact orientation and equipment location of the crane, load and IP-2 box container shall be determined by the DL and the FWS. Always refer to the Mobile crane load capacity chart for allowable crane and rigging hardware load deductions and the cranes lifting capacity parameters. Do not exceed the crane capacity load chart.

EXAMPLE



TITLE:

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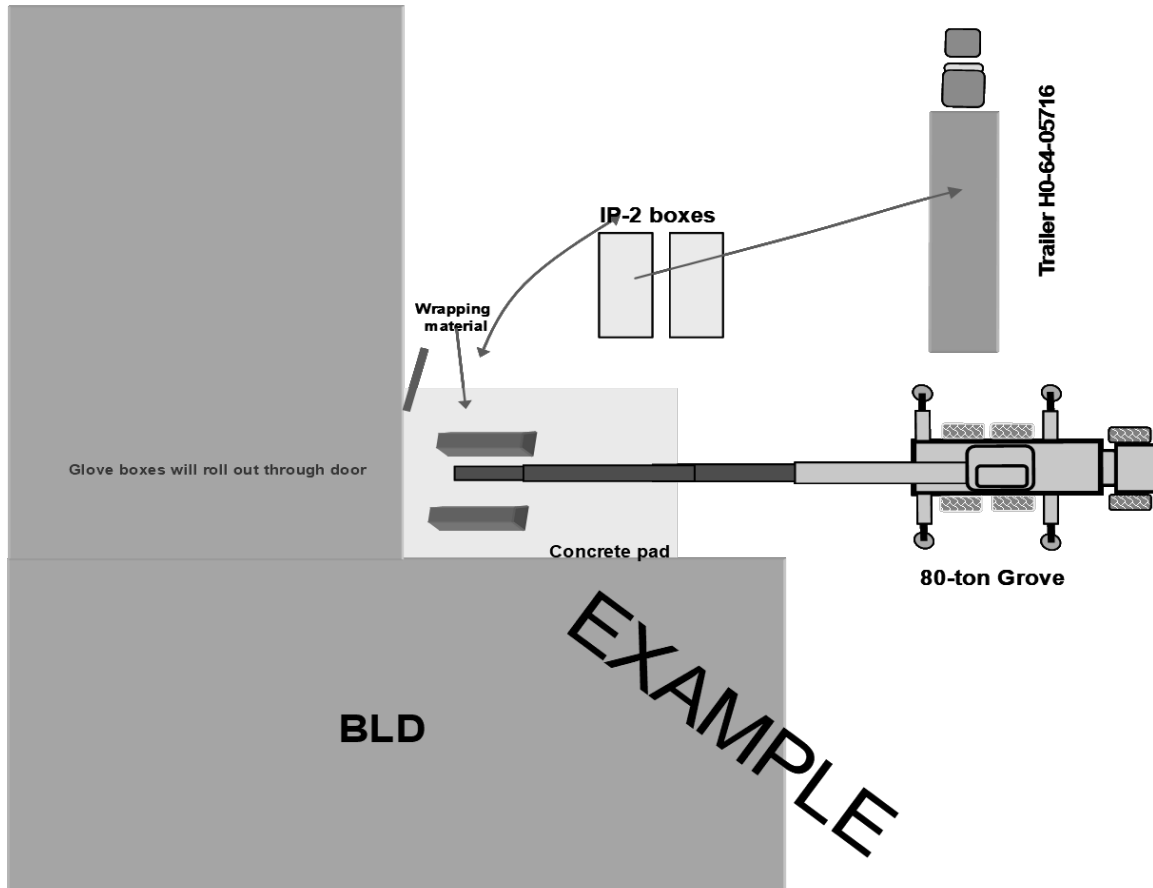
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### Appendix C LOAD PATH/CRANE CAPACITY PARAMETERS

Exact orientation and equipment location shall be determined by the DL and FWS. The crane can be repositioned for the lifting the glove boxes or the loaded IP-2 boxes. The glove boxes will be rolled outside and lifted (1<sup>st</sup> lift) and set onto wrapping material. Once wrapped and secured, lifted (2<sup>nd</sup> lift) again and placed into the designated IP-2 box. Once the IP-2 box cribbing and lid is secured each IP-2 box (3<sup>rd</sup> lift) will be loaded, one per shipment on to trailer HO-64-05716 and secured for shipment.



**IP-2 Lifts**  
 80-Ton Grove mobile crane, 360°,  
 @ 45 ft. radius, 96 ft. maximum  
 Boom (61°) boom angle,  
 Crane capacity is 25,450 lbs.

Loaded IP-2 box-----	15,842 lbs.
Hook Block-----	1,965 lbs.
Ball-----	750 lbs.
Jib stowed-----	926 lbs.
Aux. boom head-----	230 lbs.
Spreader bar-----	775 lbs.
Dynamometer-----	300 lbs.
Shackles -----	90 lbs.
<u>Rigging slings-----</u>	<u>200 lbs.</u>
Total weight-----	21,078 lbs.

**Glove Box Lifts**  
 80-Ton Grove mobile crane, 360°,  
 @ 70 ft. radius, 87 ft. (32°) (min) boom,  
 114 ft. (51°) ( Max) boom,  
 Crane capacity is 10,150 lbs.

Each glove box-----	4,500 lbs.
Hook Block-----	1,965 lbs.
Ball-----	750 lbs.
Jib stowed-----	926 lbs.
Aux. boom head-----	230 lbs.
Spreader bar-----	775 lbs.
Shackles -----	90 lbs.
Dynamometer-----	300 lbs.
<u>Rigging slings-----</u>	<u>200 lbs.</u>
Total weight-----	9,736 lbs.

**Sketch #3**  
(not to scale)

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**Appendix D**  
**CRITICAL LIFT PLAN DEVELOPMENT GUIDE**  
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**Mobile, Bridge, Gantry Cranes and Forklift Critical Lift Planning Recommendations**

Critical Lift Plans (CLP) require more extensive planning and oversight by qualified persons and are thus, a more formal approach to planning. A CLP shall be prepared and approved by qualified persons to minimize the potential of a crane failure (stability or structural). Depending on the complexity of the crane lift, the formal CLP may involve several pages (including drawings of the crane and/or the load, load charts, crane set-up, etc.) to document the necessary information pertaining to the cranes configuration, accurate load and rigging information, and the crane's rated capacity.

This attachment should be used as a guide to assist the lift plan author in evaluating specific factors of a lift. Mandatory requirements shall always be followed as defined in this PDD, (OSHA), and the (ASME) B30 standards. The CLP should be formatted to include all the underlined header topic items for standardized procedural/plan formatting and uniformity. The information included under each header topic item shall be evaluated and consider as significant or non-significant. All necessary subject matter information shall be included in the CLP and a clear and prescribed representation given as to the direct significance it represents to the lift development. Other essential subject matter items may be required depending on the circumstances of each lift.

**1.0 PURPOSE/SCOPE(topic header item)**

The purpose of this procedure is to provide H&R instructions for:

Give a description of the load to be lifted and any other relevant information required to make the lift, including adjacent equipment, trucks/trailers, buildings or structures that might have an effect on the lift or placement of the load.

**2.0 REFERENCES (topic header item)**

All references should be retrievable. If the information is not retrievable then the information should be attached to the CLP.

- PORTS Site Hoisting and Rigging Manual
- Design calculations of the lifted item
- Drawings of added value to assist with making the lift
- Vendor instructions and facility/operations procedures
- Soil test reports
- Applicable facility or organizational specific requirements
- Other related documents that may provide information



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**3.0 PERSONNEL REQUIREMENT(topic header item)**

Section 4.0 identifies the Personnel Qualifications and Training Requirements. FBP will have a program in place to ensure that the required training is provided and the training records are available. These personnel should include:

- Riggers, Truck driver(s) as needed
- Crane Operator(s)/Forklift Operator as needed
- Signal person(s) or flagman(s)
- PIC - A qualified rigger or recognized rigging authority with H&R experience selected by the employer to advise and supervise H&R activities
- Designated Contact Supervisor - The interface person between the PIC and the facility or organization

**4.0 MATERIALS TOOLS AND EQUIPMENT (topic header item)**

All the required rigging hardware, lifting devices, the lifted item, tools, and equipment need to be identified (listed) here and may be called on the rigging sketch(s). The CLP should require verification of code compliance for certain items such as lifting devices (to be labeled in accordance with ASME B30.20) and rigging hardware (to be in accordance with ASME B30.26).

**Equipment:**

- Crane/forklift identified by type and size
- Truck/trailer, as required
- Type, size, and rated capacity identified for all equipment and hardware
- DOT/Safety Analysis Report for Packaging (SARP) tie-down requirements, if any

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**Multiple crane lifts**

Lifting one load simultaneously with several cranes is considered beyond the scope of normal crane operations. This activity greatly increases the danger of both overloading and side loading a crane. It has been viewed as acceptable to undertake such lifts if a crane's working rating is reduced by approximately 25%. Such a reduction can give a false sense of security and does not ensure the success of a tandem lift if proper procedures are not followed. No simple checklist can provide a user with sufficient background to safely attempt a tandem lift. A formal lift plan (critical or special) shall be written for all two crane lifts. The plan shall identify the weight and center of gravity. The following factors are critical in evaluating tandem lifting. This list is intended to supplement the factors listed for a heavy lifting with a single crane. These factors are only an aid for qualified personnel in carrying out such lifts.

**Things that should be considered are:**

- Will the load be shared in proportion to each crane's rated capacity?
- How will the load distribution between cranes be controlled?
- Will electronic load indicating or load limiting systems be available to monitor the load on the cranes?
- If plans require cranes to carry equal loads can the rigging be set up to insure load equalization between the cranes?
- Will the swing brakes and locks be released on all cranes to help prevent side loading when lifting?
- Will all crane booms face a parallel direction when lifting to prevent side loading if booming (luffing) is required?
- Has one person been assigned to monitor the plum condition of each cranes hoist line during the lift?
- Will all operators have visual contact with the Flagman during the entire lift?

Is some crane de-rating necessary to compensate for the inability to eliminate all coordination problems with equipment or control procedures?

- Has the selection of crane movements of each crane during the lifting operation been determined?
- No motion should be combined with travel. The cranes can hoist together as needed, and any time that one crane swings, travels, or luffs it will be necessary for the other crane to move synchronously in order to keep the load lines plumb.

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- Ideal situation using two cranes would be a lift of uniform weight, using identical cranes which are symmetrically attached. Each crane would be equally loaded, load lines kept plumb, and they will remain equally loaded while in the air. The cranes will remain within their rated radius.

**Lifting device**

BTH lifting devices are in good condition, have traceable documentation with current inspection and load test date, and marked by manufacturer with name or trademark, rated capacity, weight if over 100 pounds, drawing number and serial number when applicable.

- Insure lifting devices are properly labeled
- Insure lifting device history file with load tests are on file
- Lifted Items
- Identified weight
- Identify center of gravity
- Identify lift points

**Hardware and Rigging for the lift:**

- Shackles
- Wire rope
- Bridle slings: 2, 3 or 4-leg, rated spreader bar or special lifting fixtures identified, inspected and certified.
- Ensure all rigging hardware complies with temperature limitations as per Section 11, *Rigging Hardware*, and ASME B30.26, *Rigging Hardware*.
- Threaded eyebolts have proper thread engagement and torque per manufacturer requirements.
- Consult manufacturer if rigging hardware will be used in a chemically harsh environment.
- Load tests have been performed on all required rigging hardware and hardware is properly tagged.
- Softeners specified as necessary.

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- Dynamometers and torque wrenches are within current calibration, have traceable documentation or tagging with load test date, and marked by manufacturer with name or trademark, and rated capacity.
- Other tools and equipment as necessary:
- Tag lines as required
- Radios as required

**5.0 PRECAUTIONS AND LIMITATIONS (topic header item)**

Generally all of the following precautions should be included in the CLP. Always emphasize and include in the CLP the statement that “If this procedure cannot be performed as written, stop work. Return equipment to safe configuration and inform the field work supervisor (FWS) that the procedure cannot be performed as written, and a revision or field change notice is required.”

- Rope off or barricade area to define the critical lift area as directed by the PIC to prevent the entry of unauthorized personnel.
- No personnel at any time shall be permitted to position themselves under the load.
- Ensure all rigging hardware and equipment is verified for operation and use at the low temperatures as identified in this PDD and ASME B30.26.
- Special requirements, and/or manufacturer's requirements or other required information pertaining to the lift has been considered.
- Evacuation routes, contingency plans, emergency procedures have been determined.
- Points of no return in the lift process should be defined. These points should clearly identify the actions to take to place beyond these points to place the load in a safe configuration (i.e., lifting over the edge of a hole or building roof). Before this point the safe condition maybe setting the load on the roof on dunnage after that point it will require it going to the ground or even leaving it suspended.

**6.0 PREREQUISITES (topic header item)**

Prior to making a critical lift, a functional/operational test shall be performed on all functions of the crane through the full range of movements that will be used to perform the lift. The test shall be performed with the crane set up in the exact configuration as will be used to perform the lift or series of lifts with no load on the hook.

The required inspection and annual certification documentation, crane load charts shall be confirmed to be current and posted at/in the lifting device cab/control station.

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For mobile cranes physically take the measurement from the cranes center of rotation to the loads center of gravity. This measurement can be checked against the cranes LMI system.

Identify power lines and obstructions in swing radius, load, and travel path of the crane. Verify Electrical Utilities is notified the day of the lift.

Assign a qualified signal person to verify required electrical clearance is maintained.

The work package or work instructions are complete and understood by all involved personnel involved with the lift.

Weather conditions have been considered, e.g., wind, ice, snow, electrical storms.

Maximum wind speed been identified.

Has the minimum clearance between the load and the boom during the lift been checked?

Have all the rigging and apparatuses been considered in the weight calculations?

Have all saddles, chains, binders, bolts, welds, and other securing devices been freed from the load before lifting is attempted?

Have softeners been utilized to protect corners?

Is there anything inside the load that could shift during the lift?

Will the lifting beams and other rigging hardware remain safely clear of the boom, the load, and other objects during the lift?

Correct crane(s) forklift truck(s) is/are identified and have been inspected. Load, foundation, and crane set-up verified. Is the crane level with 1 degree of level? Has the crane been checked with a 4-foot level or other acceptable method? The target level in the cab can be used, but should not be considered reliable for critical lifts.

Outrigger pads for mobiles are selected based on crane outrigger float size (approx. three times the area of crane float) with a minimum of 2-ft square for up to 22 ton; 3-ft square for up to 90 ton; 4-ft square for 110 ton. Crane mats shall be considered for crawler crane set-up.

Lifting points or attachment points have been inspected. Verification should be made of the lift points on engineered equipment with manufacturer-installed rigging hardware (eyebolts, swivel hoist rings, etc.).

The operator's manual has been verified for boom extensions, block, ball, number of parts of line, and rigging accessories weight.

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When more than one crane will support the load, the intended share of load throughout the lift for each crane has been accounted for in the above check.

Sling loading has been calculated (reference sketches).

Underground obstacles such as voids and pipes that would affect safe operation of the crane and assisting equipment have been identified and evaluated as not to be a hazard.

Loads outside the fork truck's load center, the forklift manufacturer's instructions must be consulted. If the manufacturer's instructions are not available, engineering calculations may be used to specify the reduced lifting capacity.

Have the shackle pins been checked to assure they fit the holes provided? Are the dimensions of the lifting lugs-pad eyes consistent with the shackles proposed? Will there be clearance when the shackle turns from horizontal to vertical?

Has the appropriate design safety factor been used for designing the lifting lugs?

Does the crane(s) have to travel with the load? Is the travel path compacted properly?

Has the travel and swing path been looked at for obstructions?

Has the transport route been checked for overhead obstructions?

**Landing the lifted load**

Is there adequate space for delivery/removal of the load transport vehicle without endangering operating personnel?

Will the lifted load remain clear of all obstructions throughout the lifting path?

Can rigging personnel control and manipulate the lifted load throughout the entire lifting path without exposing themselves to undue danger?

Have all loose objects been secured or removed to prevent falling from the load during the lift?

Has the load been prepared for placing in its final location by clearing bolt holes, removing temporary brackets, etc.?

**7.0 CRITICAL LIFT INSTRUCTIONS (topic header item)**

- Provide a detailed description of the exact lifting operation including all aspects of the lift succession from start to completion.
- Provide criteria for stopping the lift attempt if the estimated weight of the item being lifted is exceeded.
- Verify item can be installed in the field as planned, i.e., physically look at the field condition, photographs, and drawings. Verify that dowels/pins/bolts in the field mate/match up with the equipment to be installed.

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- Reference information may need to be obtained from the planner, system engineer, rigging engineer, FWS, or the rigging supervisor to ensure the work sequence is detailed as required to support the riggers/crane operator completing the lifting operations and provide information in the pre-job meeting.
- Attach additional pages as necessary of written direction, sketches, and drawings as necessary to ensure this lift instruction can be followed in the field.
- Verification of hold points and check points should be established for sign off to provide the documented record of the lift. This includes the assigning of the PIC by the manager of the critical lift.

**8.0 PRE-LIFT MEETING (topic header item)**

A pre-lift or pre-job meeting shall be held and a roster with names of attendees and dates shall be attached as part of this lift plan document.

**9.0 Sketches (topic header item)**

Need to show the equipment and rigging hardware in the configuration it will be used to make the lift(s). Sketches do not have to be drawn to scale, but should show the following as a minimum:

- Dimensions of item to be lifted.
- Dimensions of the lifting pick points.
- The center of gravity is identified; how was it determined and is it marked on the load?
- Lift points shall be identified.
- Method(s) of attachment and hitch configuration for slings are identified.
- Capacity and tension on slings, rigging hardware, and lifting devices at the configuration shown have been calculated.
- Sling angles are identified.
- Accessories used (softeners, dunnage, etc.)

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Other factors affecting the equipment capacity such as, but not limited to, D/d ratio or temperature ratings on rigging hardware are identified when applicable.

Rated capacity of the cranes or forklifts in the configuration(s) in which it will be used. For mobile cranes, many factors affect rated capacity, including boom length, boom angle, and work area (radius). Forklift attachment(s) that effect capacity shall be identified.

Load path and height when applicable. For lifts with mobile cranes, include the crane position(s) relative to the load and relative to surrounding obstructions. Where appropriate, include floor or soil-loading diagrams.

A note(s) indicating lifting, travel speed, and height limitations when applicable. This may be noted on the load-path sketch or in the lift plan document.

Attachment points (quantity, spacing distance, size, and type). Engineered lifting attachment points must identify configuration. Identify the pin diameter for applicable lifting bails and whole size for lifting lugs. Non-engineered lifting attachment points shall be identified and show a completed analysis to ensure structural integrity during the lifting operation:

- Known boom tip height, boom angle, boom length, lift radius.
- Crane or forklift configuration.



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**ATTACHMENT A  
LIFT CLASSIFICATION WORKSHEET  
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**LIFT CLASSIFICATION WORKSHEET**

**Work Package:** \_\_\_\_\_

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**Ordinary Lift** – Any lift not designated as a personnel lift, special lift, and critical lift or as a pre-engineered production lift.

**Personnel Lift** – This involves the lifting of personnel with a crane or forklift on a personnel lift platform. Personnel lifts are prohibited on site unless the Industrial Safety Department determines that it is less safe or not possible to access the work area using conventional methods.

**Critical Lift Determination**

1. A designated person shall classify each lift into one of the FBP lift categories (ordinary, personnel, special, critical, or pre-engineered production) prior to planning the lift.
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. If the load being lifted is 80% or more of a mobile crane’s load chart rating in the set-up configuration.
  - F. If two or more mobile cranes are used to make a lift, other than a tail crane.
  - G. 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).

**Pre-Engineered Production Lift Determination**

1. A designated person shall classify each lift into one of the FBP lift categories (ordinary, personnel, special, critical, or pre-engineered production) prior to planning the lift
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.



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**ATTACHMENT B  
FBP HOISTING AND RIGGING CHECKLIST (ORDINARY LIFTS ONLY)**



**FBP HOISTING AND RIGGING CHECKLIST (ORDINARY LIFTS ONLY)**

<b>Lift Planning Section</b>			
Work Package /WO#		Date of Annual inspection	
Description of load		Crane/forklift Model	
Weight of load		Boom Length	
Deductions		Jib Length	
Total erection load		Maximum Radius of Lift	
Total Capacity at Maximum Radius of Lift		Percent of Capacity at Maximum Lift Radius	
Shackles		lifting fixture/capacity	
Chain hoist capacity		LAF/if multi leg bridle	
Slings/WLL@75% hitch used		LAF*wt. on each leg	
<i>Questions 1 - 14 must be answered Yes, No, or N/A, prior to completing Questions 15-26.</i>			
1. Has the weight of the load been documented or accurately calculated? YES NO N/A	2. Have the lifting lugs that will be used to lift the load been designed for that purpose? YES NO N/A		
3. Will the lifting lugs be loaded only in the strong direction(s) of the lug? YES NO N/A	4. Are all items that will be lifted with the equipment included in the weight? YES NO N/A		
5. Have the capacities of the slings/rigging hardware been checked for the load? YES NO N/A	6. Have the sling angles been considered when checking the capacity of the slings and shackles? YES NO N/A		
7. Is the load less than 80% capacity of the mobile crane load chart for the setup configuration? YES NO N/A	8. Will the lifting lugs be used with the correct shackle? YES NO N/A		
9. For a one-crane lift will the crane hook be over the center of gravity at the initial pick? YES NO N/A	10. Has the soil been inspected and determined to be adequate? YES NO N/A		
11. If there is a possibility for boom or equipment interference, has a rigging layout or clearance study been made? YES NO N/A	12. Has the center of gravity been considered when checking the capacities of the sling and shackles? YES NO N/A		
13. Lift classification completed and attached? YES NO N/A	14. Does the equipment set up configuration follow the manufacturer's req's? YES NO N/A		
<b>Hoisting and Rigging Mgr. or designee approval:</b>		<b>Signature</b>	<b>Date</b>
<b>Competent Reviewer:</b>		<b>Signature</b>	<b>Date</b>
<b>Pre-Lift Checks</b>			
<i>Questions 15-27 must be completed at the lift side on the day of, prior to making the lift(s) by circling either Yes, No, or N/A</i>			
15. Has the load been checked for loose or unsecured items that might fall off during the lift? YES NO N/A	16. Are the lifting lugs visibly free of defects or damage? YES NO N/A		
17. Have the slings and shackles been visibly inspected for defects and damage? YES NO N/A	18. Has the crane received a daily inspection and operational check by the operator? YES NO N/A		
19. Is the crane supported by approved crane mats? YES NO N/A	20. Has the radius of the lift been checked by a tape measure? YES NO N/A		
21. Is the lift area free of operating process equipment, piping, or live electrical lines? YES NO N/A	22. Has the area under the lift been barricaded or everyone warned to stay away? YES NO N/A		
23. Is the wind less than 20 MPH? YES NO N/A	24. Has the Pre Lift Meeting been conducted? YES NO N/A		
25. If slings come into contact with edges corners protrusions or abrasive surfaces, has the correct sling protection been determined? YES NO N/A	26. Has the correct sling protection been put in place? YES NO N/A		
27. Rigging sketch for multi-leg hitch? YES NO N/A			
<i>The Hoisting and Rigging Manager or designee must approve any question answered NO by initialing and date on that line. Supervisor's signature below verifies the sheet is properly filled out, the correct equipment is being used, and the employees' training/qualifications are current.</i>			
Operator Signature:	BADGE#	DATE	
DLL Signature:	BADGE#	DATE	
Signalperson Signature:	BADGE#	DATE	
Supervisor Signature:	BADGE#	DATE	

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**ATTACHMENT C**  
**FBP MOBILE CRANE PRE-OPERATIONAL CHECK LIST**  
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**FBP Mobile Crane Pre-Operational Check List**  
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Equipment:	Capacity:		
Equipment number:	Owner/Lessor		
Date:	Shift:	Day	Night
Operator:			

No	Item	Pass	Fail	Comments
	<b>Pre-Operation Inspection</b>			
1	Perform 360 degree walk around. Check that all operational, instructional and warning decals are legible and that the load chart is posted in an area easily accessible to the operator.			
2	Check engine oil			
3	Check coolant reservoir for proper level			
4	Check hydraulic system for leaks			
5	Check hydraulic oil reservoir for adequate level			
6	Check fuel level for adequate level			
7	Check boom and hoist lines for wear			
8	Grease sheaves as needed			
9	Check tires for proper pressure			
10	Drain water from air tanks			
11	Check LMI set-up and functionality			
12	Check doors and controls for suitable condition and operability. Check cab for cleanliness. Ensure all glass is clean and intact.			
13	Check Hydraulic hoses for wear/damage			
	<b>Power Plant</b>			
1	Start engine and warm up			
2	Check all instruments to ensure that they are working			

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**FBP MOBILE CRANE PRE-OPERATIONAL CHECK LIST**  
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**FBP Mobile Crane Pre-Operational Check List**  
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		Pass	Fail	Comments
	<b>Hoisting Mechanism</b>			
1	Check for overhead obstructions			
2	Check ground conditions for suitability			
3	Check ball and/or block, hooks, and safety latches for defects			
4	Set outriggers (Use mats as required)			
5	Verify anti two-block device is operational			
6	Check boom operations: up, down, left, right			
7	Fully extend telescoping boom and retract (check wire rope spooling)s			
8	Verify rope reeving per crane specifications			
	<b>Travel Mechanisms</b>			
1	Test brakes			
2	Back up alarms			
3	Turn signals, lights, horn			
	<b>Equipment</b>			
1	Fire extinguisher			
2	Seat belt (mandatory use when operating)			
3	Check stowed jib attachment hardware			
	<b>Records</b>			
1	Load chart posted in machine			
2	Annual inspection report in machine			
3	Crane Manual in machine			
4	Keep this report in the machine and turn in to supervisor at the end of every shift.			

Inspector signature \_\_\_\_\_ Date \_\_\_\_\_

Supervisor signature \_\_\_\_\_ Date \_\_\_\_\_

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**ATTACHMENT D**  
**FBP FINAL MONTHLY CRANE INSPECTION CHECK LIST**  
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**FBP Final Monthly Crane Inspection Checklist**

OSHA and ASME allow only competent persons to perform shift and monthly inspections. The competent inspector must be capable of identifying existing and predictable hazards and take prompt corrective measures to eliminate them. Fall protection, where applicable, must be used at elevations above four (4) feet per OSHA 1926 and/or 1910.

MFG.
Serial#
Model#
Inspector (operator)

**Status:** ✓ = satisfactory    X = Safety Hazard    M= Monitor the condition    N/A = Not Applicable

Inspection Item	Status	Inspection Item	Status
<b>Pre-Operational</b>		<b>Safety Devices/Operational Aids</b>	
1. Ground conditions		1. Anti - Two Block Device(s)	
2. Level Crane Position		2. LMI	
3. Hydraulic Crane Level		3. Boom Length Indicator	
4. Tire Inflation/Condition		4. Boom Angle Indicator	
5. Air and Hydraulic Lines		5. Radius Indicator	
6. Fluid levels		6. Horn	
<b>CABS</b>		7. Warning Lights/Alarms	
1. Parking Brake		8. Back Up Alarm	
2. Swing Brake/Lock		9. Labels/Decals legible	
3. Cab Windows		10. Crane level indicator	
4. Load Chart/ Manuals		<b>Structural Members</b>	
5. Housekeeping		1. Main Boom	
<b>Fire Extinguisher</b>		2. Boom Extension/Jib	
1. Located in cab or on the machinery housing		3. Carrier	
2. Extinguisher is accessible		4. Outriggers and beams	
3. Gauge in green/ok position		5. Outrigger pads	
4. Fullness determined by weight		6. Frame	
5. Complete monthly insp. Tag		7. Upper housing	

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FBP FINAL MONTHLY CRANE INSPECTION CHECK LIST
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FBP Final Monthly Crane Inspection Checklist

Table with 2 columns: Inspection Item, Status. Section: Functions. Items: 1. Travel, 2. Steering, 3. Deploy Outriggers/Level Crane, 4. Boom Up/Down, 5. Boom In/Out, 6. Hoist Up/Down, 7. Swing.

Table with 2 columns: Inspection Item, Status. Section: Wire Rope. Items: 1. Main Hoist Rope, 2. Auxiliary Hoist Rope, 3. Standing Rope, 4. Sheaves and Retainers, 5. End Connections, 6. Wrapping on Drum(s), 7. Reeving, 8. Main Block Hook/Safety Latch, 9. Aux. Ball Hook/Safety Latch, 10. Boom extension/jib bracket(s).

Monthly Inspection Records must be maintained for a minimum of 3 months.
Taking apart components is not required unless the final inspection or trial operation indicated it is needed.
DO NOT operate crane until unsafe conditions are corrected.

Inspector/Operator

Comments: [Blank lines for handwritten notes]

Inspector/Operator Signature \_\_\_\_\_ Badge \_\_\_\_\_ Date \_\_\_\_\_