

TEMPORARY CHANGE REQUEST

TCR NO. **TCR-ES-MECH-007,R2-001**

(e.g., TCR-ENG-021,R0-001)

The Temporary Change Request (TCR) Form is to be used to process urgent or minor changes for PPPL Policies, Organization/Mission Statements and Procedures. The TCR should be used when changes are:

- 1) urgent, and can not wait the 2-4 week period for Department Head review/comment, or
- 2) minor, and do not warrant Department Head review.

Person Requesting Change: Mike Viola Phone Ext: 3655

Department Name: Engineering

Document Number: ES-MECH-007 Revision No.: 2

Document Title: Hoisting and Rigging Standard

Reason for change:

Update titles

Adjust criteria for critical lifts to match criteria for A1/A2 graded approach values

Change description: (Summarize and attach changed pages, with changes clearly indicated)

Matched values for critical lifts to meet minimum values of A1/A2 graded approach

Updated various title to match new titles.

1. Does this TCR significantly alter the intent or scope of the document? YES: NO: X

2. Does this TCR significantly impact **ES&H**? YES: NO: X

If 1 or 2 is **YES**, Explain why the changes should not be routed for Department Head review:

Department/Division Head Approval

Date

Chief Planning Officer/designee

Date

Release/Effective date of this TCR: 5/1/18

Incorporate this TCR into next revision of this document? YES: X NO:

PRINCETON PLASMA PHYSICS LABORATORY	ENGINEERING STANDARD	ES-MECH-007,Rev.2 Page 1 of 6
Subject: HOISTING AND RIGGING STANDARD	Effective Date: 9/21/2017	Initiated: Lift Manager
	Supersedes: Rev. 1 11/13/2012	Approved: Head, Engineering Department
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1.0 SCOPE/APPLICABILITY

This standard describes the requirements for mechanical hoisting operation where rigging is required on the PPPL site, lift equipment inspection testing and maintenance, training and qualification for operating/using any lift equipment and procurement of rigging equipment or services. Lifts are generally made to support installation or removal of equipment. Any installation or removal procedures are considered prerequisite to and separate from the lift procedure. The lift procedure shall only cover the specific steps necessary to rig and move the equipment. Standard material handling operations (i.e. forklift use) and aerial lift operations are not governed by this procedure. Only qualified crane operators may operate cranes at PPPL.

2.0 INTRODUCTION

In the preparation required for making a lift, the first step is to make the determination of whether the lift is an Ordinary Lift or a Critical Lift, there are very significant differences in the requirements for each. The guides and tools to make the determination are found in Chapter 2 of this Engineering Standard. Specific requirements for lifting equipment will be found in the individual chapters regarding the specific equipment.

3.0 REFERENCE DOCUMENTS

- a. OSHA Section 1910 Occupational Safety and Health Standard sections applicable to Hoisting and Rigging Equipment
- b. OSHA 1926 Safety and Health Regulations for Construction sections applicable to Hoisting and Rigging Equipment
- c. ANSI/ASME B30 (All applicable) Standards for Hoisting and Rigging Equipment
- d. DOE-STD-1090, DOE Hoisting & Rigging Manual
- e. ESHD 5008 PPPL Environment, Safety & Health Manual
- f. QA-005, Control of Non-conformances
- g. PPPL Procedure ENG-021, Hoisting and Rigging Program Responsibilities
- h. PPPL Procedure ESH-004, Job Hazard Analysis
- i. PPPL Procedure TR-001, "Laboratory Wide Training Program."
- j. PPPL Procedure TR-005 "Instructor Qualification and Requalification"
- k. ASME P30.1 Planning for Load Handling Activities
- l. 48 CFR 970.5223-1 Integration of environment, safety, and health into work planning and execution

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TERMINOLOGY & DEFINITIONS

The following are specialized terms commonly used when discussing hoisting and rigging operations. Many may not be used in this standard, but are included for general information. The terms are arranged in alphabetical order. Illustrations are included for clarity.

ABRASION: Surface wear.

ACCELERATION STRESS: Additional stress imposed due to increasing load velocity.

ALTERNATE LAY: Lay of wire rope in which the strands are alternately regular and lang lay.

ANSI: American National Standards Institute.

APPOINTED: Assigned specific responsibilities by the employer or the employer's representative.

AREA, METALLIC: Sum of the cross-sectional areas of individual wires in a wire rope or strand.

ATTACHMENT: A device other than conventional forks or load backrest extension, mounted permanently or removable on the elevating mechanism of a truck for handling the load. Popular types are fork extension clamps, rotating devices, side shifters, load stabilizers, rams and booms.

AUTHORIZED: Assigned by a duly constituted administrative or regulatory authority.

AUXILIARY HOIST: Supplemental hoisting unit of lighter capacity and usually higher speed than the main hoist.

BACK STAY: Guy used to support a boom or mast or that section of a main cable, as on a suspension bridge, or cableway, and the like, leading from the tower to the anchorage.

BAIL: A U-shaped member of a bucket, socket, or other fitting.

BASKET OR SOCKET: The conical portion of a socket into which a splayed rope end is inserted and secured with zinc.

BATTERY-ELECTRIC TRUCK: An electric truck in which the power source is a storage battery.

BECKET LOOP: A loop of small rope or a strand of rope fastened to the end of a large wire rope to facilitate installation.

BELOW THE HOOK DEVICES: The term used for lifting devices used below the lifting hook, other than slings, for attaching loads to the hoist

BENDING STRESS: Stress on wires of a wire rope imposed by bending. This stress need not be added to direct load stresses. When sheaves and drums are of suitable size, bending stress does not affect the normal life of the wire rope.

BIRDCAGE: A colloquialism describing the appearance of a wire rope that is forced into compression. The outer strands form a "cage" and at times displace the core.

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BIRDCAGING: The twisting of fiber or wire rope in an isolated area in the opposite direction of the rope lay, causing it to take on the appearance of a birdcage.

BOOM (Crane): A member hinged to the rotating superstructure and used for supporting the hoisting tackle.

BOOM LINE: A wire rope for supporting or operating the boom on derricks, cranes, draglines, shovels, and the like.

BRAKE: A device used for slowing or stopping motion by friction or electromagnetic means.

BRAKE, DRAG: A brake that provides stopping force without external control.

BRAKE, HOLDING: A brake that sets automatically and that prevents motion when power is off.

BRAKE, PARKING: A device to prevent the movement of a stationary vehicle.

BRAKING, COUNTER TORQUE: A method of stopping motion in which the power to the motor is reversed to develop torque in the opposite direction.

BRAKING, DYNAMIC: A method of controlling crane motor speeds when in the overhauling condition to provide a retarding force.

BRAKING, MECHANICAL: A method of slowing motion by friction.

BRAKING, REGENERATIVE: A form of dynamic braking in which the electrical energy generated is fed back into the power system.

BREAKING STRENGTH: The measured load required to break a wire rope or chain.

BRIDGE: The part of a crane, consisting of girders, walkways, railings, trucks, and drive mechanisms, that carries the trolley or trolleys.

BRIDGE TRAVEL: Horizontal travel of the crane parallel with runway rails.

BRIDLE SLING: A sling composed of multiple legs (branches), the top ends of which terminate in a fitting that latches onto the lifting hook.

BULL RING: The main large ring of a sling to which sling legs are attached.

BUMPER (BUFFER): An energy-absorbing device for reducing impact when a moving overhead crane or trolley reaches the end of its permitted travel, or when two moving cranes or trolleys come into contact.

CAB: The operator's compartment.

CABLE: A term loosely applied to wire ropes, wire strands, manila ropes, and electrical conductors.

CABLE-LAID WIRE ROPE: A type of wire rope consisting of several independent wire ropes laid into a single wire rope.

CABLE CROWD ROPE: A wire rope used to force the bucket of a power shovel into the material being handled.

CANTILEVER TRUCK: A self-loading counterbalanced or noncounterbalanced truck equipped with a cantilever load-engaging means, such as forks.

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CARRIAGE: A support structure for forks or attachments, generally roller-mounted, traveling vertically within the mast of a cantilever truck.

CENTER CONTROL: The position near the center of a truck cab from which the operator controls movement of the truck.

CERTIFICATION: Process by which management provides written endorsement of the satisfactory achievement of qualification of an individual for a specialized operations position based upon its criticality or safety impact, and generally in response to a DOE Order or a national consensus code or standard.

CERTIFIED ORGANIZATION: An organization recognized and accredited by OSHA that meets the criteria of 29 CFR 1926.1427. OSHA Accredited Organizations will be referred to as OAO.

COGNIZANT ENGINEER/ PHYSICIST: (COG) A member of the Engineering or Scientific and Research Staff who has been placed in charge of a specific project, job, or task by senior management. The COG is the Competent Person for object of the lift with detailed knowledge of the attributes of the object.

CHOKER ROPE: A short wire-rope sling used to form a slip noose around the object to be moved or lifted (see Figure 1-1).

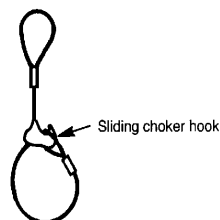


Figure 1-1. Choker Rope.

CIRCUMFERENCE: Measured perimeter of a circle circumscribing the wires of a strand or the strands of a wire rope.

CLAMP, STRAND: A fitting used to form a loop at the end of a length of strand; consists of two grooved plates and bolts.

CLEARANCE: The distance by which one object clears another, or the clear space between them.

CLEVIS: A U-shaped fitting with pins.

CLIP: A fitting used to clamp two parts of wire rope.

CLOSED SOCKET: A wire-rope fitting consisting of an integral becket and bail.

CLOSING LINE: Wire rope that closes a clamshell or orange-peel bucket and then operates as a hoisting rope.

COIL: Circular bundle of wire rope not packed on a reel.

COLLECTOR: Contacting device mounted on a bridge or trolley and used to collect current from the conductor system.

COME-ALONG: A portable, hand-operated device consisting of a housing, a length of chain or wire rope, two hooks, and a ratcheting lever, that is used for miscellaneous pulling.

CONDUCTOR: Wire, angles, bars, tees, or special sections mounted to transmit current to the collectors.

CONICAL DRUM: Grooved hoisting drum of varying diameter.

CONSTRUCTION (WIRE ROPE): Refers to the design of wire rope, including

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number of strands, number of wires per strand, and arrangement of wires in each strand.

CONTINUOUS BEND: Reeving of wire rope over sheaves and drums so that it bends in one direction (as opposed to reverse bend).

CONTROLLER: An operator's device for regulating the power delivered to a motor or other equipment.

CONTROLLER, SPRING RETURN: A controller that, when released, will return automatically to a neutral position.

CORE: The center member of a wire rope around which the strands are laid. It may be fiber, a wire strand, or an independent wire rope.

CORING LINE: Wire rope used to operate the coring tool for taking core samples during the drilling of a well.

CORROSION: Chemical decomposition by exposure to moisture, acids, alkalis, or other destructive agents.

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.

COUNTERBALANCED TRUCK: A truck equipped with load-engaging means wherein, during normal transporting, all the load is external to the polygon formed by the wheel contacts (see Figure 10-3).

COVER WIRES: The outer layer of wires.

CRANE: A machine used for lifting and lowering a load vertically and moving it horizontally and that has a hoisting mechanism as an integral part of it.

CRANES, TYPES OF:

Automatic Crane: A crane that, when activated, operates through a preset cycle or cycles.

Cab-Operated Crane: A crane controlled by an operator in a cab located on the bridge or trolley.

Cantilever Gantry Crane: A gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.

Floor-Operated Crane: A crane whose operation is controlled by use of a pendant in the hands of an operator on the floor or on an independent platform.

Gantry Crane: A crane similar to an overhead 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.

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 on existing structural members (e.g., a wall-mounted jib crane).

Mobile Crane: For the purposes of this chapter, mobile cranes are defined as wheel-mounted cranes, truck cranes, and crawler cranes.

- A **wheel-mounted** crane consists of a rotating structure with power plant, operating machinery, and boom, mounted on a base or platform equipped with axles and rubber-tired wheels for travel. The

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base is usually propelled by an engine in the superstructure, but it may be equipped with a separate engine controlled from the superstructure

- A **truck-mounted** crane consists of a rotating superstructure with power plant that operates machinery and boom, mounted on an automotive truck equipped with a power plant for travel. Commercial truck-mounted cranes are included in this category
- A **crawler crane** consists of a rotating superstructure with power plant, operating machinery and boom, mounted on a base equipped with crawler treads for travel.

Overhead Traveling Crane: A crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed-runway structure.

Power-Operated Crane: A crane whose mechanism is driven by electricity, air, hydraulics, or internal combustion.

Pulpit-Operated Crane: A crane operated from a fixed operator station that is not attached to the crane.

Remote-Operated Crane: A crane controlled by an operator not in a pulpit or cab attached to the crane, by any method other than pendant or rope control (e.g., radio-controlled crane). The existence of a remote control does not change the category, type, operator qualification, or inspection requirements of that crane. However, a remote control practical is required.

Semigantry Crane: A gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or

runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.

Shop Crane: A Portable Automotive Service Equipment (PASE), self contained hydraulic and pneumatic-hydraulic crane characterized by a pair of laterally spaced legs, an upright mast, a pivoting boom with a boom extension and hook, and a hydraulic unit. The hydraulic unit moves the boom up and down at a pivot point for the purpose of raising, removing, transporting in the lowered position, and replacing automotive engines, transmissions and other components. Shop cranes have a capacity of 4 tons (8000 pounds) or less.

Wall-Mounted 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.

Wall-Mounted Jib Crane: See Cranes, Types Of, Jib Crane.

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 their normal positions.

CYLINDRICAL DRUM: Hoisting drum of uniform diameter.

DECELERATION STRESS: Additional stress imposed on a wire rope due to decreasing the load velocity.

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DEFLECTION:

- Sag of a rope in a span, usually measured at midspan as the depth from a chord joining the tops of the two supports.
- Any deviation from a straight line.

DESIGN FACTOR: Ratio of ultimate strength to the design working stress.

DESIGNATED: Selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

DIAMETER: Distance measured across the center of a circle circumscribing the wires of a strand or the strands of a wire rope.

DIESEL-ELECTRIC TRUCK: An electric truck in which the power source is a generator driven by a diesel engine.

DOCKBOARD: A portable or fixed device for spanning the gap or compensating for the difference in level between loading platforms and carriers.

DOG-LEG: Permanent short bend or kink in a wire rope caused by improper use.

DRAGLINE: Wire rope used to pull an excavating or drag bucket.

DRIVE: Motor, coupling, brake and gear case, or gear cases used to propel bridge, trolley, or hoist.

DRIVE GIRDER: A girder on which is mounted the bridge drive, cross shaft, walk, railing, and operator's cab.

DRUM: A cylindrical-flanged barrel of uniform (cylindrical drum) or tapering

(conical drum) diameter on which a wire rope is wound for operation or storage. It may be smooth or grooved.

ELASTIC LIMIT: Limit of stress beyond which a permanent deformation takes place within the material. This limit is approximately 55-65 percent of breaking strength of steel-wire ropes.

ELECTRIC TRUCK: A truck in which the principal energy is transmitted from power source to motor(s) in the form of electricity.

END CONTROL: An operator-control position that is located at the end opposite the load end of the truck.

EQUALIZER: A device used to compensate for unequal length or stretch of a hoist rope.

EQUALIZING SLINGS: Slings composed of wire rope and equalizing fittings.

EQUALIZING THIMBLES: A special type of fitting used as a component part of some wire-rope slings.

EYE OR EYE SPLICE: A loop with or without a thimble formed in the end of a wire rope.

FAIL-SAFE: A provision designed to automatically stop or safely control any motion in which a malfunction could occur.

FATIGUE: The tendency of a material to break under repeated stress.

FIBER CENTERS: Cords or rope made of vegetable fiber used in the center of a strand.

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FIBER CORES: Cords or rope made of vegetable fiber used in the core of a wire rope.

FIRST POINT: The first setting on the operator's controller that starts crane motion (slowly) in each direction.

FITTING: Any accessory used as an attachment for wire rope.

FLAG: Mark or marker on a rope to designate position of load.

FLAT ROPE: Wire rope made of parallel alternating right-lay and left-lay ropes sewn together by relatively soft wires.

FLATTENED STRAND ROPE: A wire rope with either oval or triangular strands that present a flattened rope surface.

FLEET ANGLE: Angle between the position of a rope at the extreme end wrap on a drum and a line drawn perpendicular to the axis of the drum through the center of the nearest fixed sheave.

FORKS: Horizontal tine-like projections, normally suspended from the carriage, used to engage and support loads.

FORK HEIGHT: The vertical distance from the floor to the load-carrying surface adjacent to the heel of the forks with the mast vertical, and in the case of reach trucks, with the forks extended.

FORKLIFT TRUCK: A high-lift self-loading truck equipped with load carriage and forks for transporting and tiering loads (see Figure 10-3).

GALVANIZE: To coat with zinc to protect against corrosion.

GALVANIZED ROPE: Rope made of galvanized wire.

GALVANIZED STRAND: Strand made of galvanized wire.

GALVANIZED WIRE: Wire coated with zinc.

GAS-ELECTRIC TRUCK: An electric truck in which the power source is a generator driven by an LP-gas or gasoline engine.

GROMMET: A seven-strand wire-rope sling made from one continuous length of strand or an endless synthetic-web sling.

GROOVED DRUM: Drum with grooved outer surface to accommodate and guide a rope.

GROOVES: Depressions in the outer surface of a sheave or drum for positioning and supporting a rope.

GUY LINE: Strand or rope, usually galvanized, for holding a structure in position.

HANDLING FIXTURE: A cradle, structure, shipping fixture, or container designed specifically to facilitate supporting, lifting or handling a component during fabrication, loading, shipping, storage, or installation.

HIGH-LIFT TRUCK: A self-loading truck equipped with an elevating mechanism designed to permit tiering. Popular types are high-lift platform trucks (see Figure 10-3).

HIGH-LIFT PLATFORM TRUCK: A self-loading truck equipped with an elevating mechanism intended primarily for

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transporting and tiering loaded skid platforms (see Figure 10-3).

HOIST: A device that applies a force for lifting or lowering which does not have top running rails. A hoist may be either portable (i.e. chain fall) or under hung (i.e. gantry, jib).

HOISTING: *vt.* the lifting of equipment. *adj.* hoisting equipment. see hoist.

HOIST, LEVER OPERATED: A lever-operated manual device used to lift, lower, or pull a load and to apply or release tension.

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.

HOOK LOAD: The total live weight supported by the hook of a crane, derrick, or other hoisting equipment, including the load, slings, spreader bars, and other tackle not part of the load, but supported by the hook and required for the handling of the load.

IDLER: Sheave or roller used to guide or support a rope.

INDEPENDENT WIRE-ROPE CORE: Wire rope used as the core of a larger rope.

INNER WIRES: All wires of a strand except surface or cover wires.

INTERNAL-COMBUSTION ENGINE TRUCK: A truck in which the power source is a gas or diesel engine.

INTERNALLY LUBRICATED: Wire rope or strand having all wires coated with lubricant.

KINK: Permanent distortion of wires and strands resulting from sharp bends.

LAGGING: External wood covering on a reel of rope or a strand.

LANG-LAY ROPE: Wire rope in which the wires in the strands and the strands in the rope are laid in the same direction.

LAY LENGTH: The lengthwise distance on a wire rope in which a strand makes one complete turn around the rope's axis (see Figure 1-2).



Figure 1-2. Rope Lay

Left Lay:

- **Strand:** Strand in which the cover wires are laid in a helix having a left-hand pitch, similar to a left-hand screw.
- **Rope:** Rope in which the strands are laid in a helix having a left-hand pitch, similar to a left-hand screw.

Right Lay:

- **Strand:** Strand in which the cover wires are laid in a helix having a right-hand pitch, similar to a right-hand screw.
- **Rope:** Rope in which the strands are laid in a helix having a right-hand pitch, similar to a right-hand screw.

LIFT:

- Maximum safe vertical distance through which a hook can travel.

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- The hoisting of a load.

LIFT, CRITICAL: A lift for which the application of provisions applicable to ordinary lifts would not adequately eliminate or control the likelihood or severity of the following:

- personnel injury or significant adverse health impact (onsite or offsite).
- significant release of radioactivity or other hazardous material or other undesirable conditions.
- undetectable damage that would jeopardize future operations or the safety of a facility.
- damage that would result in delay to schedule or other significant program impact such as loss of vital data.
- A lift should also be designated as critical if the load requires exceptional care and handling because of size, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.

A CRITICAL LIFT REQUIRES MITIGATIVE ACTIONS THAT INCLUDES A WRITTEN LIFT PROCEDURE APPROVED BY THE RESPONSIBLE ENGINEER AND LIFT MANAGER TO REDUCE THE RISKS.

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- Requires more than 1 crane.

LIFT, ORDINARY: Any lift not designated as a critical lift or a pre-engineered production lift.

LIFT, REPETITIVE: A repetitive lift is the second or subsequent occurrence of an

approved lift using at least two members of the original lift team members. Repetitive, production-type lifting operation, independent of the nature of the load to be lifted, in which the probability of dropping, upset, or collision is reduced to a level acceptable to the lift manager by preliminary engineering evaluation, specialized lifting fixtures, detailed procedures, operation-specific training, and independent review and approval of the entire process. TCR-ES-MECH-007,R2-001

LIFT AREA - The horizontal distance from the bridge equal to the height of the bridge or the radius around a mobile crane equal to the fully extended boom length.

LIFT FIXTURE: Any below the hook lifting device as defined in ANSI/ASME B.30.20 or DOE Hoisting & Rigging Manual.

LIFT DATA SHEET A Lift Data Sheet is the specification of the method of rigging to be used for the lift.

LIFT CREW – The Lift Crew is defined as the Qualified Riggers and Qualified Crane/Hoist operators necessary for the lift.

LIFT ENGINEER: Up to three PPPL designated engineers who are appointed to review and approve written lift procedures for Critical Lifts. Qualifications for a PPPL Lift Engineer will include an engineering degree, at least 5 years of construction experience, specific training relative to performing lifts, and recommendation of the Lift Manager. Lift Engineers are appointed by the Head, Engineering Department. Lift Engineers are Competent Persons for a lift to assist Qualified Persons.

LIFT MANAGER: A PPPL designated engineer who reviews and approves written

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lift procedures for all Critical Lifts and assures compliance with the technical operations hoisting and rigging procedure. The Lift Manager is appointed by the PPPL Head, Engineering Department. The Lift Manager provides oversight, guidance, and support for the implementation of this procedure.

LIFT PROCEDURE: A Lift procedure is a statement of work which states what tasks must be performed to perform the lift. A lift procedure shall have a lift data sheet attached to it.

LIFTING SERVICE: Whenever equipment governed by this standard is used to perform lifts.

LINE: A rope used for supporting and controlling a suspended load.

LOAD: The total weight superimposed on the load block or hook.

LOAD BLOCK: The assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting ropes.

LOAD-BACKREST EXTENSION: A device extending vertically from the fork carriage frame.

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 a part 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.

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.

LOW-LIFT TRUCK: A self-loading truck equipped with an elevating mechanism designed to raise the load only sufficiently to permit horizontal movement (see Figure 10-3).

MAGNET: An electromagnetic device carried on a crane hook and used to pick up loads.

MAIN HOIST: The hoist mechanism provided for lifting the maximum-rated load.

MAN TROLLEY: A trolley having an operator's cab attached to it.

MARLINE SPIKE: Tapered steel pin used in splicing wire rope.

MESSENGER STRAND: Galvanized strand or bronze strand used to support telephone and electrical cables.

MODULUS OF ELASTICITY: Mathematical quantity giving the ratio, within the elastic limit, between a definite range of unit stress on a wire rope and the corresponding elongation.

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.

NARROW-AISLE TRUCK: A self-loading truck intended primarily for right-angle stacking in aisles narrower than those

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normally required by counterbalanced trucks of the same capacity (see Figure 10-3).

NONDESTRUCTIVE EXAMINATION (NDE): The development and application of technical methods to examine materials or components, in ways that do not impair future usefulness and serviceability, in order to detect, locate, measure, and evaluate discontinuities, defects, and other imperfections; to assess integrity, properties, and composition; and to measure geometrical characteristics.

NONDESTRUCTIVE TESTING (NDT): See NONDESTRUCTIVE EXAMINATION.

NONROTATING WIRE ROPE: See ROTATION-RESISTANT WIRE ROPE.

OPERATOR'S DAILY CHECLIST (ODCL): A daily checklist performed by a crane operator to ensure that all required items are inspected prior to use for that day.

OPEN SOCKET: A wire-rope fitting consisting of a basket and two ears with a pin.

ORDER-PICKER TRUCK, HIGH-LIFT: A truck, controllable by an operator stationed on a platform, which is movable, has a load-engaging means, and is intended for (manual) stock selection. The truck may be capable of self-loading and/or tiering (see Figure 10-3).

OSHA ACCREDITED ORGANIZATION: An organization recognized and accredited by OSHA that meets the criteria of 29 CFR 1926.1427. OSHA Accredited Organizations will be referred to as OAO.

OVERHEAD GUARD: A framework fitted to a truck over the head of a riding operator.

PALLET TRUCK: A self-loading, non-motorized or motorized low-lift truck equipped with wheeled forks of dimensions sized to go between the top and bottom boards of a double-faced pallet, the wheels fitting into spaces between the bottom boards, so as to raise the pallet off the floor for transporting (see Figure 10-3).

PEENING: Permanent distortion of outside wire in a rope caused by pounding.

PORTABLE AUTOMOTIVE SERVICE EQUIPMENT (PASE): See Shop Crane.

POWERED INDUSTRIAL TRUCK: A mobile, power-driven vehicle used to carry, push, pull, lift, stack, or tier material.

POWER PLANT – Is defined as the power source for the equipment.

PPPL OPERATIONS CENTER: A central record archive and distribution center of information including Lift Procedures and Lift Data Sheets.

PRECISION LOAD POSITIONING DEVICES: A rigging accessory designed specifically to precisely raise and lower a load through a limited range of lifting/lowering motion (stroke). Standards units typically have 12 in. (30 cm) stroke and can position a load within 0.001 in. (0.025 mm). These devices commonly include a built-in load scale and in such cases may also serve as a load-indicating device.

PREFORMED WIRE ROPE: Wire rope in which the strands are permanently shaped, before being fabricated into the

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rope, to the helical form they assume in the wire rope.

PREFORMED STRAND: Strand in which the wires are permanently shaped, before being fabricated into the strands, to the helical form they assume in the strand.

PRESTRESSING: Stressing a wire rope or strand before use under such a tension and for such a time that stretch that would otherwise occur once the load is picked up is largely nonexistent.

PROOF LOAD: A specific load applied in the performance of a proof load test.

PROOF TEST: A nondestructive tension test performed to verify construction and workmanship of slings or rigging accessories.

PUBLIC CARRIER: A for-hire company engaged in the public transportation of goods.

QUALIFICATION: Process by which factors, such as education, experience, and any special requirements (e.g., medical examinations) are evaluated in addition to training to assure that an individual can competently perform a specialized job function to an anticipated level of proficiency.

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

QUALIFIED CRANE INSPECTOR: A qualified and appointed PPPL employee

who has been trained and qualified in the inspection and repair and maintenance of cranes and hoists. The Qualified Inspector is qualified to perform the required frequent and/or periodic inspections and maintenance in accordance with Inspection, Testing, and Maintenance, Chapter 6 (with the exception of performing an actual load lift). The Qualified Inspector shall record all inspection/maintenance on the appropriate inspection report. The Qualified Inspector shall tag out of service any crane which does not satisfactorily pass his inspection or is not inspected by the due date and notify the Lift Manager of the tag out. These responsibilities may also be carried out by qualified subcontractor personnel hired to perform the Qualified Crane Inspector duties. Subcontract inspectors must provide a statement of qualification as inspectors and operators. Such statement must be approved by the Lift Manager. Crane Inspectors must have Ladder Safety and Fall Protection training.

QUALIFIED CRANE OPERATOR is a person who has demonstrated his or her ability to safely operate a specific crane (or cranes). One whose competence to operate equipment safely and effectively (including the ability to accurately spot and control loads) has been demonstrated by extensive experience, operational tests, and training, and must possess a current PPPL crane operator's card, valid Crane Operators state license, or valid operating engineer's card. The various types of Crane operators follow.

QUALIFIED CRANE OPERATOR (CAB) is a person who is qualified to operate overhead cranes and hoists for Ordinary lifts or maintenance items only. Cab Crane Operator Qualification is for a period of three years and requires passing a written and a practical test, or certified by an OAO, and meeting the training requirements

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listed below and designation by the Lift Manager:

Ladder Safety

Fall Protection

MOBILE CRANE OPERATOR is a person who is qualified to operate mobile cranes for ordinary lifts. Qualifications for Mobile Crane Operators are the same as Cab Crane Operators including OAO training as well as a having a current medical examination as listed below:

Minimum physical qualifications required on the annual medical evaluation are:

- a) Vision 20/30 Snellen in one eye and 20/50 in the other with or without corrective lenses, adequate depth perception, field of vision, and be able to distinguish colors, if required for operation.
- b) Hearing, with or without a hearing aid, adequate for specific operations.
- c) Must have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of equipment operation and to climb up and down vertical ladders.
- d) Must have no diseases, physical defect or emotional instability which could interfere with the operator's safe performance of crane operation. Minimum experience required is 1 year as a rigger and 6 months with 12 documented lifts as a Pendant Crane Operator.

PENDANT CRANE OPERATOR is a person who is qualified to operate pendant-controlled cranes (those without cabs) and hoists for ordinary lifts or maintenance items only. Pendant Crane Operator Qualification is for a period of three years and requires passing a written and a practical test meeting the minimum experience requirements of 1 month and 10 lifts as a rigger, and

designation by the Lift Manager. There are no medical requirements for Pendant Crane Operators.

CRITICAL LIFT CRANE OPERATOR (CLCO) This is the most advanced crane operator designation. A Critical Lift Crane Operator is a qualified cab or pendant crane operator who is designated to perform Ordinary and Critical Lifts. Critical Lift Crane Operator Qualification is for a period of three years and requires passing a written and a practical test, meeting the minimum experience of 1 year as a cab or pendant Crane Operator, having an annual medical evaluation per the requirements of a mobile crane operator, being recommended by a QRS and designated by the Lift Manager. In the absence of a medical evaluation in the past year, a Critical Lift Crane Operator is automatically downgraded to a Pendant Crane Operator.

CRANE OPERATOR INSTRUCTOR is a person who has demonstrated their ability to safely operate a specific class of equipment and possess current qualification to operate the equipment. Additionally, this person has demonstrated their ability to proficiently instruct others in the operation of the equipment and has been recommended by the Lift Manager to become a qualified instructor per TR-005. Crane operator instructors are qualified operators who have been designated by the Lift Manager, with Training concurrence, to instruct in the operation of hoisting equipment. The instructor must: 1) be currently qualified and proficient on the equipment for which he is instructing; 2) have the ability to communicate verbally, in writing, and demonstrate operating techniques applicable to the specific equipment; 3) have the ability to evaluate trainee operator performance and verify that the trainee has achieved the degree of

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proficiency required to operate the equipment safely.

QUALIFIED RIGGER: Qualification as a Rigger requires passing a written and a practical test. This qualifies the person to perform rigging and operate up to and including 5 ton manually operated hoists for ordinary lifts. A qualified rigger may only operate push button pendant hoists that they have been trained on and endorsed to use. It does not qualify a person to operate a crane. Rigger qualification is for a period of three years. There are no medical requirements for Riggers. The term “rigger” or “qualified rigger” refers to the function performed, and in no way relates to the workmen’s classification in any union or bargaining unit. Qualified riggers shall maintain a basic understanding of rigging requirements and implement them on each lift. Qualified riggers are familiar with, and competent in the use of, the rigging equipment they are required to use.

QUALIFIED RIGGING SPECIALIST (QRS): A QRS is designated by the Lift Manager to direct all PPPL Critical Lifts. The QRS shall be a qualified crane operator. Minimum physical qualifications required on the medical evaluations are: no physical restrictions that would render employee incapable of safe rigging duties; normal depth perception, field of vision, reaction time, manual dexterity and coordination. Specific QRS’s may be designated as Area QRS’s who are responsible for maintaining and managing rigging equipment for a specific area of the laboratory as noted in specific chapters of this procedure. A QRS is a Competent Person for the lift and may assist Qualified Persons.

QUALIFIED SIGNAL PERSON: The training program for Basic Rigging includes required signal training resulting in all

riggers and crane operators being qualified as a Signal Person per OSHA 1926.1428(a)(2).

QUALIFIED SLING INSPECTOR: All slings must be inspected before each use. The inspection criteria are listed in Chapter 8 of this Standard. Inspection requirements are part of the Basic Rigging training class. All Qualified Riggers are qualified to inspect slings.

QUALIFIED SUBCONTRACTOR: One whose qualifications have either been evaluated and accepted by the PPPL Lift Manager or whose parent company qualification program has been evaluated and accepted by the Lift Manager and the individual carries documentation (e.g. card) which shows completion.

QUALITY CONTROL (QC): A PPPL individual reporting to the Quality Assurance Division responsible for independent verification of activities specified by this procedure.

RATED CAPACITY: The maximum load that a piece of hoisting equipment is designed to carry; also the maximum load that an industrial truck or a sling, hook, shackle, or other rigging tackle is designed to carry.

NOTE: At the option of the user, a rated capacity can be assigned that is less than the design-rated capacity.

REACH TRUCK: A self-loading truck, generally high-lift, having load-engaging means mounted so it can be extended forward under control to permit a load to be picked up and deposited in the extended position and transported in the retracted position.

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REEL: The flanged spool on which wire rope or strand is wound for storage or shipment.

REEVING: A system in which a rope travels around drums or sheaves.

REGULAR-LAY ROPE: Wire rope in which the wires in the strands and the strands in the rope are laid in opposite directions.

REVERSE BEND: Reeving of a wire rope over sheaves and drums so that it bends in opposite directions.

RESPONSIBLE ENGINEER (RE): The Engineer responsible for the system or equipment being moved.

RIDER TRUCK: A truck that is designed to be controlled by a riding operator.

RIGGING: The hardware or equipment used to safely attach a load to a lifting device. The art or process of safely attaching a load to a hook by means of adequately rated and properly applied slings and related hardware.

ROLLERS: Relatively small-diameter cylinders or wide-faced sheaves used for supporting or guiding ropes.

ROTATION-RESISTANT WIRE ROPE: Wire rope consisting of a left-lay, lang-lay inner rope covered by right-lay, regular-lay outer strands.

RUNNING ROPE: A rope that moves over sheaves or drums.

RUNNING SHEAVE: A sheave that rotates as the load block is raised or lowered.

RUNWAY: Assembly of rails, girders, brackets, and framework on which a crane operates.

SAFE WORKING LOAD: Load that a rope may carry economically and safely.

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.

SEIZE: To securely bind the end of a wire rope or strand with seizing wire or strand.

SEIZING STRAND: Small strand, usually of seven wires, mad of soft-annealed-iron wire.

SEIZING WIRE: A soft-annealed-iron wire.

SELF-LOADER: A truck with tires that can fit between the top and bottom boards of a double-faced pallet.

SERVE: To cover the surface of a wire rope or strand with a wrapping of wire.



Figure 1-3. Shackle

SHACKLE: A type of clevis normally used for lifting (see Figure 1-3).

SHALL: A word indicating that an action is mandatory.

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SHEAVE: A grooved wheel or pulley used with a rope to change direction and point of application of a pulling force.

SHEAVE, NONRUNNING (EQUALIZER): A sheave used to equalize tension in opposite parts of a rope, called nonrunning because of its slight movement.

SHEAVE, RUNNING: A sheave that rotates as the load block is lifted or lowered.

SHOULD: A word indicating a recommended action, the advisability of which depends on the facts in each situation.

SIDE LOADER: A self-loading truck, generally high-lift, having load-engaging means mounted in such a manner that it can be extended laterally under control to permit a load to be picked up and deposited in the extended position and transported in the retracted position.

SIDE PULL: That portion of a hoist pull acting horizontally when the hoist lines are not operated vertically.

SIGNAL PERSON: A person required at point of operation if the operator's view of operation is impaired or required due to specific safety concerns. DOE 1090-2011 requires the use of a Signal Person for all Critical Lifts.

SLINGS: Wire ropes, chains, synthetic web, and metal mesh made into forms, and with or without fittings, for handling loads. All slings must be inspected before each use.

SLINGS, BRAIDED: Very flexible slings composed of several individual wire ropes braided together.

SMOOTH-FACED DRUM: Drum with a plain, not grooved, face.

SPAN: The horizontal, center-to-center distance of runway rails.

SPIRAL GROOVE: Groove that follows the path of a helix around a drum, similar to the thread of a screw.

SPLICING: Interweaving of two ends of rope to make a continuous or endless length without appreciable increasing the diameter. Also refers to making a loop or eye in the end of a rope by tucking the ends of the strands.

Splice, Hand Tucked: A loop or eye formed in the end of a rope by tucking the end of the strands back into the main body of the rope in a prescribed manner.

Splice, Mechanical: A loop or eye formed in the end of a wire rope by pressing or swaging one or more metal sleeve over the wire rope junction.

STAINLESS-STEEL ROPE: Wire rope made of chrome-nickel steel wires having great resistance to corrosion.

STANDING ROPE (PENDANT): A supporting rope that maintains a constant distance between two points of attachment to the component connected by the rope.

STEEL-CLAD ROPE: Rope with individual strands spirally wrapped with flat steel wire.

STRAND: An arrangement of wires helically laid about an axis or another wire or fiber center to produce a symmetrical section.

SUSPECT/COUNTERFEIT ITEMS (S/CI): A suspect item is one in which visual inspection, testing, or other means indicate that it may not conform to

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established Government or industry-accepted specifications or national consensus standards. A counterfeit item is a suspect item that has been copied or substituted without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by the vendor, supplier, distributor, or manufacturer (see Chapter 13).

NOTE: (refer to DOE G 440.1-6 “Implementation Guide For Use With Suspect/Counterfeit Requirements” of DOE O 440.1, Worker Protection Management).

SWAGED FITTINGS: Fittings in which wire rope is inserted and attached by a cold-forming method.

SWITCH, ELECTRIC: A device for making, breaking, or changing the connections in an electrical circuit.

SWITCH, EMERGENCY STOP: A manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.

SWITCH, LIMIT: A switch that is operated by some part or motion of a power-driven machine or equipment to alter the electrical circuit associated with the machine or equipment.

SWITCH, MAIN: A switch controlling the entire power supply to a crane or other equipment, often called the disconnect switch.

TAG LINE: A rope used to prevent rotation of a load. The Tag Line may only be handled by a qualified rigger.

TAPERING AND WELDING: Reducing the diameter of the end of a wire rope and welding it to facilitate reeving.

THIMBLE: Grooved metal fitting to protect the eye of a wire rope (see Figure 1-4).



Figure 1-4. Thimble

TIERING: The process of placing one load on or above another.

TINNED WIRE: Wire coated with tin.

TRAINING: Instruction designed to develop or improve job performance.

TROLLEY: A unit consisting of frame, trucks, trolley drive, and hoisting mechanism moving on the bridge rails in a direction at right angles to the crane runway.

TROLLEY GIRTS: Structural members that are supported on the trolley trucks and that contain the upper sheave assemblies.

TROLLEY TRAVEL: Horizontal travel of a trolley at right angles to runway rails.

TROLLEY TRUCK: An assembly consisting of wheels, bearings, axles, and structural-supporting hoist mechanism and load girts.

TRUCK, POWERED INDUSTRIAL: A mobile, power-propelled truck used to carry, push, pull, lift, stack, or tier material (see Figure 10-3).

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TURNBUCKLE: A device attached to wire rope for making limited adjustments in length. It consists of a barrel and right- and left-hand threaded bolts.

WIRE (SHAPED): A single continuous length of metal either cold drawn or cold rolled from a rod.

TWO-BLOCKING: The act of continued hoisting in which the load-block and head-block assemblies are brought into physical contact, thereby preventing further movement of the load block and creating shock loads to the rope and reeving system.

VERIFICATION: A procedure in which a design, calculation, drawing, procedure, instruction, report, or document is checked and signed by one or more parties to confirm that a specific action has been performed in accordance with specified requirements. Verification is typically independent; that is, performed by someone other than the individual who performed the action to be verified. The one or more persons designated to sign verify, based on personal observation, certified records, or direct reports, that a specific action has been performed in accordance with specified requirements.

WEDGE SOCKET: Wire-rope fitting in which the rope end is secured by a wedge.

WHEEL BASE: Distance between centers of outermost wheels for bridge and trolley trucks.

WHEEL LOAD: The load on any wheel with the trolley and lifted load (rated load) positioned on the bridge to give maximum-loading conditions.

WIRE ROPE: Wire strands laid helically around an axis or a core.

WIRE (ROUND): Single continuous length of metal, cold drawn from a rod.

CHAPTER 2 DETERMINING THE LIFT CATEGORY

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This chapter provides guidelines for critical-lift or non critical lift determination and requirements for planning and performing a critical lift safely and judiciously.

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CHAPTER 2 DETERMINING THE LIFT CATEGORY

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1.0 DETERMINATION OF LIFT CATEGORIZATION TCR-ES-MECH-007,R2-001

The Cognizant Engineer/Physicist shall determine if the lift will be an ordinary, special, or critical lift, then PROCEED to Chapter 3 for Ordinary Lifts and Special Lifts or Chapter 4 for a Critical Lift as appropriate. Table 2-1 is offered as a guide. Consult with the Lift Manager if needed.

- a. A lift is designated “Ordinary” if all of the following conditions are met: the cost impact is less than \$100K (either the value of the item being lifted or the horizontal clearance is greater than 5 feet from any hardware valued more than \$100K), any schedule impact is less than 1 month, there is no possible environmental impact, the potential for radiation exposure to a worker is less than 100 mREM. Only qualified persons using rigging equipment that has current inspections may perform ordinary lifts.
- b. Special Lift plans are documented lifts but do not require the technical rigor of a critical lift and do not have to be performed in a step-by-step sequence. If sequential actions are required because of the complexity of the lift or operation then they must be noted in the lift plan. A written lift plan shall be created for special lifts. A lift is designated “Special” if all of the “Ordinary” conditions are met and any of the following additional factors exist.
 - Transferring a load in mid-air from one lifting device to another
 - Any load that its center of gravity might be relocated due to lifting operation; such as a tank filled with liquid
 - Use of multiple lifting devices; such as use of more than one lifting equipment in sharing the load
 - Working in or within the reach (the area 360 degrees around the crane equipment, up to crane equipment's maximum erected/fully extended boom length) of either
 - 1) the specified clearance of power lines per 29 CFR 1926.1407-1411 or ASME B30.5 or
 - 2) the limited approach boundary of exposed energized electrical equipment as defined per NFPA 70E.
 - Use of complicated custom designed rigging equipment or hardware
 - Multiple load line operation such as those referred to 29 CFR 1926.1432
 - Lifting Personnel.
- c. A lift is designated “Critical” (A1 and A2 items per QAPD) if any of the following conditions are met:
 - The cost impact is greater than \$100K (either the value of the item being lifted or the horizontal clearance less than 5 feet from any hardware valued more than \$100K) Possible schedule impact is greater than 1 month
 - There is a possible environmental impact that exceeds the Permissible Environmental Limit (PEL)
 - The potential radiation exposure to a worker is greater than 100 mREM
 - The lift requires the use of more than one crane.

Note that some lifts are classified as critical lifts because of the value, importance, the safety aspects of the items they are lifted over or attached to, the load requires exceptional care and

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handling because of size, weight, close-tolerance installation, high susceptibility to damage, or other unusual factors.

CLASSIFICATION TCR-ES-MECH-007,R2-001		
CONDITIONS	ORDINARY (A3) [all conditions must be met]	CRITICAL (A1/A2) [any one condition]
COST IMPACT	LESS THAN \$ 100K	\$ 100K OR MORE OR IS UNIQUE AND/OR IRREPLACEABLE
UNIQUE AND/OR SCHEDULE IMPACT	LESS THAN ONE MONTHS	ONE MONTHS OR MORE
LOCATION OF HOOK VS. HARDWARE	MORE THAN 5 FT. HORIZ. CLEARANCE TO ALL HARDWARE VALUED GREATER THAN \$100K	<ul style="list-style-type: none"> • TRAVEL WITHIN 5 FT HORIZ. CLEARANCE OF EXP. DEVICE / CRITICAL HARDWARE • POTENTIAL DAMAGE GREATER THAN \$100K
RADIATION EXPOSURE TO WORKER	LESS THAN 100 mREM	100 mREM OR MORE
ENVIRONMENTAL IMPACT	NONE POSSIBLE	POSSIBLE RELEASE INTO THE ENVIRONMENT OF RADIOACTIVE OR HAZARDOUS MATERIAL EXCEEDING THE ESTABLISHED PEL
SPECIAL (A3) [Ordinary Lift and any one condition from Additional Factors below]		<ul style="list-style-type: none"> • IF THE LIFT REQUIRES THE USE OF MORE THAN ONE CRANE • A LIFT SHOULD ALSO BE DESIGNATED AS CRITICAL IF THE LOAD REQUIRES EXCEPTIONAL CARE AND HANDLING BECAUSE OF SIZE, WEIGHT, CLOSE-TOLERANCE INSTALLATION, HIGH SUSCEPTIBILITY TO DAMAGE, OR OTHER UNUSUAL FACTORS.
ADDITIONAL FACTORS THAT WOULD CAUSE A LIFT TO REQUIRE DOCUMENTATION AS EITHER A SPECIAL LIFT OR A CRITICAL LIFT	<ul style="list-style-type: none"> • Transferring a load in mid-air from one lifting device to another • Any load that its center of gravity might be relocated due to lifting operation; such as a tank filled with liquid • Use of multiple lifting devices; such as use of more than one lifting equipment in sharing the load • Working in or within the reach (the area 360 degrees around the crane equipment, up to crane equipment's maximum erected/fully extended boom length) of either 1) the specified clearance of power lines per 29 CFR 1926.1407-1411 or ASME B30.5 or 2) the limited approach boundary of exposed energized electrical equipment as defined per NFPA 70E. • Use of complicated custom designed rigging equipment or hardware • Multiple load line operation such as those referred to 29 CFR 1926.1432 	

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	• Lifting Personnel in a basket or on a platform.	
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Table 2-1 Ordinary, Special or Critical Lift Determination

A CRITICAL LIFT REQUIRES MITIGATIVE ACTIONS THAT INCLUDE A WRITTEN LIFT PROCEDURE APPROVED BY THE LIFT MANAGER TO REDUCE THE RISKS. (See Chapter 4 for directions)

2.0 LIFT EQUIPMENT REVIEW

There may be occasion for a non standard use of equipment or configuration for a lift. A request may be made to the Lift Manager to accept this non standard condition for the lift using the Lift Equipment Review Request. The Lift Manager will review the request and the proposed lift to make a determination of whether the non standard equipment or configuration may be used safely.

Responsibility	Action
Requestor	<ol style="list-style-type: none"> 1. Fill out Lift Equipment Review Request form in detail describing the non-standard exception(s) or addition(s) and why the change(s) is needed. Provide all information related to the lift required to make a determination. 2. Sign and send form to Lift Manager to make a determination of acceptability for the change.
Lift Manager	<ol style="list-style-type: none"> 3. Review the request for the non standard equipment change for the lift. Determine if the exception(s) or addition(s) will have an impact on the safety or conditions described for the lift. 4. If the changes are acceptable, approve and file in the Lift Manager file with copies to other parties as required for the lift or safety notification. 5. If the changes are not acceptable return the form to the requestor with the reasons why the request was denied.

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3.0 LIFT EQUIPMENT REVIEW REQUEST

Date: _____

Description of Item: _____

Quantity: _____ Location: _____

Exceptions/additions requested and reasons:

Requested by: _____

Lift Manager's Dispositions:

Approved: _____

Date: _____

Distribution: Lift Manager Files,

_____, _____,

_____, _____

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CHAPTER 3 PERFORMING ORDINARY AND SPECIAL LIFTS

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1.0 ORDINARY LIFT PLANNING

Lift planning should comply with ASME P30.1, “Planning for Load Handling Activities” and shall comply with 48 CFR 970.5223-1 “Integration of environment, safety, and health into work planning and execution” aka Integrated Safety Management System (ISMS). The following additions and exceptions to the above cited standard should also be implemented:

- a. A written lift plan beyond normal site work planning and control documents is not required for ordinary lifts. However, the Designated Leader may determine that a written plan is prudent.
- b. The designated leader shall ensure that in addition to the P30.1 “Standard Lift Plan” considerations, the following pre-lift planning issues are addressed, as applicable, prior to the lift.
 - i. Identify the item to be moved
 - ii. Its intrinsic characteristics (e.g., load integrity, loose materials, liquids)
 - iii. Weight
 - iv. Dimensions
 - v. Center of gravity
 - vi. Its ability to support imposed lifting forces (both the load and any lift points)
 - vii. Whether it contains any hazardous or toxic materials
- c. Validate the loads path and clearances.
- d. Identify lifting equipment and rigging to be used by type and rated capacity.
- e. Prepare rigging sketches, as necessary.
- f. 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).
- g. Identify any special or site-specific operating procedures and special instructions.
- h. Riggers and Crane Operators may not work alone.
- i. A single qualified rigger may rig and then perform a lift if the JHA evaluation of the work permits a single person to do the work.

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2.0 SPECIAL LIFTS

Some ordinary lifts have additional risks that warrant special consideration. Such lifts shall have documented plans but do not require the technical rigor of a critical lift and do not have to be performed in a step-by-step sequence. If sequential actions are required because of the complexity of the lift or operation then they must be noted in the lift plan. A written lift plan shall be created for special lifts using the lift data sheet (below) where any of the following conditions are present:

- Load transfer; such as transferring a load in mid-air from one lifting device to another
- Any load that its center of gravity might be relocated due to lifting operation; such as a tank filled with liquid
- Use of multiple lifting devices; such as use of more than one lifting equipment in sharing the load
- Use of complicated custom designed rigging equipment or hardware
- Working in or within the reach (the area 360 degrees around the crane equipment, up to the crane equipment's maximum erected/fully extended boom length) of
 - The specified clearance of power lines per 29 CFR 1926.1407-1411 or ASME B30.5.
 - Limited approach boundary of exposed energized electrical equipment as defined per NFPA 70E.
- Multiple load line operation such as those referred to 29 CFR 1926.1432
- Lifting Personnel

CHAPTER 3 PERFORMING ORDINARY AND SPECIAL LIFTS

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3.0 PROCEDURE FOR AN ORDINARY OR SPECIAL LIFT

Note: The first step in preparing for a lift is to make the determination of whether the lift is an Ordinary Lift, Special Lift or a Critical Lift. Please use the guides and tools of Chapter 2 of this Engineering Standard to make this determination before making any preparations.

Responsibility	Action
----------------	--------

NOTE: Any person may request the stoppage of any lift that appears unsafe at any time. Crane operator shall stop lift at stop signal from any person.

Requirements for ALL lifts:

- Hard hats must be worn by all people in the lift area.
- The Lift Area is the horizontal distance from the bridge equal to the height of the bridge or the radius around a mobile crane equal to the fully extended boom length.
- The lift area needs to have a barrier, lights or a lift crew member to warn and protect people from entering the lift area.
- Only members of the Lift Crew shall be in the Lift Area during lifting operations.
- Tag lines may only be handled by a qualified rigger.
- A helper may assist a qualified rigger but a qualified rigger must inspect all rigging prior to use as well as any hitches/connection made by the helper prior to the lift. The helper must remain outside the Lift Area during the lift.

- | | |
|---------------------------------|---|
| Cognizant
Engineer/Physicist | <ol style="list-style-type: none"> 1. Determine if a crane (a machine for lifting and lowering a load vertically and moving it horizontally if necessary) or hoist (a device that applies a force for lifting or lowering) is required. 2. Determine if this meets a “Special” lift criteria then obtain the assistance of a QRS to develop a lift data sheet. 3. Have the Lift data sheet approved by the Lift Manager. |
|---------------------------------|---|

CHAPTER 3 PERFORMING ORDINARY AND SPECIAL LIFTS

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4. Arrange for qualified personnel as follows:
 - a. For Ordinary Lifts using hoists with rated capacity of 5 tons or less, arrange for a Qualified Rigger that is qualified for the specific hoist to be used.
 - b. For Ordinary Lifts using cranes or hoists greater than 5 tons rated capacity, arrange for a crane operator qualified for the type of lift equipment.

Note: All lifts require qualified personnel to operate the lifting device. Qualified Crane Operator or Hoist Operator may also be the Qualified Rigger.

 - c. For Special Lifts, arrange for a QRS and Lift Engineer to be present during the lift. The QRS shall direct the lift.
5. Verify that qualification cards are current and are being carried. (<http://hr.pppl.gov/Qualifications.htm>).
6. For mobile crane lifts at more than 75 percent of crane capacity (per load chart) stop and notify the Lift Manager.
7. Ensures the items in the lift are free from any connection or obstruction.

Qualified Rigger/
Qualified Crane
Operator

8. Perform the following:
 - a. Ensure involved personnel understand the lift and check their qualification cards.
 - b. Ensure that the weight of the load is known and that proper equipment and accessories are selected.

NOTE: If weight of load is estimated and exceeds 75% of the rated capacity, a load cell is recommended.

- c. Survey the lift site for hazardous/unsafe conditions including ensuring that the items in the lift are free from any connection or obstruction.
- d. Visually inspect and approve all lifting equipment prior to use. Note: See Daily Inspection Requirements for the appropriate equipment.
- e. Verify the annual inspection color mark on slings. **Note:** The following convention will be used. Colors: Black, Red, Orange, Yellow, Green, Blue, Violet, and White will be used in the order stated. For calendar year (CY) 2016 black will be used, for CY 2017 Red, and so on.

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- f. Verify the inspection date on cranes/hoists and PALDs.
- g. Ensure the monthly hook & wire rope/chain inspection has been completed within the past 30 days.
- h. For overhead cranes perform Operator's Daily Check List (Chapter 6, Section 9.0) if the ODCL or monthly hook and wire rope inspection are unsatisfactory or expired.

Note: ODCL's will be maintained for 3 years. At least the most recent ODCL that has the monthly hook and wire rope performed shall be maintained in holders installed at each crane that has running wire ropes.

- i. Ensure that equipment is properly set up and positioned.
- j. Ensure that a signal man is assigned, if needed, and identify him to the operator.
- k. If more than one person is a part of the lift team, a designated leader must be assigned.
- l. Direct lift operation safely and efficiently.
- m. Perform the lift.

NOTE: FAILURE TO FOLLOW SAFE WORK STEPS MAY SUBJECT EMPLOYEES TO DISCIPLINARY ACTIONS UP TO AND INCLUDING DISMISSAL AS DESCRIBED IN THE LABORATORY CODE OF CONDUCT POLICY.

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4.0 LIFT DATA SHEET BLANK

LIFT AREA: TITLE:	Effective Date:	Repetitive Lift Expiration Date:
LIFT PROCEDURE NO. <u>L</u> - Sheet No (if applicable) LDS:	Approved: _____ LIFT MANAGER	Repetitive Lift: _____ Approved LIFT MANAGER
ITEM PREPARATION VERIFIED AND READY TO BE LIFTED COG : _____ (Print and Initial)		
PROCEDURE PREREQUISITES COMPLETED QC : _____ (Print and Initial-QRS for repetitive lifts)		
DESCRIPTION: WEIGHT: _____ DETERMINED BY: _____ Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Load Angles Sketch of equipment shall include: Dimensions, Allowable Tilt, Approx. CG		
(Print & Initial)	QRS(s) or CLCO(s)	Rigging Team
_____	_____	_____
_____	_____	_____
_____	_____	_____
APPROVED: _____ (Print and Initial) QRS CLCO COG LIFT ENGINEER (Rigged to sketch) (Equipment ready to lift) (Qualification/Inspection complete) N/A for repetitive lift		

... PERFORM LIFT... PERFORM LIFT ... PERFORM LIFT ...

Equipment is secure and rigging may be removed: **COG**: _____ **Date Performed**: _____
COG SHALL SEND/RETURN COMPLETED ORIGINAL DATA SHEETS TO PPPL OPERATIONS CENTER.

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5.0 LIFT DATA SHEET SAMPLE

LIFT AREA: Test Cell TITLE: Heavy Box Lift	Effective Date:	Repetitive Lift Expiration Date:
LIFT PROCEDURE NO. <u>L-NSTX-XXXX</u> Sheet No (if applicable) LDS:	Approved: _____ LIFT MANAGER	Repetitive Lift: _____ Approved LIFT MANAGER
ITEM PREPARATION VERIFIED AND READY TO BE LIFTED COG: <u>S. Raftopoulos</u> (Print and Initial)		
PROCEDURE PREREQUISITES COMPLETED QC: <u>J. Boscoe</u> (Print and Initial-QRS for repetitive lifts)		

25 Ton Hook

(2) 10 ft. slings
1 ton min.

(2) 10 ft. chain fall
1 ton min.

(2) Shackles
1 ton min.

(4) Swivel eye
1 ton min.

H = 7 FT.

L = 10.5 FT.

3 FT.

7.5 FT.

15 FT.

2000 lb. Box

C.G.

Note:

$< 5^\circ$ tilt

PATH

DOOR

TEST CELL

END

START

Load Angle Factor (LAF) = $L/H = 10.5/7 = 1.5$

Total Stress = WEIGHT x LAF = 2000 x 1.5 = 3000

Only take credit for 2 legs of multiple leg hitches.

Allowable Stress per Sling = Total Stress/2

3000/2 = 1500 lbs. ✓ 1-ton minimum available.

DESCRIPTION:	WEIGHT: <u>2000 lbs.</u>	DETERMINED BY: <u>ESTIMATE</u>	
Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Load Angles			
Sketch of equipment shall include: Dimensions, Allowable Tilt, Approx. CG			
(Print & Initial)	<u>QRS(s) or CLCO(s)</u>	<u>Rigging Team</u>	
	<u>F. Simmonds</u>	<u>D. Voorhees CCO</u>	
	<u>K. Gilton</u>		
APPROVED:	<u>F. Simmonds</u>	<u>D. Voorhees</u>	<u>S. Raftopoulos</u>
Print and Initial)	QRS	CLCO	COG
	(Rigged to sketch)		(Equipment ready to lift)
			<u>M. Viola</u>
			LIFT ENGINEER
			(Qualification/Inspection complete)
			N/A for repetitive lift

... PERFORM LIFT... PERFORM LIFT... PERFORM LIFT...

Equipment is secure and rigging may be removed: COG: _____ Date Performed: _____

COG SHALL SEND/RETURN COMPLETED ORIGINAL DATA SHEETS TO PPPL OPERATIONS CENTER.

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6.0 REPETITIVE LIFT DATA SHEET TRACKING PAGE

Title

[illegible]

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7.0 PERFORMING A REPETITIVE SPECIAL LIFT

Note: Any person may request the stoppage of any lift that appears unsafe at any time.

Requirements for ALL lifts:

- Hard hats must worn by all people in the lift area.
- The Lift Area is the horizontal distance from the bridge equal to the height of the bridge or the radius around a mobile crane equal to the fully extended boom length.
- The lift area needs to have a barrier, lights or a lift crew member to warn and protect people from entering the lift area.
- Only members of the Lift Crew shall be in the Lift Area during lifting operations.
- Tag lines may only be handled by a qualified rigger.
- A helper may assist a qualified rigger but a qualified rigger must inspect all rigging prior to use as well as any hitches/connection made by the helper prior to the lift. The helper must remain outside the Lift Area during the lift.

Responsibility	Action
Responsible Engineer (RE)	1. Support staffing requirements of lift teams.
Lift Manager	2. After a Special lift has been performed the first time, the Lift Manager may authorize a repetitive lift. The Lift Manager will approve a lift as repetitive and give the lift data sheet an expiration date, typically one or two years. 3. Lift Manager (or Lift Engineer) will initial next to the printed name of each QRS or Crane Operator previously present during that lift. Other qualified individuals may be added to subsequent lifts.
Cognizant Engineer/Physicist	4. Obtain the following: <ul style="list-style-type: none"> a. One copy of the latest revision to the lift procedure. b. A copy of the Repetitive Lift Data Sheet specifying the configuration of the planned lift for use. <p>Note: The tracking page of Section 6 of this chapter shall be used to allow tracking of the most up-to-date copy of the repetitive lift data sheet and to ensure the proper sheet is used for the lift.</p>

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Cognizant
Engineer/Physicist
(Continued)

5. Arrange for a Qualified Rigging Specialist (QRS), Crane Operator and riggers to perform the lift using the existing procedure. Verify that all qualifications are current. Include at least two members from either the original lift team or of a previously performed lift that were acting in the capacity of a cog, QRS, or Crane Operator. Members authorized will have their names initialed by the Lift Manager or Lift Engineer on the Repetitive Lift Data Sheet.
6. For mobile crane lifts at more than 75 percent of crane capacity (per load chart) notify the Lift Manager.
7. Conduct a pre-lift meeting with all personnel associated with the lift.
8. Sign the lift data sheet that all prerequisites have been completed prior to the lift (i.e. shutdown, disconnection, and disassembly).

Crane Operator

9. Perform Operator's Daily Check List.

Note: ODCL's will be maintained for 3 years. At least the most recently run ODCL shall be maintained in holders installed at each crane.

QRS

10. Prior to placing rigging, the QRS shall:
 - a. Verify that the inspection tag on the lift device is current.
 - b. Ensure the monthly hook & wire/chain inspection has been completed within the past 30 days.

Riggers

11. Respond to the direction of the QRS for performing the lift. Inspect all lifting equipment used and assure that the rigging is performed according to procedure. Other personnel may assist the riggers during the lift procedure as needed, however, only qualified PPPL riggers, QRS or subcontractor QRS with Lift Manager approval must check all rigging.

QRS

12. Complete and approve the Lift Data Sheet. Note: The QRS acts on behalf of the Lift Engineer for repetitive lifts and accepts responsibility for conducting the lift safely.
13. Interpret technical aspects of lift procedures that affect the hoisting and rigging; and witness their implementation.
14. Review Lift Data Sheet and allows rigging to be placed.
15. Monitor and retain overall responsibility for the hoisting and rigging for repetitive lifts.
16. Checks the qualification status of the individuals assigned to the lift.

CHAPTER 3 PERFORMING ORDINARY AND SPECIAL LIFTS

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- | | |
|--------------------|--|
| QRS
(Continued) | 17. Visually inspect, check for current equipment inspection, and approve all lifting equipment prior to use. Ensures the proper annual inspection sticker on cranes and hoists, color mark on slings. Note: The following convention will be used. Colors: Black, Red, Orange, Yellow, Green, Blue, Violet, and White will be used in the order stated. For calendar year (CY) 2016 black will be used, for CY 2017 Red, and so on. |
| COG | 18. Sign the Lift Data Sheet accepting responsibility for the equipment safety. |
| | 19. Interpret technical aspects of the lift procedure and Lift Data Sheet that protect the item to be lifted and witness their implementation. |
| | 20. Concur that the Lift Data Sheet reflects the hoisting and rigging setup; approve the Lift Data Sheet, and give permission to the QRS to proceed with the lift. Both individuals shall remain on site during the lift the COG shall monitor and retain overall responsibility for the safety of the equipment. |
| QRS | 21. Direct riggers to place rigging.

NOTE: The QRS shall monitor and be responsible for checking if the weight of load is estimated and exceeds 75% of the rated capacity, a load cell is required to weigh the load either prior to or during the lift unless waived by the lift manager. |
| Qualified Riggers | 22. Place rigging. |
| QRS | 23. Verify rigging has been placed and direct the lift according to the procedure. |
| Crane Operator | 24. Respond to the direction of the QRS for performing the lift. |
| COG | 25. Sign Lift Data Sheet to indicate that the equipment is secure and that rigging may be removed. |
| QRS | 26. Direct the rigging removal and returns hoisting and rigging to equipment storage area. |
| COG | 27. Return completed and signed-off Lift Data Sheet, and, if applicable, the revised Lift Data Sheet to the PPPL Operations Center. |
| Operations Center | 28. File the Lift Data Sheet(s). |

CHAPTER 4 PERFORMING A CRITICAL LIFT

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CHAPTER 4 PERFORMING A CRITICAL LIFT

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1.0 DEVELOPING THE CRITICAL LIFT PROCEDURE

Note: The first step in preparing for a lift is to make the determination of whether the lift is an Ordinary Lift or a Critical Lift. Please use the guides and tools of Chapter 2 of this Engineering Standard to make this determination before making any preparations.

Responsibility	Action
----------------	--------

- | | |
|----------------------------------|--|
| Cognizant
Engineer/ Physicist | <ol style="list-style-type: none"> 1. Determine if a Lift procedure for the desired lift is already on file in the PPPL Operations Center (OPs Center). <ol style="list-style-type: none"> a. If yes, DETERMINE if a repetitive lift has been approved for the activity. If yes, PROCEED to Section 8.0 of this chapter, Performing a Repetitive Critical Lift.
If no, PROCEED to Section 7.0 of this chapter, Performing a Non-Repetitive Critical Lift. b. If not, develop or revise an existing procedure to conform with this Section and Section 2.0 of this chapter, Instructions for Completing Critical Lift Procedure. 2. Consult with the Lift Manager for choosing a Qualified Rigging Specialist. QRS is responsible for the rigging sketch. 3. Consult with Lift Manager for the Lift Team and the best methods for a safe lift. 4. Obtain the information for the Lift Data Sheet (Section 4.0) from the area's Qualified Rigging Specialist (QRS). Provide the rigging sketch for the lift data sheet using the guidance provided in Section 2.0 5. Sign and distribute the procedure and Lift Data Sheet for review to the RE, Technical Authority (TA), Chief Engineer (CE), COG, QRS(s) and the Lift Manager. TCR-ES-MECH-007,R2-001 6. Retrieve and resolve comments. 7. Obtain a number from the Operations Center Format: L-(site)-(project)-XXX. TCR-ES-MECH-007,R2-001 8. Obtains approval signatures from the RE, TA, CE, COG, QRS(s) and Lift Manager. TCR-ES-MECH-007,R2-001
 Note: Signatures signify: <ol style="list-style-type: none"> a. COG has reviewed the equipment safety aspects of the lift. b. RE understands the lift and accepts responsibility for its safety. c. Lift Manager has reviewed the technical aspects of the lift procedure to assure adequate and safe compliance with the hoisting & rigging program and accepts responsibility for the activity. d. QRS(s) has reviewed the Lift Data Sheet 9. Forward approved lift procedure to OPs Center. |
|----------------------------------|--|

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CHAPTER 4 PERFORMING A CRITICAL LIFT

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2.0 INSTRUCTIONS FOR COMPLETING CRITICAL LIFT PROCEDURE**A. Critical Lift Procedure Instructions**

The Critical Lift Procedure provides the necessary guidance to mitigate the risks involved with a lift that has been identified as a critical Lift per Critical Lift Determination. The Cognizant Engineer shall use the form in section 3.0 of this chapter to write the procedure.

Fill out the introduction (section A), which describes the component to be lifted, classification and reason for classification.

Add any prerequisite items that are required before performing this lift such as installation or removal procedures. Disassembly steps shall not be listed in the lift procedure. These add distractions to the performance of the lift.

List any precautions that might affect the risks involved with performing this lift. Fill out the Procedure Section (section E) listing any special handling steps that are required and affect rigging to the item to be lifted per the sketch and performing the lift.

Signatures shall not be listed or required in the body of the lift procedure. All signatures are located on the cover sheet of the lift procedure or within the lift data sheet while performing the lift.

B. LIFT DATA SHEET INSTRUCTIONS

The Lift Data Sheet provides the specification for the hoisting and rigging aspects of the lift and shall be initiated by the cognizant engineer. A QRS shall provide the specifics of the rigging to be employed along with consultation from the Lift Manager.

Reference any drawings/sketches in Lift Data Sheet. Include as attachments any required drawings. These can be marked up blue prints or a sketch. Sketch inclusions: (see attached example also)

- 1) Identification of the items to be moved, the weight, dimensions, and center of gravity of the load, and any hazardous or toxic materials that are present.
- 2) Identification of lifting equipment to be used by type and rated capacity.
- 3) Rigging sketches include (as applicable):
 - i. Identification and rated capacity of slings, lifting bars, rigging accessories, and below-the-hook lifting devices. Calculate and provide the rated capacity of equipment in the configuration in which it will be used.
 - ii. Load-indicating devices.
 - iii. Load vectors.
 - iv. Lifting points.
 - v. Sling angles.

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- vi. Boom and swing angles.
 - vii. Methods of attachment.
 - viii. Crane orientations.
 - ix. Other factors affecting equipment capacity (e.g. load path sketch, key point heights, floor or soil bearing capacity).
- 4) Operating procedures and special instructions to operators including rigging precautions and safety measures to be followed as applicable. Show floor plan with path of intended travel. Note lift points and travel (by cart/fork lift) path.
 - 5) If the rigging team is an outside contractor, provide the names and copies of qualification of team members.
 - 6) Effective date is the date the Lift Data Sheet is approved by the Lift Manager

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3.0 CRITICAL LIFT PROCEDURE

Procedure No. L -

TITLE: _____

Note: LIFT DATA SHEET NEEDED TO PERFORM THIS LIFT

PREPARED BY (COG ENGINEER): _____ DATE _____

GROUP/DIVISION HEAD: _____ DATE _____

ALTERNATE COG: _____ DATE _____

ALTERNATE COG: _____ DATE _____

ALTERNATE COG: _____ DATE _____

QRS: _____ DATE _____

QRS: _____ DATE _____

QRS: _____ DATE _____

LIFT MANAGER DATE RESPONSIBLE ENGINEER DATE

TECHNICAL AUTHORITY DATE CHIEF ENGINEER DATE

PROCEDURE INCLUDES ALL ATTACHMENTS

A. INTRODUCTION

Describes component to be lifted, classification and reason for classification.

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B. PREREQUISITES

1. COG will attest on the Lift Data Sheet that any installation, disassembly, or removal procedures required to allow the equipment to be moved have been completed.
2. PPPL Lift Manager and QC shall be notified in advance of a non-repetitive Critical lift.
3. No Critical lift may be commenced without the presence of a PPPL Lift Engineer or his designee (e.g., the QRS for repetitive lifts)
4. All rigging equipment used in critical lifts shall have proof load certificates or a proof load test shall have been performed per the appropriate Chapter for the equipment.
5. All Critical Lifts require the use of a Signal Person.

C. PRECAUTIONS

Include in the procedure only those precautions which are directly applicable:

1. Protection of slings and equipment from edges.
2. Protection of finished surfaces from damage.
3. Areas needed to be roped off.
4. Security guards, if necessary.
5. Adjacent equipment protection needed.
6. Ensure the items in the lift are free from any connection or obstruction.

D. PROCEDURE FIELD CHANGES

Procedure field change can be made on site if approved by the PPPL Lift Engineer by revising an existing or developing a new Lift Data Sheet. Revised lift data sheets also require written approval of the Lift Manager. Revised Lift data sheets shall be filed in the OPS Center.

E. PROCEDURE

Assure all prerequisites and precautions have been completed. Indicates the technical requirements to protect the equipment and personnel during the lift and QC shall assure that all Prerequisites are complete. List steps and order if applicable.

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4.0 LIFT DATA SHEET BLANK

LIFT AREA: TITLE:	Effective Date:	Repetitive Lift Expiration Date:
LIFT PROCEDURE NO. L - _____ Sheet No (if applicable) LDS:	Approved: _____ LIFT MANAGER	Repetitive Lift: _____ Approved LIFT MANAGER
ITEM PREPARATION VERIFIED AND READY TO BE LIFTED COG: _____ (Print and Initial)		
PROCEDURE PREREQUISITES COMPLETED QC: _____ (Print and Initial-QRS for repetitive lifts)		
<p>DESCRIPTION: WEIGHT: _____ DETERMINED BY: _____</p> <p>Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Load Angles</p> <p>Sketch of equipment shall include: Dimensions, Allowable Tilt, Approx. CG</p>		
(Print & Initial)	QRS(s) or CLCO(s) _____ _____ _____	Rigging Team _____ _____ _____
<p>APPROVED: _____</p> <p>(Print and Initial) QRS CLCO COG LIFT ENGINEER</p> <p style="text-align: center;">(Rigged to sketch) (Equipment ready to lift) (Qualification/Inspection complete)</p> <p style="text-align: center;">N/A for repetitive lift</p>		
... PERFORM LIFT... PERFORM LIFT ... PERFORM LIFT ...		
Equipment is secure and rigging may be removed: COG: _____ Date Performed: _____		

COG SHALL SEND/RETURN COMPLETED ORIGINAL DATA SHEETS TO PPPL OPERATIONS CENTER.

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5.0 LIFT DATA SHEET SAMPLE

LIFT AREA: Test Cell TITLE: Heavy Box Lift	Effective Date:	Repetitive Lift Expiration Date:
LIFT PROCEDURE NO. <u>L-D-NSTX-XXXX</u> Sheet No (if applicable) LDS:	Approved: _____ LIFT MANAGER	Repetitive Lift: _____ Approved LIFT MANAGER
ITEM PREPARATION VERIFIED AND READY TO BE LIFTED COG: <u>S. Raftopoulos</u> (Print and Initial)		
PROCEDURE PREREQUISITES COMPLETED QC: <u>John Boscoe</u> (Print and Initial-QRS for repetitive lifts)		

25 Ton Hook

(2) 10 ft. slings
1 ton min.

(2) Shackles
1 ton min.

H = 7 FT.
L = 10.5 FT.

(2) 10 ft. chain fall
1 ton min.

(4) Swivel eye
1 ton min.

3 FT.

7.5 FT.

2000 lb. Box

C.G.

15 FT.

Note:
/ < 5° tilt

PATH

DOOR

TEST CELL

END

START

NORTH

Load Angle Factor (LAF) = $L/H = 10.5/7 = 1.5$

Total Stress = WEIGHT x LAF = $2000 \times 1.5 = 3000$

Only take credit for 2 legs of multiple leg hitches.

Allowable Stress per Sling = Total Stress/2

$3000/2 = 1500$ lbs. ✓ 1-ton minimum available.

DESCRIPTION: WEIGHT: <u>2000 lbs.</u> DETERMINED BY: <u>ESTIMATE</u>	
Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Load Angles	
Sketch of equipment shall include: Dimensions, Allowable Tilt, Approx. CG	
(Print & Initial) <u>F. Simmonds</u> <u>D. Voorhees CCO</u> <u>K. Gilton</u>	QRS(s) or CLCO(s) Rigging Team
APPROVED: <u>F. Simmonds</u> <u>D. Voorhees</u> <u>S. Raftopoulos</u> <u>M. Viola</u> (Print and Initial) QRS CLCO COG LIFT ENGINEER (Rigged to sketch) (Equipment ready to lift) (Qualification/Inspection complete)	

... PERFORM LIFT... PERFORM LIFT... PERFORM LIFT...

Equipment is secure and rigging may be removed: COG: _____ Date Performed: _____

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Title_____

[illegible]

CHAPTER 4 PERFORMING A CRITICAL LIFT

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7.0 PERFORMING A NON-REPETITIVE CRITICAL LIFT (RESPONSIBILITIES)

Note: Any person may request the stoppage of any lift which appears unsafe at any time. Crane operator shall stop lift at stop signal from any person.

Requirements for ALL lifts:

- Hard hats must worn by all people in the lift area.
- The Lift Area is the horizontal distance from the bridge equal to the height of the bridge or the radius around a mobile crane equal to the fully extended boom length.
- The lift area needs to have a barrier, lights or a lift crew member to warn and protect people from entering the lift area.
- Only members of the Lift Crew shall be in the Lift Area during lifting operations.
- Tag lines may only be handled by a qualified rigger.
- A helper may assist a qualified rigger but a qualified rigger must inspect all rigging prior to use as well as any hitches/connection made by the helper prior to the lift. The helper must remain outside the Lift Area during the lift.

Responsibility

Action

Responsible
Engineer(RE)

1. Support staffing requirements of lift teams. TCR-ES-MECH-007,R2-001

Lift Manager

2. Assign the Lift Engineer and confirm the rigging team.

Cognizant Engineer/
Physicist

3. Obtain the following from the OPS Center:
 - a. One copy of the latest revision to the lift procedure.
 - b. Two copies of the Lift Data Sheet specifying the configuration of the planned lift for use.
4. For mobile crane lifts at more than 75 percent of crane capacity (per load chart) the Lift Manager shall be notified.
5. Conduct a pre-lift meeting including all personnel, the Lift Engineer, and QC.

Cognizant Engineer/
Physicist

6. Sign the Lift Data Sheet indicating disassembly is complete.
7. Request QC and Lift Engineer at the lift site.

NOTE: Provide a 48-hour notice of lift to the Lift Manager, QC and lift team members.

NOTE: Non-Repetitive critical lifts may commence only when the PPPL Lift Manager or his designee is present.

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QC	8.	Sign the lift data sheet that all prerequisites have been completed prior to the lift (i.e. shutdown, disconnection, and disassembly).
	9.	Check that the qualifications are current for each QRS and for the crane operator and each rigger.
Critical Lift Crane Operator	10.	Perform Operator's Daily Check List. Note: ODCL's will be maintained for 3 years. At least the most recently run ODCL shall be maintained in holders installed at each crane.
QRS	11.	Prior to placing rigging, the QRS shall: <ul style="list-style-type: none"> a. Verify that the inspection tag on the lift device is current. b. Ensure that the rigging has been approved for critical lifts by evidence of gold stripes on a black background marked on the rigging. c. Ensure the monthly wire rope inspection has been completed within the past 30 days.
Riggers	12.	Respond to the direction of the QRS for performing the lift. Inspect all lifting equipment used and assure that the rigging is performed according to procedure. Other personnel may assist the riggers during the lift procedure as needed, however, qualified PPPL riggers, QRS or subcontractor QRS with Lift Manager approval must check all rigging.
QRS	13.	Complete and approve the Lift Data Sheet.
	14.	Visually inspect, check for current equipment inspection, and approve all lifting equipment prior to use. Ensures that the rigging has been approved for critical lifts by evidence of gold stripes on a black background marked on the rigging. Ensures the proper annual inspection color mark on slings and inspection sticker on cranes and hoists. Note: The following convention will be used. Colors: Black, Red, Orange, Yellow, Green, Blue, Violet, and White will be used in the order stated. For calendar year (CY) 2008 black will be used, for CY 2009 Red, and so on.
Cognizant Engineer/ Physicist	15.	Sign the Lift Data Sheet accepting responsibility for the equipment safety.
Lift Engineer	16.	Interpret technical aspects of lift procedures that affect the hoisting and rigging and witness their implementation.
	17.	Review Lift Data Sheet, documents any modifications and allows rigging to be placed.
Cognizant Engineer/ Physicist	18.	Interpret technical aspects of the lift procedure and Lift Data Sheet that protect the item to be lifted and witness their implementation.
Lift Personnel (all)	19.	Ensure that all personnel in the lift area wear hard hats within 20 feet of the crane shadow.

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COG and Lift Engineer	20.	Concur that the Lift Data Sheet reflects the hoisting and rigging setup; if applicable, revise the spare copy of the Lift Data Sheet, approve the Lift Data Sheet, and give permission to the QRS to proceed with the lift. Both individuals shall remain at the lift location during the lift.
Cognizant Engineer/ Physicist	a.	monitor and retain overall responsibility for the safety of the equipment.
Lift Engineer	b.	monitor and retain overall responsibility for the hoisting and rigging for non-repetitive lifts.
QRS	21.	Direct riggers to place rigging. NOTE: If weight of load is estimated and exceeds 75% of the rated capacity, a load cell is required to weigh the load either prior to or during the lift unless waived by the lift engineer in writing.
Qualified Riggers	22.	Place rigging.
QRS	23.	Verify rigging has been placed and direct the lift according to the procedure.
QRS, CLCO, COG, LE	24.	Approve the performance of the lift by printing and initialing the Lift Data Sheet.
CLCO	25.	Maintain a thorough knowledge of crane operation requirements of this Standard, implement them on each lift and stop any lift that appears unsafe.
	26.	Respond to the direction of the QRS for performing the lift. Only a qualified crane operator may operate a crane (Chapter 6).
COG	27.	Sign Lift Data Sheet to indicate that the equipment is secure and that rigging may be removed.
QRS	28.	Direct the rigging removal and returns hoisting and rigging to equipment storage area.
COG	29.	Return completed and signed-off Lift Data Sheet, and, if applicable, the revised Lift Data Sheet to the PPPL Operations Center.
OPs Center	30.	File the Lift Data Sheet(s).

NOTE: FAILURE TO FOLLOW SAFE WORK STEPS MAY SUBJECT EMPLOYEES TO DISCIPLINARY ACTIONS UP TO AND INCLUDING DISMISSAL AS DESCRIBED IN THE LABORATORY CODE OF CONDUCT POLICY.

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8.0 PERFORMING A REPETITIVE CRITICAL LIFT

Note: Any person may request the stoppage of any lift that appears unsafe at any time.

Requirements for ALL lifts:

- Hard hats must worn by all people in the lift area.
- The Lift Area is the horizontal distance from the bridge equal to the height of the bridge or the radius around a mobile crane equal to the fully extended boom length.
- The lift area needs to have a barrier, lights or a lift crew member to warn and protect people from entering the lift area.
- Only members of the Lift Crew shall be in the Lift Area during lifting operations.
- Tag lines may only be handled by a qualified rigger.
- A helper may assist a qualified rigger but a qualified rigger must inspect all rigging prior to use as well as any hitches/connection made by the helper prior to the lift. The helper must remain outside the Lift Area during the lift.

Responsibility	Action
Responsible Engineer (RE)	1. Support staffing requirements of lift teams. TCR-ES-MECH-007,R2-001
Lift Manager	2. After a critical lift has been performed the first time, a repetitive lift may be authorized by the Lift Manager. The Lift Manager will approve a lift as repetitive and give the lift data sheet an expiration date, typically one or two years. 3. Lift Manager (or Lift Engineer) will initial next to the printed name of each QRS or CLCO previously present during that lift. Other qualified individuals may be added to subsequent lifts.
Cognizant Engineer/Physicist	4. Obtain the following: <ol style="list-style-type: none"> a. One copy of the latest revision to the lift procedure. b. A copy of the Repetitive Lift Data Sheet specifying the configuration of the planned lift for use. <p>Note: The tracking page of Section 6 of this chapter shall be used to allow tracking of the most up-to-date copy of the repetitive lift data sheet and to ensure the proper sheet is used for the lift.</p>

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| Cognizant Engineer/
Physicist | 5. Arrange for a Qualified Rigging Specialist (QRS), Critical Lift Crane Operator (CLCO), and riggers to perform the lift using the existing procedure. Verify that all qualifications are current. Include at least two members from either the original lift team or of a previously performed lift that were acting in the capacity of a, QRS, or CLCO. Members authorized will have their names initialed by the Lift Manager or Lift Engineer on the Repetitive Lift Data Sheet. |
| | 6. For mobile crane lifts at more than 75 percent of crane capacity (per load chart) notify the Lift Manager. |
| Cognizant Engineer/
Physicist | 7. Conduct a pre-lift meeting with all personnel associated with the lift. |
| | 8. Sign the lift data sheet that all prerequisites have been completed prior to the lift (i.e. shutdown, disconnection, and disassembly). |
| Critical Lift Crane
Operator | 9. Perform Operator's Daily Check List.

Note: ODCL's will be maintained for 3 years. At least the most recently run ODCL shall be maintained in holders installed at each crane. |
| | 10. Prior to placing rigging, the QRS shall: <ul style="list-style-type: none"> a. Verify that the inspection tag on the lift device is current. b. Ensure that the rigging has been approved for critical lifts by evidence of gold stripes on a black background marked on the rigging. c. Ensure the monthly hook & wire/chain inspection has been completed within the past 30 days. |
| Riggers | 11. Respond to the direction of the QRS for performing the lift. Inspect all lifting equipment used and assure that the rigging is performed according to procedure. Other personnel may assist the riggers during the lift procedure as needed, however, only qualified PPPL riggers, QRS or subcontractor QRS with Lift Manager approval must check all rigging. |
| QRS | 12. Complete and approve the Lift Data Sheet. Note: The QRS acts on behalf of the Lift Engineer for repetitive lifts and accepts responsibility for conducting the lift safely. |
| | 13. Interpret technical aspects of lift procedures that affect the hoisting and rigging; and witness their implementation. |
| | 14. Review Lift Data Sheet and allows rigging to be placed. |
| | 15. Monitor and retain overall responsibility for the hoisting and rigging for repetitive lifts. |
| | 16. Checks the qualification status of the individuals assigned to the lift. |

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| QRS | 17. Visually inspect, check for current equipment inspection, and approve all lifting equipment prior to use. Ensures that the rigging has been approved for critical lifts by evidence of gold stripes on a black background marked on the rigging. Ensures the proper annual inspection sticker on cranes and hoists, color mark on slings. Note: The following convention will be used. Colors: Black, Red, Orange, Yellow, Green, Blue, Violet, and White will be used in the order stated. For calendar year (CY) 2016 black will be used, for CY 2017 Red, and so on. |
| COG | 18. Sign the Lift Data Sheet accepting responsibility for the equipment safety. |
| | 19. Interpret technical aspects of the lift procedure and Lift Data Sheet that protect the item to be lifted and witness their implementation. |
| | 20. Concur that the Lift Data Sheet reflects the hoisting and rigging setup; approve the Lift Data Sheet, and give permission to the QRS to proceed with the lift. Both individuals shall remain on site during the lift the COG shall monitor and retain overall responsibility for the safety of the equipment. |
| QRS | 21. Direct riggers to place rigging. |
| | NOTE: The QRS shall monitor and be responsible for checking if the weight of load is estimated and exceeds 75% of the rated capacity, a load cell is required to weigh the load either prior to or during the lift unless waived by the lift manager. |
| Qualified Riggers | 22. Place rigging. |
| Lift personnel (all) | 23. Ensure that all personnel in the lift area wear hard hats within 20 feet of the shadow of the crane. |
| QRS | 24. Verify rigging has been placed and direct the lift according to the procedure. |
| CLCO | 25. Respond to the direction of the QRS for performing the lift. Only a CLCO may operate a crane for a critical lift. |
| COG | 26. Sign Lift Data Sheet to indicate that the equipment is secure and that rigging may be removed. |
| QRS | 27. Direct the rigging removal and returns hoisting and rigging to equipment storage area. |
| COG | 28. Return completed and signed-off Lift Data Sheet, and, if applicable, the revised Lift Data Sheet to the PPPL Operations Center. |
| OPs Center | 29. File the Lift Data Sheet(s). |

CHAPTER 5 PERSONNEL TRAINING AND QUALIFICATION

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1.0 INITIAL TRAINING AND QUALIFICATION RESPONSIBILITIES

This section details the training and qualification requirements for Riggers, Pendant Crane Operators, Cab Crane Operators, Cab Remote Crane Operators, Mobile Crane Operators, Critical Lift Crane Operators, Maintenance Qualified Inspectors, and Qualified Rigging Specialists. Qualified personnel or trainees shall be at least 18 years old and understand spoken and written English. Sections 3.0 and 4.0 lists general qualification requirements and Section 6.0 is used by Human Resources to document an individual's qualification and history.

Responsibility	Action
Candidate's Supervisor or Manager	<ol style="list-style-type: none"> 1. Determine the qualification required (see examples in Sections 3.0 and 4.0) and requests training and qualification of personnel by contacting Human Resources. Requests guidance from the Lift Manager, as necessary. <p>Note: Crane Operators with external certification(s) may not require classroom training or written test with Lift Manager approval. (External certification must be from an OSHA Accredited Organization, OAO)</p>
Human Resources	<ol style="list-style-type: none"> 2. Consult with the PPPL Lift Manager and select a qualified instructor to provide classroom training, practical training, and required tests, as applicable. [Courses are approved PPPL courses or outside training approved by Lift Manager.] 3. Schedule training and makes all necessary logistical arrangements for the training. 4. Notify the candidate of required scheduled training and arranges for practical training.

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| Candidate | <p>5. Attend the scheduled training course, or arranges to challenge any required training and tests through Human Resources.</p> <p>6. Provide lift resume/experience summary (Section 6), as required, for the qualification sought.</p> <p>7. Complete medical examination requirements, as applicable.</p> |
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| Qualified Instructor | <p>8. Provide the appropriate training and testing. If crane operations qualification is requested, the candidate is evaluated on each type of crane/hoist used and the instructor documents the training on a Performance Evaluation checklist (see examples in Section 7.0 for Crane operators and see Sections 8.0 and 9.0 for Riggers).</p> |
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NOTE: Because of their unique nature, each cab crane or mobile crane requires individual instruction. Qualification Card will list which cab cranes operator has been instructed on.

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| Human Resources | <p>9. Prepare and maintain a qualification package for each successful candidate.</p> <p>10. Prepare a PPPL Qualification Card with the appropriate qualification and expiration date entered on the card (see Section 10.0). If a crane or hoist qualification is given, the applicable cranes or hoists are listed on the card. PPPL qualifications are valid for a period not to exceed three (3) years from the date of the practical or written test, whichever date is earliest provided the medical examination requirements, if applicable, are current.</p> <p>11. Sign the PPPL Qualification Card for Riggers or forwards the card and checklist to the Lift Manager for Crane Operator for approval.</p> |
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| Lift Manager or Designee | <p>12. Sign the PPPL Qualification Card (see Section 10.0) and Performance Evaluation checklist for Crane Operators, and return both the card for distribution, and the checklist, for record purposes to Human Resources.</p> |
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CHAPTER 5 PERSONNEL TRAINING AND QUALIFICATION

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Human Resources

13. Copy the completed card (both sides) for file, and distributes the card to the individual.
14. Maintain training and qualification records.
15. Monitor due dates and notifies the individual's manager or supervisor of actions needed to maintain or renew qualifications.

2.0 CONTINUING TRAINING AND QUALIFICATION RESPONSIBILITIES

This section outlines the continuing (ongoing) training and qualification requirements for the Lift Qualifications listed in Lift Personnel Qualifications Requirements, Sections 3.0 and 4.0.

Responsibility	Action
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Human Resources

1. Notify the individual's supervisor or manager of continuing training and qualification requirements (such as medical examinations) that require completion.

NOTE: Initial qualifications are issued for an effective period not to exceed three (3) years, unless otherwise specified or revoked, at which time requalification is required. If it is determined at any time that the capabilities of an individual are not in accordance with the qualifications specified for that job, that individual shall be removed from that job. Such removals shall be handled on a case-by-case basis by the PPPL Lift Manager and the applicable supervisor.

Individual's
Supervisor and
Manager

2. Notify the individual of these continuing training and qualification requirements (such as medical examinations).

Note: Crane Operators with external certification(s) may not require classroom training or written test with Lift Manager approval.

Human Resources

3. Arrange for refresher training and required tests for applicable qualification for Crane Operator.
4. Schedule practical training.
5. Notify the individual of scheduled practical training.

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| Individual/
Candidate | <p>6. If required, complete refresher training and challenge tests through Human Resources. Note: Written tests must be current in order to renew Rigger OJT and Crane Practical Exams.</p> <p>7. Complete medical examination requirements, as applicable.</p> |
| Qualified
Instructor | <p>8. Make all necessary logistical arrangements for Rigger, Pendant, Cab and Mobile Crane Operator and Crane Inspector qualifications.</p> <p>9. Provide the practical training and testing for Pendant, Cab and Mobile Crane Operator and Crane Inspector qualifications and documents it on a Performance Evaluation checklist (Section 7.0). Cab Crane Operators only need to be evaluated on one cab-type crane in order to renew all cab and pendant-type crane qualifications.</p> <p>NOTE: Crane Inspectors are not required to demonstrate proficiency in lifting a load. However, they must be proficient with all aspects of crane operation.</p> <p>10. Provide the practical training and testing for Rigger qualification, including any pendant hoists, and documents it on a Performance Evaluation checklist (Sections 8.0 and 9.0).</p> |
| Human Resources | <p>11. Prepare a PPPL Qualification Card (Section 10.0) with the appropriate qualification and expiration date entered on the card. If a crane or hoist qualification is given, the applicable cranes or hoists are listed on the card. PPPL qualifications are valid for a period not to exceed three (3) years from the date of the practical or written test, whichever date is earliest provided the medical examination requirements, if applicable, are current.</p> <p>12. Sign the PPPL Qualification Card for Riggers, or forwards the card and checklist to the Lift Manager for Crane Operator for approval.</p> |
| Lift Manager or
Designee (Lift
Engineer or
Qualified Lift
Instructor) | <p>13. Signs the PPPL Qualification Card (see Section 10.0) and Performance Evaluation checklist for Crane Operators, and return both the card for distribution, and the checklist, for record purposes to Human Resources.</p> |

CHAPTER 5 TRAINING AND QUALIFICATION

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| Lift Manager | 14. Affirm continued proficiency within qualification area of CLCO or QRS by signing the PPPL Qualification Card, indicating qualification as a CLCO or QRS, and returning the card to Human Resources for distribution. |
| Human Resources | 15. Copy the completed card (both sides) for file, and distribute the card to the individual. |
| | 16. Maintain training and qualification records. |
| | 17. Monitor due dates and notify the individual's manager or supervisor of actions needed to maintain or renew qualifications. |
| Lift Manager | 18. Perform periodic program evaluation with PPPL Lift Engineers and QRS's. Distributes industry operating experience and Lessons Learned (both PPPL and external) to Riggers, Crane Operators, and Lift Engineers. |

CHAPTER 5 TRAINING AND QUALIFICATION

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3.0 LIFT PERSONNEL QUALIFICATION REQUIREMENTS (RIGGER, PENDANT CRANE OPERATOR, CAB CRANE OPERATOR, MAINTENANCE INSPECTORS, MOBILE CRANE OPERATOR)

	Rigger (includes all manual hoists ≤ 5 tons) (portable or installed)	Pendant Crane Operator	Cab Crane Operator	Maintenance Technicians and Qualified Overhead Crane Inspectors*	Mobile Crane Operator
Prerequisite	None	Qualified Rigger or OAO Certification	Qualified Rigger or OAO Certification	Approved Maintenance/ Crane Inspector Course	Qualified Rigger and Pendant crane or OAO Certification
Initial Training and Testing	Hoisting and Rigging (H&R)	Overhead Crane Operator or OAO Certification	Overhead Crane Operator or OAO Certification	Overhead Crane written exam	Mobile Crane Operator or OAO Certification
Initial OJT and Practical Test	Rigging Practical	Pendant Crane Practical by Individual Crane	Cab Crane Practical by Individual Crane	Crane Practical by Individual Crane	Mobile Crane Practical (by individual crane)
Annual Medical	No	No	No	No	Yes Per Chapter 1.0
Ladder Safety and Fall Protection	No	Yes	Yes	Yes	No
3 Year Requalification	<ul style="list-style-type: none"> H&R Refresher and Test Practical Evaluation 	<ul style="list-style-type: none"> Current Prerequisite Qualification Overhead Crane Refresher and Test or OAO Practical Evaluation on One (1) Pendant Crane Lift Manager Approval 	<ul style="list-style-type: none"> Current Prerequisite Qualification Overhead Crane Refresher and Test or OAO Practical Evaluation on One (1) Cab Crane Lift Manager Approval 	<ul style="list-style-type: none"> Current Prerequisite Qualification Overhead Crane Refresher and Test or OAO Practical Evaluation on One (1) Cab Crane Lift Manager Approval 	<ul style="list-style-type: none"> Current Prerequisite Qualification Practical Evaluation on One (1) Mobile Crane Lift Manager Approval

Table 5-1 Rigger, Pendant Crane Operator, Cab Crane Operator, Maintenance Tech Inspectors, Mobile Crane Operator Training Requirements

* To operate cranes, Maintenance Technicians and Qualified Inspectors only require the Crane Operator Course and the practical training. This provides qualification for operating all cranes without a load. Lifting is only allowed using pendant type cranes if the individual complies with Section 3.0. A qualified subcontractor may also carry out these responsibilities. Subcontract personnel may be hired to perform the qualified inspector crane duties. Subcontract inspectors must provide a statement of qualification as inspectors and operators including a current medical examination. The Lift Manager must approve such statement.

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4.0 LIFT PERSONNEL QUALIFICATION REQUIREMENTS (CRITICAL LIFT CRANE OPERATOR, QUALIFIED RIGGING SPECIALIST, LIFT ENGINEER)

	Critical Lift Crane Operator (CLCO)	Qualified Rigging Specialist (QRS)	Lift Engineer
Prerequisite	Rigger and Cab Crane and/or Pendant Crane Operator, or OAO Certification, Approved by Lift Manager	Rigger and CLCO, Approved by Lift Manager	An engineer appointed by the Head, Engineering Department
Initial Training and Testing	Overhead Crane Operator	Specialized Training, as determined by the Lift Manager, including running wire rope inspection	Specialized Training, as determined by the Lift Manager
Initial OJT and Practical Test	Assessment and approval from Lift Manager		Specialized Training, as determined by the Lift Manager
Annual Medical	No	No	No
Ladder and Fall Protection	Yes (If using a Cab Crane)	No	No
3 Year Requalification	<ul style="list-style-type: none"> • Current Prerequisite Qualification • Overhead Crane Refresher and Test or OAO • Lift Manager Approval 	<ul style="list-style-type: none"> • Current Prerequisite Qualification • Lift Manager Approval • Running wire rope inspection 	<ul style="list-style-type: none"> • Current Prerequisite Qualification • Head, Engineering Department approval

Table 5-2 Critical Crane Operator, Qualified Rigging Specialist, Lift Engineer Training Requirements**A. ATTENTION ALL RIGGERS:**

While the classroom video does a good job of describing how to operate push button pendant cranes, we don't check personnel out on each crane like we do with cab and pendant cranes greater than 5-ton capacity. Riggers must be provided OJT training on any cranes that they use. Therefore, those individuals who are ONLY rigger trained are only allowed to operate only manual hoists. In other words, individuals who are ONLY rigger trained are NOT allowed to operate motorized hoists or cranes until they get checked out on that hoist or crane by a crane trainer, receive a training sheet and receive an endorsement on their rigger qualification card from training. Pendant crane operators may operate the pendant cranes listed on their qualification card as well as any pendant crane less than or equal to 5 tons.

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5.0 LIFT PERSONNEL QUALIFICATION REQUIREMENTS (RECORDS AND EXAMINATIONS)**a. Qualification Records**

- 1) Personnel qualifications shall be documented in an easily auditable format and shall include, as a minimum, the following types of information:
 - i. Records of training completed at PPPL, or elsewhere, such as attendance sheets or computer summaries or certificates.
 - ii. Results of medical examinations where applicable.
 - iii. Records of training exceptions.
 - iv. Record of training and performance evaluations.
- 2) Written Examinations
 - i. Written examinations with a score of 85% or higher are required to pass any individual examination at PPPL.
 - ii. Written examinations are required for initial qualification and every 3 years thereafter.
- 3) Performance Evaluations
 - i. Performance evaluations are based upon the performance items enumerated in the applicable Performance Evaluation Checklist.
 - ii. No numerical value is assigned to operational evaluations. The candidate's demonstrations are evaluated by the examiner as "satisfactory" or "unsatisfactory" based upon the following criteria:
 - 1) The individual exhibits a basic ability in the performance area.
 - 2) The individual is capable of correctly performing the action after some clarification by the examiner.
 - iii. The job functions demonstrated, the candidate's performance in these demonstrations, and the examiner's evaluation shall be documented.
 - iv. The operational evaluation score for qualification shall be a composite grade of all individual operational evaluations. The composite score for operational evaluations shall be "satisfactory," with no outstanding "unsatisfactory" items (i.e., 100% of demonstrations should be "satisfactory").
 - v. Candidates must initially qualify for each crane, pendant hoists for Riggers, they operate.
 - vi. Candidates for requalification should perform hoisting and rigging operations twice a month on average and successfully complete a performance on one (1) of the type of crane operated (pendant, cab or mobile) in order to extend qualifications on each individual crane previously qualified and operated.

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6.0 LIFT RESUME

NAME: _____ **Date:** _____

- a. Years employed at PPPL: _____
- b. Years working in the Hoisting and Rigging Program: _____
- c. Classroom Lift Training: Course: _____ Date: _____

- d. Practical Training: Course: _____ Date: _____
- _____

- e. Indicate 12 lifts (at the highest qualified position), you participated in, preferably where a lift procedure was required:

<u>Lift:</u>	<u>Date:</u>
1) _____	_____
2) _____	_____
3) _____	_____
4) _____	_____
5) _____	_____
6) _____	_____
7) _____	_____
8) _____	_____
9) _____	_____
10) _____	_____
11) _____	_____
12) _____	_____

- f. Last PPPL Medical Exam: _____ ☐ N/A

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7.0 CRANE OPERATOR REQUEST FORM AND PERFORMANCE EVALUATION

Trainee (<i>Please Print</i>): _____	Date: _____
Existing Qualifications: <input type="checkbox"/> Crane Classroom Course or <input type="checkbox"/> Resume Completed <input type="checkbox"/> OAO Certified* <input type="checkbox"/> Current Crane Expiration _____ *Attached <input type="checkbox"/> Medical (<i>if applicable</i>) _____	
Type: <input type="checkbox"/> Remote <input type="checkbox"/> Pendant <input type="checkbox"/> Cab <input type="checkbox"/> Critical <input type="checkbox"/> Broderson <input type="checkbox"/> Grove <input type="checkbox"/> Other <input type="checkbox"/> Maintenance	
Location: <input type="checkbox"/> D-Site <input type="checkbox"/> C-Site <input type="checkbox"/> Shops	
<i>List desired crane:</i> _____	
<i>Trainee Signature</i> _____ Date: _____	
<i>Supervisor's Recommendation:</i> <input type="checkbox"/> Concur / <input type="checkbox"/> Disagree _____ <i>Supervisor Signature</i> _____ Date: _____	
<i>Crane Instructor's Evaluation:</i> Evaluated Cranes: <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <input type="checkbox"/> NSTX Test Cell (NTC)* <input type="checkbox"/> TFTR Test Cell (D-TC)* <input type="checkbox"/> Mock Up (D-MU)* <input type="checkbox"/> RESA* <input type="checkbox"/> * Remote </div> <div style="width: 30%;"> <input type="checkbox"/> D-Site MG (D-MG) <input type="checkbox"/> Neutral Beam (NBPC) <input type="checkbox"/> Rad Waste Building* <input type="checkbox"/> Grove <input type="checkbox"/> Broderson </div> <div style="width: 30%;"> <input type="checkbox"/> C-Site MG (C-MG) <input type="checkbox"/> ESAT <input type="checkbox"/> CS* <input type="checkbox"/> RF #15 (15 ton) <input type="checkbox"/> _____ </div> </div>	
Performance Evaluation: <input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory	
Comments: _____ <i>Signature</i> _____ Date: _____	
<i>Lift Manager Review:</i> <input type="checkbox"/> Approve / <input type="checkbox"/> Disapprove _____ <i>Signature</i> _____ Date: _____	

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8.0 CRANE OPERATOR PERFORMANCE EVALUATION

*For each statement below, check (ü) either S (Satisfactory) or U (Unsatisfactory).
For items that do not apply, use NA (Not Applicable).*

	<u>S</u>	<u>U</u>
1. Performed Operator's Daily Checklist.	_____	_____
2. Secured work area(s) prior to operations (e.g., roped, coned off area, placed signs)	_____	_____
3. Accessed crane properly during normal conditions.	_____	_____
4. Tested Lift.	_____	_____
5. Operated Controls properly.	_____	_____
a. Performed smooth operation of bridge/trolley controls	_____	_____
b. Performed smooth operation of mobile crane controls.	_____	_____
c. Raised & Lowered hook(s) so as not to shock load.	_____	_____
d. Remote (if applicable)	_____	_____
6. Cleared obstacles at a safe distance.	_____	_____
7. Understood/responded properly to hand signals.	_____	_____
8. Understood/responded properly to verbal instructions.	_____	_____
9. Demonstrated acceptable depth perception.	_____	_____
10. Shutdown the crane properly:	_____	_____
a. Placed bridge/trolley in correct position.	_____	_____
b. Placed cab in proper position.	_____	_____
11. Egressed crane properly during normal conditions.	_____	_____

Restrictions: _____

Comments: _____

Approved by: _____
Instructor's Signature

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9.0 RIGGER/PORTABLE HOIST PERFORMANCE EVALUATION CHECK LIST

Operator's Name _____ Date _____
(Please Print)

Instructor _____ Supervisor _____
(Please Print) (Please Print)

For each statement below, check either S (Satisfactory) or U (Unsatisfactory).

1. Equipment identification and inspection:

S U

a.	Properly inspected slings for defects.		
b.	Identified faulty sling (if existed).		
c.	Properly inspected accessories for defects.		
d.	Properly inspected hoist/chainfall for defects/current sticker.		
e.	Hoist/chainfall used for inspection		
f.	Properly inspected hook for defects.		
g.	Inspected spreader/fixture sticker.		

2. Pre-Planning:

S U

a.	Determined load weight.		
b.	Determined load center of gravity.		
c.	Determined proper rigging required for job.		
d.	Determined rough angle of rigging for load angle factor.		
e.	Determined if existing configuration of load could be safely rigged.		

3. Center of Gravity (CG)

S U

a.	Rig to CG.		
b.	Figure offset of CG.		

4. Load Angle Factor (LAF) guide sheet and problems:

S U

a.	Check LAF.		
----	------------	--	--

5. Determined proper configuration for:

S U

a.	Balanced load (connection point above the CG).		
b.	Unbalanced load (basket hitch under the CG).		
c.	Loads with offset center of gravity.		
d.	Various rigging angles.		
e.	Select equipment (shackle, sling, chainfall, swivel hoist rings)		

6. Successfully demonstrated the following actions:

S U

a.	Rigged with a basket hitch.		
b.	Rigged with a vertical/straight hitch.		
c.	Rigged with a choker hitch.		
d.	Rigged with a D-D Ratio		
e.	Sling protection		
f.	Rigged with a multiple leg – only use 2 legs		
g.	Rigged to hoist.		

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h.	Installed shackle correctly.		
<i>For each statement below, check (v) either S (Satisfactory) or U (Unsatisfactory).</i>			

7. Successfully verified rigging

S U

a.	Positioned hook over CG.		
b.	Applied gentle strain to check rigging.		
c.	Lifted slightly to verify level lift.		
d.	Corrected any imbalances.		
e.	Demonstrated proper tag-line usage.		
f.	Properly stowed rigging when completed.		

8. Successfully performed lift

S U

a.	Performed ODCL on fixed hoist (< 5 tons)		
b.	Secured work area prior to operations (roped or coned off)		
c.	Tested lift		
d.	Lifted load safely and smoothly.		
e.	Traveled Smoothly		
f.	Lowered load safely and smoothly.		
g.	No persons or body parts were under lifted load.		
h.	Installed shackle correctly.		
i.	Cleared obstacles at a safe distance		
j.	Properly secured hoist when finished.		

9. Signaling

S U

a.	Demonstrated proper use of hand signals.		
b.	Understood and responded to hand signals during lift.		
c.	Understood and responded to verbal signals during lift.		

*****If you're not taught to use specific equipment, do **NOT** use it.*****

Restrictions: _____

Comments: _____

Hoists checked out on _____

Chainfalls checked out on _____

Approved by: _____

Instructor's Signature

Instructor's Signature

CHAPTER 5 TRAINING AND QUALIFICATION

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TR-FORM – 31 REV 5, 9/2016

Operator's Name _____

10.0 RIGGER/FIXED HOIST PERFORMANCE EVALUATION CHECK LIST

PERFORMANCE EVALUATION

Operator's Name _____ Date _____
(Please Print)Instructor _____ Supervisor _____
(Please Print) (Please Print)*For each statement below, check (v) either S (Satisfactory) or U (Unsatisfactory).*

Successfully operated hoist		S	U
a.	Performed ODCL on fixed hoist (< 5 tons)		
b.	Secured work area prior to operations (roped or coned off)		
c.	Tested lift		
d.	Lifted load safely and smoothly.		
e.	Traveled Smoothly		
f.	Lowered load safely and smoothly.		
g.	No persons or body parts were under lifted load.		
h.	Installed shackle correctly.		
i.	Cleared obstacles at a safe distance		
j.	Properly secured hoist when finished.		

*****If you're not taught to use specific equipment, do **NOT** use it.*****

Restrictions: _____

Comments: _____

Hoists checked out on _____

Chainfalls checked out on _____

Approved by: _____
Instructor's Signature Instructor's Signature

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For Each Hoist/Chainfall trained on and passed enter an S, Failed enter a U, Blank if not trained

ID	Crane & Weight (Tons)	S	U
117	Canal PH Hoist (0.25)		
109	CAS Crane (2)		
28	CLEAN RM Crane (1)		
105	CMG 1st floor Gantry (0.5)		
108	CMG Bsmnt Hoist (0.25)		
29	CMG Monorail (1)		
139	CS HiBay North Jib (1)		
10	D-Site Gantry (5)		
107	D-Site Hoist (3)		
26	DCON Jib (0.5)		
46	DMG-2 Monorail (5)		
32	DTower Crane (5)		
95	ESAT Hoist (2)		
56	ESAT Jib (0.5)		
57	ESAT Jib (1)		
25	ESAT Monorail (2)		
55	FCPC 2nd 246 Jib (0.25)		
40	FCPC-2 Monorail (2)		
66	L-110 Monorail (0.5)		
24	LTX Gantry (0.5)		
110	MER #83 Jib (0.5)		
49	MER AS Jib (1)		
178	MU Hoist (1.5)		
38	MU Monorail (2.5)		
115	MU Monorail (2)		
7	MU Rope hoist (0.25)		
122	NBPC Hoist (1)		

ID	Crane & Weight (Tons)	S	U
35	NBPC Underhung (3)		
44	NBPC-138 Gantry (2)		
45	NBPC-138 Monorail (3)		
111	NBPC-2 Gantry (1)		
92	PBX Hoist (1)		
18	Pump House Monorail (0.5)		
59	Pump Room Gantry (0.5)		
9	Pump Room Rope hoist (1)		
8	RESA Crane (2)		
106	RESA Hoist (3)		
47	RESA Jib (1)		
79	RESA Jib (1)		
14	RF Hi Bay Crane (5)		
16	RF-1 R104 Crane (2)		
21	RF-107&108 Crane (2)		
80	RF-2 R229 Monorail (0.5)		
2	RF-2 R232 Hoist (0.5)		
4	RF-2 R232 Monorail (0.5)		
17	RF-2 R233 Monorail (0.5)		
19	RF-2 R233 Monorail (0.5)		
5	RF-2 R234 Underhung (1)		
123	RF-3 R310A Hoist (0.5)		
20	RF-3 R320 Hoist (0.5)		
54	Tritium B Monorail (0.5)		

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Operator's Name _____

11.0 QUALIFICATION CARD EXAMPLE

FRONT of CARD

Name: _____ is qualified to
Operate the following equipment at PPPL:

<input type="checkbox"/> Rigger	Valid to _____
<input type="checkbox"/> Forklift IC Electric Walkie	_____
<input type="checkbox"/> Aerial Boom Lift	_____
<input type="checkbox"/> Scissor Lift	_____
<input type="checkbox"/> Backhoe	_____
<input type="checkbox"/> Skid Steer	_____
<input type="checkbox"/> Valid Driver's License	

Issued by: _____
Human Resources

BACK of CARD

Crane Operator: ☐ BMC ☐ Grove Valid to _____
☐ Cab ☐ Pendant ☐ Maint Ops _____
 Cranes or Hoists Qualified to Operate:

☐ QRS ☐ CLCO _____
 Lift Manager Approval/Date

Medical Exam Expiration Date (*Required for Mobile*)

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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1.0 INSPECTION, MAINTENANCE AND TESTING RESPONSIBILITIES**A. PERIODIC (ANNUAL) INSPECTION**

Responsibility	Action
Equipment Owner	1. Know where equipment is at all times and provide equipment for inspection.
OPs Center	2. Maintain the inspection records for periodic inspection/maintenance.
Lift Manager	3. Maintain due date to inspect equipment periodically on Inspection Status List. If the maintenance or inspection is not completed the equipment shall be CAUTION tagged OUT OF SERVICE until such time as the required actions are completed.
Lift Manager	4. Determine if each crane is to be kept in service. <ul style="list-style-type: none"> a. If crane is not to be kept in service, request the equipment owner to CAUTION tag item OUT OF SERVICE. b. If crane is to be kept in service continue to step 5.
Procurement Technical Representative (PTR)	5. Determine when during the calendar year each crane periodic inspection/maintenance is due. 6. Arrange for a qualified crane inspector/technician or subcontractor to perform the inspection/maintenance.
Qualified Crane Inspector or Qualified Subcontractor	7. Perform required crane maintenance per the manufacturer's recommendations and periodic inspection as per the Overhead Crane Inspection Criteria (Section 6.0) or the Mobile Crane Inspection Criteria (Section 7.0). 8. Perform running wire rope inspection (Section 8.0) and records on ODCL per Section 9.0. 9. Determine if rope needs maintenance. <ul style="list-style-type: none"> a. If yes, perform required rope maintenance. b. If no, continue

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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**1.0 INSPECTION, MAINTENANCE AND TESTING RESPONSIBILITIES
(continued)**

- | | |
|--|---|
| Qualified Crane Inspector or Qualified Subcontractor | <p>10. Perform Hook Non Destructive Examination (NDE) if required per Section 6.0 or Section 7.0 of this Chapter.</p> <p>11. Record the inspection/maintenance on the appropriate Periodic Inspection Report (Sections 10.0, 11.0, 13.0 and 15.0) or maintenance report.</p> <p>12. Check all motion limit devices for proper performance.</p> <p>13. Check rope reeving for compliance to manufacturer's design.</p> <p>14. All function, instruction, caution, and warning labels or plates for legibility.</p> <p>15. If no deficiencies are found, submit inspection report to Lift Manager and affix inspection sticker, showing expiration date either to pendant control and/or cab control, remote control and exterior of mobile cranes if present, contact PTR.</p> <p>16. If deficiencies are found, submit inspection report to Lift Manager and have PTR apply CAUTION tag OUT OF SERVICE.</p> |
| Lift Manager | <p>17. Review, sign and submit all inspection reports to OPs Center, and update inspection status list.</p> |
| OPs Center | <p>18. Check for Lift Manager's signature, file inspection reports.
Note: Maintenance/Inspection Reports are maintained for the life of the crane.</p> |
| Area QRS | <p>19. Perform a monthly hook and wire rope inspection and records inspection on ODCL form.</p> <p>Note: Other competent individuals trained in wire rope and hook inspection may be designated to perform wire rope and hook inspections by the Lift Manager.</p> |

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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B. DAILY INSPECTION

Responsibility	Action
Crane Operator or Mobile Crane Operator	1. Obtain proper Operator's Daily Check List form for the equipment to be used.
	2. Check that the Hook and Chain or Wire Rope Monthly Inspection is current. If not current, have Area QRS perform the required inspections.
	3. Perform the ODCL inspection on the crane marking using the ODCL checklist from Section 9.0 (Operator's Daily Checklist, Cranes), Section 12.0 (Grove Mobile Crane Daily Inspection Report) or Section 14.0 (Broderson Mobile Crane Daily Inspection Report).
	4. Perform a monthly hook and wire rope inspection and records inspection on ODCL form if required.
	5. Determine if deficiencies are found (Satisfactory or Unsatisfactory). <ul style="list-style-type: none"> a. If none, sign and date ODCL, store with crane. b. If yes, submit inspection report to Lift Manager and apply CAUTION tag OUT OF SERVICE.
Crane Operator or Mobile Crane Operator Area QRS	6. Submit the ODCL to the Area QRS at the end of the day for filing.
	7. File ODCL. ODCL's will be maintained for 3 years. At least the most recently run ODCL shall be maintained in holders installed at each crane that has running wire ropes.

C. CRANE LOAD TEST RESPONSIBILITIES

Rated Load Test: Prior to initial use, all new or reinstalled hoists/cranes and hoists/cranes in which the load sustaining parts have been altered, modified, repaired, or replaced, or whose rated capacities have been affected shall be tested by a QRS or a qualified crane operator under the direction of a Qualified Crane Inspector (PPPL Qualified Crane Inspectors are not qualified to perform load lifts). Test loads shall not be less than 100 percent or more than 125 percent of the rated capacity, unless otherwise recommended by the manufacturer. The replacement of load chain and rope is specifically excluded from this requirement; however, an operational test of the crane shall be made prior to putting the equipment back in service.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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C. CRANE LOAD TEST RESPONSIBILITIES (continued)

RESPONSIBILITY ACTION

Qualified Subcontractor for crane inspection 1. Perform periodic inspection per Overhead Crane, Inspection Criteria (Section 5.0). Assure NDE of hook is current if hook is greater than 10 ton capacity for greater than normal service category*. If the maintenance or inspection is not completed, the equipment shall be CAUTION tagged OUT OF SERVICE until such time as the required actions are completed.

* NOTE: All PPPL lifting equipment falls under normal service use. NDE is not normally required.

QRS 2. Determine load test weights and rigging.
3. Document load test configuration on Load Test Data Sheet (Chapter 14) and signs.
4. Arrange to have weights moved to the load test site.
5. Notifies QC of load test.

Lift Manager 6. Approves the Load Test Data Sheet (Chapter 14).

Crane Operator 7. Perform ODCL inspection per Section 9.0, 12.0 or 14.0.

Note: ODCL's will be maintained for 3 years. At least the most recently run ODCL shall be maintained in holders installed at each crane that has running wire ropes.

Riggers 8. Perform rigging inspection and reports to QRS all items are acceptable.

QRS 9. Verify and sign the Load Test Data Sheet.

Riggers 10. Place rigging.

QRS 11. Perform load test according to the Load Test Data Sheet (Chapter 14).

Lift Engineer/QC 12. Witness and sign the Load Test Data Sheet confirming that load test was performed as documented. Note: The Lift Manager may N/A the requirements for the Lift Engineer to witness the load test.

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QRS

13. Submit Load Test Data Sheet to Operations Center for filing.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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2.0 MAINTENANCE REQUIREMENTS**A. GANTRY AND OVERHEAD CRANES**

Note: No modifications or additions which affect the capacity or safe operation of the equipment shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

- i. Maintenance shall be performed according to the manufacturer's recommendations and as a minimum shall meet the requirements of OSHA, 29 CFR 1910, 29 CFR 1926, ESH-001 (Tagout) and ESH-016 (Lock Out).
 - a. Power plant shall be stopped and starting means rendered inoperative.
 - b. All controls in the off position and all operating systems secured from inadvertent motion by brakes, blocks or other means.
 - c. Moved to a location where it will cause the least interference with other cranes and operations.
 - d. Other manufacturer specified precautions.
- ii. A scheduled planned maintenance, lubrication and inspection system shall be followed based on the manufacturer's recommendations.
- iii. Only qualified, trained and authorized personnel shall be permitted to maintain, repair, adjust and inspect cranes.
- iv. Unusual maintenance or repairs require consultation with the manufacturer.
- v. All parts requiring replacement shall be replaced only by parts equivalent as to the safety of those used in the original design.
- vi. Repaired cranes shall be inspected prior to be returned to service by qualified inspectors or sub contractors. The inspection report will be signed by the inspector and the Lift Manager and be filed in the equipment's file in the Operations Center.
- vii. Safety switches and functionality shall not be impaired by service technicians unless required for the repair operation. Such impaired cranes shall be tagged as out of service until the safety impairment is removed.
- viii. All loads shall be landed prior to any repair work being performed.
- ix. Warning signs and barriers shall be placed under crane where overhead maintenance creates a hazard.
- x. A barrier or signal person is required if the runway must remain energized to prohibit other cranes from approaching the crane being worked on or the equipment being used to work on it.
- xi. Pitted or burned electrical contacts shall be corrected only by replacement and in sets.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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B. MOBILE CRANES

Note: No modifications or additions which affect the capacity or safe operation of the equipment shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

- i. Maintenance shall be performed according to the manufacturer's recommendations and as a minimum shall meet the requirements of OSHA, 29 CFR 1910, 29 CFR 1926, ESH-001 (Tagout) and ESH-016 (Lock Out).
 - a. Power plant shall be stopped and starting means rendered inoperative.
 - b. Power Take Off shall be rendered inoperative.
 - c. All controls in the off position and all operating systems secured from inadvertent motion by brakes, blocks or other means.
 - d. Elevating booms and load blocks lowered to the full down position or otherwise secured by supports to prevent dropping.
 - e. Hydraulic oil pressure relieved from all hydraulic circuits before loosening or removing hydraulic components.
 - f. Other manufacturer specified precautions.
- ii. A scheduled planned maintenance, lubrication and inspection system shall be followed based on the manufacturer's recommendations.
- iii. Only qualified, trained and authorized personnel shall be permitted to maintain, repair, adjust and inspect mobile cranes.
- iv. Unusual maintenance or repairs require consultation with the manufacturer.
- v. All parts requiring replacement shall be replaced only by parts equivalent as to the safety of those used in the original design.
- vi. Repaired cranes shall be inspected prior to be returned to service by qualified inspectors or sub contractors. The inspection report will be signed by the inspector and the Lift Manager and be filed in the equipment's file in the Operations Center.
- vii. Safety switches and functionality shall not be impaired by service technicians unless required for the repair operation. Such impaired cranes shall be tagged as out of service until the safety impairment is removed.
- viii. Moved to a location where it will cause the least interference with other cranes and operations.
- ix. Replacement parts shall have at least original design factor.

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**3.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE
CRITERIA INTRODUCTION**

All PPPL cranes fall into the standby and normal service category as stipulated in the following list of requirements. Frequent and/or monthly Inspections are performed per this chapter and include manufacturer's recommendations using the ODCL (Sections 9.0, 12.0 or 14.0) as a checklist. Periodic Inspections are also performed per this chapter and include manufacturer's recommendations using the Crane Inspection Report (Section 10.0, 11.0 13.0 or 15.0) as the checklist. Checklists are the official PPPL records of inspections. ODCL's are maintained for 3 years. Periodic Crane Inspection Reports are maintained for the life of the crane.

4.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
Cranes	OPS CTR.

Table 6-1 Record Storage Requirements

5.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	<1 mo.	> 1 mo. & < 1yr.	≥ 1 yr.	
Cranes	ODCL Current Hook & Rope/mo.	ODCL & CIR* & Hook & Rope Insp.	ODCL & CIR* & Hook & Rope Insp.	MFG. Rec. & ODCL & CIR*

ODCL -- Operator's Daily Checklist (Sections 9.0, 12.0 or 14.0).

CIR* ---- Crane Inspection Report is indicated by a current inspection sticker

Table 6-2 Required Inspections (Must be ensured prior to each use)

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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6.0 OVERHEAD CRANE PERIODIC INSPECTION/TESTING CRITERIA**PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN OPS CTR. FOR LIFE OF CRANE

INSPECTION CHECK LIST:

- a. An [ODCL](#) shall be performed before any movement of the crane takes place.
- b. The following shall be inspected by a qualified person:
 - 1) All functional operating mechanisms shall be checked for proper operation, proper adjustment, and unusual sounds.
 - 2) Verify operation of the upper-limit device under no-load conditions. If more than one upper-limit device is present, only the operation of the primary upper-limit device needs be verified. Care shall be exercised; the block shall be inched into the limit or run in at slow speed.
 - 3) Deterioration or leakage in lines, tanks, valves, drain pumps and other parts of air or hydraulic systems.
 - 4) Hooks and latches in accordance with Chapter 9.
 - 5) Rope for proper spooling onto the drum(s) and sheaves(s).
 - 6) Components for deformation, cracks, or corrosion.
 - 7) Bolts, rivets, nuts, and pins for being loose or absent.
 - 8) Fasteners identified by DOE as "suspect" (for a list of DOE Suspect Headmarks, see Chapter 13, check QA web page <<http://www-local.pppl.gov/qa/SCI/SCI.shtml>>, or contact QA for further information).
 - 9) Sheaves and drums for cracks or wear.
 - 10) Parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices, bumpers, and stops for wear, cracks, or distortion.
 - 11) Brake-system parts, linings, pawls, and latches for excessive wear.
 - 12) Load, wind, and other indicators over their full range for any significant inaccuracies.
 - 13) Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with other applicable standards.
 - 14) Chain-drive sprockets for excessive wear and chains for excessive stretch.
 - 15) Electrical apparatus for signs of pitting or any deterioration of controllers, master switches, contacts, limit switches, and push-button stations (not limited to these items).

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TCR-ES-MECH-007,R2-001

6.0 Overhead Crane Periodic Inspection/Testing Criteria (continued)

- 16) Hooks for damage from chemicals, deformation, cracks, any visible apparent bend or twist from the plane of the unbent hook, or any distortion causing an increase in throat opening of 5% not to exceed 1/4 in. unless otherwise recommended by the manufacturer. See Chapter 9 for additional hook requirements.
- 17) Hook retaining nuts or collars and pins, welds, or riveting used to secure the retaining members for soundness.
- 18) Nondestructive examination of hooks, welds, bearings, or other suspect load-bearing parts when required by the inspector.
- 19) Testing of motion limit devices, which interrupt power or cause a warning to be activated, for proper performance (each motion shall be inched or operated at low speed into the limit device with no load on the crane).
- 20) Rope reeving for compliance with crane manufacturer's design.
- 21) All function, instruction, caution, and warning labels or plates for legibility.

TESTING:**a. Operational Tests**

- 1) Prior to initial use, all new, reinstalled, repaired, or modified cranes shall be tested by a designated person to ensure compliance with this chapter, including the following functions:
 - i. Lifting and lowering.
 - ii. Trolley travel.
 - iii. Bridge travel
 - iv. Locking, limiting, and indicating devices, if provided.
 - v. Limit switches/devices.
- 2) The trip setting of hoist-limit devices shall be determined by tests with an empty hook traveling at increasing speeds up to the maximum speed. The actuating mechanism of the upper-limit device shall be located so that it will trip the device under all conditions and in sufficient time to prevent contact of the hook or load block with any part of the trolley or crane.

b. Rated Load Test

- 1) Prior to initial use, all new or reinstalled cranes and cranes in which the load sustaining parts have been altered, modified, repaired, or replaced, or whose rated capacities have been affected shall be tested by a QRS or a qualified crane operator under the direction of a Qualified Crane Inspector (PPPL Qualified Crane Inspectors are not qualified to perform load lifts).
- 2) A written report confirming the rated load testing of the crane shall be furnished by the inspector.

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6.0 Overhead Crane Periodic Inspection/Testing Criteria (continued)

- 3) Test loads shall not be less than 100 percent or more than 125 percent of the rated capacity, unless otherwise recommended by the manufacturer or a qualified person.
- 4) Testing shall consist of the following operations as minimum requirements:
 - i. Hoist the test load a sufficient distance to ensure that the load is supported by the crane and held by the hoist brakes. Personnel shall be kept clear of the test load while it is suspended.
 - ii. Transport the test load by means of the trolley for the full length of the bridge.
 - iii. Transport the test load by means of the bridge for the full length of the runway, in one direction with the trolley as close to the extreme right-hand end of the crane as practical, and in the other direction with the trolley as close to the extreme left-hand end of the crane as practical.
 - iv. Lower the test load, stopping by the brakes.
- 5) The replacement of load chain and rope is specifically excluded from this requirement; however, an operational test of the crane shall be made in accordance with the operational testing requirements above prior to putting the crane back in service.
- 6) If wire rope clips or wedge socket end connection are installed during wire rope installation:
 - i. The crane should be cycled several times with a load equal to or greater than the maximum operational load, normally 100 percent of the rated capacity.
 - ii. If wire rope clips are used, then check and retighten nuts to the wire rope clip or wire rope manufacturer's recommended torque value.
 - iii. If a wedge socket is used, then verify that the rope is properly seated.
- 7) Operational testing of altered, repaired, or modified cranes whose load sustaining parts or rated capacities have not been affected may be limited to the functions affected by the alteration, repair or modification as determined by a qualified person.
- 8) Test loads should not be carried over critical systems or components.
- 9) Test loads shall be accurate to within -5 percent, +0 percent of stipulated values.
- 10) Perform periodic inspection requirements at the completion of the load test.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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7.0 MOBILE CRANE PERIODIC INSPECTION/TESTING CRITERIA**PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN OPS CT (WIRE ROPE AT CRANE).

INSPECTION CHECK LIST:

An [ODCL](#) shall be performed before any movement of the crane takes place (this satisfies the monthly and pre-operational check). Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard.

The following shall be inspected by a qualified person:

- a. All control mechanisms for maladjustment interfering with proper operation.
- b. All control mechanisms for excessive wear of components and contamination by lubricants or other foreign matter.
- c. All hydraulic hoses, particularly those that flex in normal operation of crane functions, should be visually inspected.
- d. Hooks and latches for deformation, chemical damage, cracks, and wear. Refer to Chapter 9.
- e. Safety devices for malfunction.
- f. Operational aids for malfunction and/or inaccuracies
- g. Rope reeving for compliance with crane manufacturer's specifications.
- h. Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation.
- i. Hydraulic systems for proper oil level.
- j. Tires for recommended inflation pressure.
- k. Deformed, cracked, or corroded members in the crane structure and entire boom.
- l. Bolts, rivets, nuts, and pins for being loose or absent.
- m. Fasteners identified by DOE as "suspect" (See Chapter 13, and check QA web page <<http://www-local.pppl.gov/qa/SCI/SCI.shtml>> or contact QA for further information).
- n. Cracked or worn sheaves and drums.
- o. Hooks for damage from chemicals, deformation, cracks, any visible apparent bend or twist from the plane of the unbent hook, or any distortion causing an increase in throat opening of 5% not to exceed 1/4 in. unless otherwise recommended by the manufacturer. See Chapter 9 for additional hook requirements.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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7.0 Mobile Crane Periodic Inspection Criteria (continued)

- p. Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, and locking devices.
- q. Excessive wear on brake and clutch system parts, linings, pawls, and ratchets.
- r. Load, boom angle, and other operating aids over their full ranges for any significant inaccuracies (if calibration is required, it shall be done by a qualified person).
- s. Gasoline, diesel, electrical, or other power plants for improper performance or noncompliance with safety requirements.
- t. Radiators and oil coolers, for leakage, improper performance, or blockage of air passages.
- u. Excessive wear of chain drive sprockets and excessive chain stretch.
- v. Steering, braking, and locking devices, for malfunctioning.
- w. Excessively worn or damaged tires.
- x. Rust on piston rods and control valves when crane has been idle.
- y. Inspect Hydraulic and Pneumatic Hose, Fittings, and Tubing for
 - 1) Evidence of leakage at the surface of the flexible hose or its junction with the metal couplings.
 - 2) Blistering or abnormal deformation of the outer covering of the hydraulic or pneumatic hose.
 - 3) Leakage at threaded or clamped joints that cannot be eliminated by normal tightening or recommended procedures.
 - 4) Evidence of excessive abrasion or scrubbing on the outer surface of a hose, rigid tube, or fitting (means shall be taken to eliminate the interface of elements in contact or to otherwise protect the components).
- z. Inspect Hydraulic and Pneumatic Pumps and Motors for:
 - 1) Loose bolts or fasteners.
 - 2) Leaks at joints between sections.
 - 3) Shaft seal leaks.
 - 4) Unusual noises or vibration.
 - 5) Loss of operating speed.
 - 6) Excessive heating of the fluid.
 - 7) Loss of pressure.
- aa. Hydraulic and pneumatic valves for:
 - 1) Cracks in valve housing
 - 2) Improper return of spool to neutral position
 - 3) Leaks at spools or joints
 - 4) Sticking spools
 - 5) Failure of relief valves to attain correct pressure setting

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7.0 Mobile Crane Periodic Inspection Criteria (continued)

- 6) Relief valve pressures as specified by manufacturer
- bb. Hydraulic and pneumatic cylinders
 - 1) Drifting caused by fluid leaking across the piston
 - 2) Rod seals leakage
 - 3) Leaks at welded joints
 - 4) Scored, nicked or dented cylinder rods
 - 5) Dented case (barrel)
 - 6) Loose or deformed rod eyes or connecting joints
- cc. Evidence of rubber particles on the filter element or metal chips on the filter

TESTING:

- a. Operational Tests
 - 1) The following shall be tested during an initial test:
 - i. Load lifting and lowering mechanisms.
 - ii. Boom lifting and lowering mechanisms.
 - iii. Boom extension and retraction mechanism.
 - iv. Swinging mechanism.
 - v. Travel mechanism.
 - vi. Safety devices.
 - 2) Rated Load Test
 - i. Prior to initial use, all cranes in which load-sustaining parts have been modified, replaced, or repaired shall be load-tested by a QRS or a qualified crane operator under the direction of a Qualified Crane Inspector (PPPL Qualified Crane Inspectors are not qualified to perform load lifts). All rated load tests shall be performed in accordance with manufacturer's recommendations. A designated or authorized person shall determine if repairs made to a crane are extensive and require a rated load test, or if repairs are routine maintenance and require only operational testing. The replacement of rope is excluded from this requirement. However, a functional test of the crane under a normal operating load should be made prior to putting it back in service.
 - ii. Test weights shall not exceed 110 percent of the rated capacity and shall be accurate to within -5 percent, +0 percent of stipulated values.

NOTE: Load tests shall not be conducted in locations where the lift meets the definition of a critical lift (see Chapter 1).
 - iii. A written report shall be furnished by the inspector showing test procedures and confirming the adequacy of repairs or alterations. Test reports shall be kept on file and shall be readily available to appointed personnel.
 - iv. Perform periodic inspection requirements at the completion of the load test.

CHAPTER 6 CRANE INSPECTION, MAINTENANCE AND TESTING

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8.0 RUNNING WIRE ROPE PERIODIC INSPECTION CRITERIA

PERIODIC INSPECTIONS

PERIODICITY: DAILY, MONTHLY AND ANNUAL

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED AT CRANE LOCATION
as part of ODCL

INSPECTION CHECK LIST:

All Running ropes in continuous service should be visually inspected once every working day. Inspection of ropes in service shall be made once a month or prior to use and a written, dated and signed record of inspection kept on file. As part of the periodic inspection, any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard:

- a. Reduction of rope diameter below nominal diameter (See Table 6-3 below) due to loss of core support, internal or external corrosion or wear of outside wires.

Rope diameter	Maximum allowable reduction from Nominal diameter
Up to 5/16 in. (8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over 3/4 in. to 1 1/8 in. (29 mm)	1/16 in. (1.6 mm)
Over 1 1/8 in. to 1 1/2 in. (38 mm)	3/32 in. (2.4 mm)

Table 7-3 Maximum allowable rope reductions

- b. A number of broken outside wires and the degree of distribution or concentration of such broken wires.
- c. Worn outside wires.
- d. Sections of rope which are normally hidden during inspection or maintenance procedures, such as parts passing over sheaves, should be given close inspection as these are points most likely to fail.
- e. Corroded or broken wires at end connections.
- f. Corroded, cracked, bent, worn or improperly applied end connections.
- g. Severe kinking, crushing, cutting or unstranding.

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8.0 Running Wire Rope Periodic Inspection Criteria (continued)

- h. All rope on cranes that have been idle for 1 month or more due to shutdown or storage shall be inspected before the crane is returned to service. A dated and signed report of the rope inspection, including results, shall be documented on an ODCL and filed.

WIRE ROPE MAINTENANCE

- a. Rope shall be stored to prevent damage or deterioration.
- b. Unreeling or uncoiling of rope shall be done as recommended by the rope manufacturer and with extreme care to avoid kinking or inducing a twist.
- c. Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands. On pre-formed rope, one seizing on each side of the cut is required. On non-preformed ropes of 7/8 inch diameter or smaller, two seizings on each side of the cut are required, and for non-preformed rope of 1-inch diameter or larger, three seizings on each side of the cut are required.
- d. During installation care shall be observed to avoid dragging of the rope in dirt or around objects which will scrape, nick crush or induce sharp bends in it.
- e. Rope should be maintained in a well lubricated condition. It is important that lubricant applied as part of a maintenance program shall be compatible with the original lubricant and to this end the rope manufacturer should be consulted. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.
- f. When an operating rope shows greater wear at well defined localized areas than on the remainder of the rope, rope life can be extended in some cases, where a reduced rope length is adequate, by cutting off a section at one end, and thus shifting the wear to different areas on the rope.

ROPE REPLACEMENT CRITERIA -- MOBILE CRANES, OVERHEAD CRANES, AND HOISTS

No precise rules can be given for determination of the exact time for replacement of rope, since many variable factors are involved, safety in this respect depends largely upon the use of good judgment by an appointed or authorized person in evaluating remaining strength in a used rope after allowance for deterioration disclosed by inspection. Safety of rope operation depends upon this remaining strength.

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8.0 Running Wire Rope Periodic Inspection Criteria (continued)

a. Mobile Cranes

- 1) Removal criteria for wire rope replacement shall be as follows:
 - i. In running ropes, 6 randomly distributed broken wires in one rope lay, or 3 broken wires in one strand in one rope lay.
 - ii. In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
 - iii. In rotation resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in thirty rope diameters.
 - iv. One outer wire broken at the point of contact with the core of the rope that has worked its way out of the rope structure and protrudes or loops out from the rope structure; additional inspection of this part of the rope is required.
 - v. A diameter reduction of more than 5% from nominal diameter.
 - vi. For rotation resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
 - vii. Independent wire rope core or strand core protrusion between outer strands.
 - viii. Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
 - ix. Evidence of heat damage from any cause.
 - x. Severe corrosion as evidenced by pitting.

b. Overhead Cranes and Hoists

- 1) Removal criteria for wire rope replacement shall be as follows:
 - i. In running ropes, 6 randomly distributed broken wires in one rope lay, or 3 broken wires in one strand in one rope lay.
 - ii. Wear of one-third of the original diameter of outside individual wires.
 - iii. Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
 - iv. Evidence of heat damage from any cause.
 - v. Reduction from nominal diameter greater than the amounts listed in Table 7-3.
 - vi. Replacement rope and connections shall have strength at least as great as the original rope and connections furnished by the crane manufacturer.

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- vii. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the crane manufacturer, or a qualified person.
- viii. Never use discarded rope for slings.
- viii. For rotation resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
- ix. In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
- x. In pendants or standing wire ropes: More than two broken wires in one rope lay located in rope beyond end connections and/or more than one broken wire in a rope lay located at an end connection.
- xi. Prior electrical contact with a power line.
- xii. A broken strand.

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9.0 OPERATOR'S DAILY CHECKLIST [ODCL] CRANES

CRANE NO.		CAPACITY	TYPE		LOCATION		SHIFT 1 2 3	
OPERATORS NAME:			INSTRUCTIONS: Check all items. Inspect and indicate as: satisfactory - S, unsatisfactory - U, or not applicable - NA					
1. WALK AROUND INSPECTION		S/U/NA	2. MACHINERY INSPECTION		S/U/NA	3. OPERATOR CAB INSPECTION		S/U/NA
4. OPERATION INSPECTION		S/U/NA						
a	Foundations		a	Monthly Hook/Chain/Rope * Within previous 30 days		a	Housekeeping	
b	Access		b	Holding Brake *		b	Warning Tags *	
c	Secured Items		c	Load Control Brake		c	Cab Door(s)	
d	Walkways/Handrails		d	Covers Secure		d	Fire Extinguisher	
e	Bridge, Drive Motor		e	Upper Sheaves *		e	Controls Identification	
f	Bridge Brake *		f	Wire Rope *		f	Electrical Enclosures	
g	Hydraulics		g	Hook(s) *		g	Pendant Strain Relief	
h	Couplers/Connecting Rods		h	Fluid Leaks		h	Visibility/Windows	
i	End Trucks *		i	Batteries		i	Safety Devices *	
j	Rail Sweeps		j	Electric Motors		j	Warning/Indicator Light	
k	Windlocks/Chocks/Stops		k	Electrical Panels		k	Alarms	
l	Housekeeping		l	Runway/Bridge Conductors		l	Main Hook *	
m	Warning Tags/Signs		m	Runway/Bridge Collectors		m	Auxiliary Hook *	
n	Fire Extinguisher in room		n	Electrical Guards		n	Work Area	
o	Electrical Enclosures		o	Festoon System		o	Runway Stops *	
p	Electrical disconnect in room		p	Warning Tags/Signs		p	Travel Limit Relays *	
			q	Exposed Electrical Hazards				
			r	Trolley Stops *				
<p>INSTRUCTIONS - Inspect all applicable items each shift of operations. Suspend all operations immediately upon observing any unsafe condition or an unsatisfactory condition for asterisked (*) items and immediately notify supervisor and the Lift Manager. Record all abnormal conditions under "Remarks" below.</p> <p>Call the area QRS to perform Hook and Chain or Wire Rope Inspection if not current. (within the last 30 days)</p> <p style="text-align: center;">❖❖❖❖❖❖❖❖❖</p>								<p>OPERATOR'S NAME:</p> <p>PRINT:</p> <p>SIGN:</p> <p>DATE:</p>
REMARKS:								<p>MONTHLY HOOK AND CHAIN OR WIRE ROPE INSPECTION</p> <p>DATE:</p>

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10.0 CRANE MECHANICAL INSPECTION REPORT & MAINTENANCE CHECKLIST

CRANE/HOIST #:	CAPACITY:	MAKE:	LOCATION:
STATUS CODE: ✓ – OK ✓ R – Repaired/Adjusted NR – Needs Repair NA – Not Applicable			

All items shall be inspected and lubricated annually.

ITEM	CODE	COMMENT	ITEM	CODE	COMMENT
Bridge			Trolley drive		
Alignment			Wheels, driver		
Girders (camber)			Wheels, idler		
Rails			Wheel bearings		
Walks, ladders, railings			Axles and couplings		
Truck to girder connection			Motor coupling		
Trucks			Gear reducer		
Wheels, driver			Gear reducer oil seals		
Wheels, idler			Axle pinion		
Wheel bearings			Axle gear		
Axles and couplings			Cam followers/guides		
Squaring shaft			Energy absorbing bumpers		
Squaring shaft bearings			End stops		
Squaring shaft couplings			Hoist(s)		
Motor coupling			Hook		
Gear reducer			Hook bearing		
Gear reducer oil seals			Sheaves		
Axle pinion			Sheave bearings		
Axle gear			Equalizer sheave		
Runway alignment			Rope/chain		
Cam followers/guide			Rope anchors		
Runway end-stops			Drum grooving		
Railway sweeps/safety lugs			Drum shafts		
Energy absorbing bumpers			Motor pinion		
Monorail			Motor gear		
Girder			Intermediate pinion		
Girder supports			Intermediate gear		
Sway braces			Drum pinion		
End stops			Drum gear		
Misc.			Hoist case bearing		
Clearances overhead 3"			Mechanical load brake		
Clearances lateral 2"			Friction discs		
Rated load markings:			Pawl		
Each side of crane bridge			Pawl shifter		
Each hoist/load block			Ratchet or band		
Fasteners-no suspects found			Motor coupling		
			Hoist case coupling		

Needs Immediate Action:

Notes:

Check One: ☐ (PASS – SATISFACTORY TO USE with new sticker) ☐ (FAIL – TAGGED OUT)

INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____

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11.0 CRANE BRAKE AND ELECTRICAL INSPECTION REPORT

CRANE/HOIST #: _____ CAPACITY: _____ MAKE: _____ LOCATION: _____

STATUS CODE: ✓ – OK ✓ R – Repaired/Adjusted NR – Needs Repair NA – Not Applicable

All items shall be inspected and lubricated annually.

ITEM	CODE	COMMENT	ITEM	CODE	COMMENT
Brakes			Controls		
M.H. brake shoes and discs			<i>For Magnetic Control</i>		
M.H. brake linings			Master switches		
M.H. brake linkage			Pushbutton station		
M.H. brake coil			M.H. contactors		
A.H. brake shoes or discs			A.H. contactors		
A.H. brake lining			Trolley contactors		
A.H. brake linkage			Bridge contactors		
A.H. brake coil			M.H. overhead relays		
Trolley brake shoes or discs			A.H. overhead relays		
Trolley brake lining			Trolley overhead relays		
Trolley brake linkage			Bridge overhead relays		
Trolley brake coils			M.H. limit switch contacts		
Bridge brake shoes or discs			A.H. limit switch contacts		
Bridge brake lining			<i>For Manual Drum Control</i>		
Bridge brake linkage			M.H. finger tips		
Bridge brake coils			M.H. segments		
Hydraulic brake bleeder			A.H. finger tips		
Motors			A.H. segments		
Bridge motor bearings			Trolley finger tips		
Bridge motor brushes			Trolley segments		
Bridge motor rings			Bridge finger tips		
Trolley motor bearings			Bridge segments		
Trolley motor brushes			Resistors		
Trolley motor rings			M.H. resistors		
M.H. motor bearings			A.H. resistors		
M.H. motor brushes			Trolley resistors		
M.H. motor rings			Bridge resistors		
A.H. motor bearings			Mainline		
A.H. motor brushes			Mainline switch		
A.H. motor rings			Fuses (Sizes.....)		
Misc.			Power wiring		
			Control wiring		
			Trolley collectors		
			Runway collectors		
			Bridge conductors		
			Runway conductors		

Needs Immediate Action:

Notes:

Check One: ☐ (PASS – SATISFACTORY TO USE with new sticker) ☐ (FAIL – TAGGED OUT)

INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____

CHAPTER 6 CRANES TCR-ES-MECH-007,R2-001

12.0 GROVE MOBILE CRANE DAILY INSPECTION REPORT

Crane# 119	MAKE/MODEL: <u>GROVE</u>	RT65S (35 TON)	SERIAL #: <u>38022</u>	HOUR METER: _____	
STATUS CODE: S = Satisfactory U = Unsatisfactory					
	S/U	COMMENT		S/U	COMMENT
EXTERNAL					
Appearance/Paint			Auto Transmission Oil Level		
Check Fuel Cap			Air Compressor Oil Level		
Crankcase Oil Level			Outriggers and Boxes		
Cold Weather Starting Aid			Outrigger Float Pads		
Radiator			Tire Condition and Pressure		
Antifreeze and Coolant			Wheel Lugs		
Cleaner			Hoists		
Fan Belts			Boom Sections, Attachments		
Pumps and Motors			Boom Stops		
Battery			Lubrication/Grease or Oil Leaks		
Muffler			All Sheaves Lubed		
Brake and Air System (Bleed)			Wire Rope Kinks or Breaks		
Hydraulic Reservoir			Wire Rope Dirt and Lube		
Hydraulic Oil Filter			Hook and Hook Block		
All Hydraulic Hoses & Fittings			Counterweight & Torque		
Hydraulic Leaks			Handrails		
Lamps: Turn Signals, Headlamps, Flashers, Cab, Boom, Backup			Welds & Cracks: Hoists, Boom, Sheaves, Hook, Block, Motor, Valves, Cylinders		
INSIDE CAB					
Fire Extinguisher Pressure			Boom Angle Indicator		
Operator Manual & Load Chart			Load Moment Indicator (PAT)		
Hand Signal Chart			Anti Two Block & Boom Stops		
Glass			Gearshift Control		
Windshield Wiper			Foot and Parking Brakes		
Gauges: Oil, Fuel, Amp			Swing Brake		
Lights and Horn			Control Lever Linkage		
Backup Alarm			Throttle Linkage		
Heater			Engine RPM		
REMARKS:					
MONTHLY HOOK AND WIRE ROPE INSPECTION	Monthly Hook and Wire Rope Inspection must be done by a QRS or a qualified Wire Rope Inspector within the last 30 days:			Inspector (Signature): DATE:	
Check One: <input type="checkbox"/> (PASS – SATISFACTORY TO USE with new sticker) <input type="checkbox"/> (FAIL – TAGGED OUT)					
INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____					

CHAPTER 6 CRANES TCR-ES-MECH-007,R2-001

13.0 GROVE MOBILE CRANE PERIODIC INSPECTION REPORT

Crane# 119 MAKE/MODEL: GROVE RT65S (35 TON) SERIAL #: 38022 HOUR METER: _____

STATUS CODE:		S = Satisfactory		U = Unsatisfactory	
SEMI-ANNUALLY	S/U	COMMENT	ANNUALLY	S/U	COMMENT
Check Bolt Torque:			Paint		
– Transmission Mount			Cracks or Leaks:		
– Turntable			– Swing Gearbox Case		
– Engine Mount			– Transmission Case		
– Hoist Mount			– Pump Drive Box		
– Gearbox Mount			– Engine Intake		
– Axle Mount			– Axle Differential		
Engine RPM			Boom Wear Pads		
Muffler Connections			Brake Lines		
Wiring Harness			Axle Planetary Hubs		
Battery Cables			Cleaner		
Battery Water Level			Clutch Release Bearing		
Master Cylinders			Gearshift Control		
Pump Drive Gearbox			Steering System Oil		
Swing Gearbox			Crankcase Breather		
Axle Lockout			Wheel Lugs		
Axle Differential			Tie Rod Balljoints		
Axle Planetary Oil			Steering Knuckles		
Boom Sheaves			Drag Link U-joint		
Boom Alignment			Drag Link Ends		
Jib Alignment			Windshield Wiper		
Machine Structure			Level Indicator		
Clean/Change:			Emergency Brake		
– Differential Breather			Gauges: Oil, Fuel, Amp		
– Fuel Filter Screen					
– Compressor Strainer					
– Transmission Filter					
Drum					
Wire Rope Dirt/lube/Size/Kinks					
Hook & Latch					
Block & Sheaves					
Guards in position					
Emergency Stop					
Welds & Cracks: Hoists, Boom, Sheaves, Hook, Block, Motor, Valves, Cylinders					
Lamps: Turn Signals, Headlamps, Flashers, Cab, Boom, Backup					
Fasteners-no suspects found					

Comments: Note any potential hazards or malfunctions:

Check One: ☐ (PASS – SATISFACTORY TO USE with new sticker)

☐ (FAIL – TAGGED OUT)

INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____

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14.0 BRODERSON MOBILE CRANE DAILY INSPECTION REPORT

Crane# 146	MODEL: <u>Broderson IC200C (15 Ton)</u>	SERIAL #: <u>103851</u>	HOUR METER: _____
STATUS CODE: S = Satisfactory U = Unsatisfactory			
	S/U		S/U
Check levels of engine oil, coolant and transmission fluid. Drain water from diesel filter.		Check tire pressure: 130 PSI (radial tires). Check for loose wheel nuts. (500 foot-pounds torque required)	
Check air cleaner intake system for cracks or looseness.		Check lights and turn signals.	
Check general condition of tires.		Check power steering lines for damage.	
Visually inspect for loose pins, bolts, physical damage & leaks.		Check brake lines for damage.	
Check hydraulic oil level.		Check operation of horn.	
Check fuel level.		Check operation of hoist brake for smoothness.	
Check hydraulic filter indicator gauge after running at least twenty minutes.		Check outrigger holding valves for operation.	
Check engine oil pressure.		Check boom topping holding valves for operation.	
Check engine coolant temperature.		Check rotation gears for looseness or backlash.	
Check battery charging amperage.		Check boom extension cylinder holding valve for operation	
Check transmission temperature.		Check operation of windshield wipers (if equipped).	
Check hydraulic brake operation.		Boom extension (if equipped) properly pinned with retainers in place.	
Check parking brake operation.			
Check power steering operation.			
Observe chassis for normal driving operation.			
Observe boom operation for normal power and speed.		Check for suspect fasteners	
Check load line and hooks for damage.			
Check condition of sheaves and load line retainers.			
Check anti-two-block system for proper operation.			
Check back-up alarm for proper operation.			
Check operation of all transmission gears, forward and reverse.			
Clean all glass (if equipped) and check for cracks.			
Check operation of all warning and safety devices.			
REMARKS:			
MONTHLY HOOK AND WIRE ROPE INSPECTION	Monthly Hook and Wire Rope Inspection must be done by a QRS or a qualified Wire Rope Inspector within the last 30 days:		Inspector (Signature): DATE:
Check One: <input type="checkbox"/> (PASS – SATISFACTORY TO USE with new sticker) <input type="checkbox"/> (FAIL – TAGGED OUT)			
INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____			

15.0 BRODERSON MOBILE CRANE PERIODIC INSPECTION REPORT

Crane# 146		MODEL: <u>Broderson IC200C (15 Ton)</u>		SERIAL #: <u>103851</u>	HOUR METER: _____ _____
STATUS CODE: S = Satisfactory U = Unsatisfactory					
50 HOUR INTERVAL		S/U	250 HOUR OR 3 MONTH INTERVAL		S/U
50-hour lubrication as shown on lube schedule.			50-hour maintenance.		
Inspect wire rope thoroughly.			50-hour and 250-hour lubrication.		
Inspect for physical damage and leaks.			Clean engine and battery.		
Clean radiator fins and check coolant level.			Change engine oil and filter.		
Check tire pressure and condition.			Clean crankcase breather.		
Check fluid levels in engine, transmission, hydraulic tank, brakes, and battery.			Clean and lubricate governor linkage.		
Clean air filter inlet screen and empty the precleaner dust cup.			Clean and inspect distributor and ignition wires.		
Inspect air intake and exhaust systems for cracks, leaks, and loose bolts.			Clean the air filter.		
Torque cylinder head bolts on Perkins 4.236. (NOT T4.236) after first 50 hours			Clean engine mounts and radiator mounts.		
Adjust valve clearance on Perkins engines.			Inspect all bolts on the machine for tightness.		
Check tension and condition of fan and alternator belts.			Visually inspect all welds for cracks.		
Check the hydraulic filter indication with warm oil; change element if indicated.			Check hydraulic fittings and center post for leaks.		
Check idle and maximum engine speed and adjust if necessary.			Check park brake cable for adjustment.		
Check rotation gear and pinion fit and gear train backlash.					
Check rotation bearing and gearbox bolt tightness.					
Check axle mounting bolts and pins.					
Torque wheel mounting nuts. (500 ft-lbs torque)					
Check for loose pins or pin retainers.					
Check steering for damage.					
Inspect sheaves and hooks for damage and excessive wear.					
Visually inspect welds on boom, turret and outriggers.					
REMARKS:					
Check One: <input type="checkbox"/> (PASS – SATISFACTORY TO USE with new sticker) <input type="checkbox"/> (FAIL – TAGGED OUT)					
INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____					

15.0 Broderson Mobile Crane Periodic Inspection Report (continued)

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CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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1.0 INSPECTION, MAINTENANCE AND TESTING RESPONSIBILITIES**RESPONSIBILITY ACTION**

Equipment Owner	1. Know where equipment is at all times and provide equipment for inspection.
OPs Center	2. Maintain the inspection records for periodic inspection/maintenance.
Lift Manager	3. Maintain due date to inspect equipment annually on Inspection Status List. If the maintenance or inspection is not completed the equipment shall be CAUTION tagged OUT OF SERVICE until such time as the required actions are completed. 4. Determine if each hoist is to be kept in service. a. If hoist is not to be kept in service, requests the equipment owner to CAUTION tag item OUT OF SERVICE. 5. Determine when during the calendar year each crane annual inspection/maintenance is due. 6. Arrange for a qualified crane technician or subcontractor to perform the inspection/maintenance.
Qualified Inspector or Qualified Subcontractor	7. Perform required maintenance per the manufacturer's recommendations and periodic inspection as per the Hoist and Chainfall Periodic Inspection Criteria (Section 7.0). 8. Record the inspection/maintenance (see Sections 8.0, 9.0 and 10.0).
Procurement Technical Representative (PTR)	9. Determine if deficiencies are found. a. If no, submit inspection report to Lift Manager and affix inspection sticker, showing expiration date either to pendant control and/or cab control, remote control if present and chainfall body or housing. b. If yes, submit inspection report to Lift Manager and CAUTION tag OUT OF SERVICE.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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1.0 INSPECTION, MAINTENANCE AND TESTING RESPONSIBILITIES (continued)**RESPONSIBILITY ACTION**

Qualified Inspector or Qualified Subcontractor	10. Perform Hook Non Destructive Examination (NDE) as per Hook Inspection Criteria (Chapter 9) for greater than 10 ton capacity and greater than normal service duty and records the inspection if required.
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NOTE: All PPPL lifting equipment falls under normal service use. NDE is not normally required.

Lift Manager	11. Review, signs and submits all inspection reports to OPs Center, and updates inspection status list.
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OPs Center	12. Checks for Lift Managers signature and file inspection reports.
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2.0 MAINTENANCE REQUIREMENTS

Note: No modifications or additions which affect the capacity or safe operation of the equipment shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

- i. Maintenance shall be performed according to the manufacturer's recommendations and as a minimum shall meet the requirements of OSHA, 29 CFR 1910, 29 CFR 1926, ESH-001 (Tagout) and ESH-016 (Lock Out).
 - a. Power plant shall be stopped and starting means rendered inoperative.
 - b. All controls in the off position and all operating systems secured from inadvertent motion by brakes, blocks or other means.
 - c. Moved to a location where it will cause the least interference with other hoists and operations.
 - d. Hydraulic oil pressure relieved from any hydraulic circuits before loosening or removing hydraulic components.
 - e. Other manufacturer specified precautions.
- ii. A scheduled planned maintenance, lubrication and inspection system shall be followed based on the manufacturer's recommendations.
- iii. Only qualified, trained and authorized personnel shall be permitted to maintain, repair, adjust and inspect hoists.
- iv. Unusual maintenance or repairs require consultation with the manufacturer.
- v. All parts requiring replacement shall be replaced only by parts equivalent as to the safety of those used in the original design.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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2.0 MAINTENANCE REQUIREMENTS (continued)

- vi. Repaired hoists shall be inspected prior to be returned to service by qualified inspectors or sub contractors. The inspection report will be signed by the inspector and the Lift Manager and be filed in the equipment's file in the Operations Center.
- vii. Safety switches and functionality shall not be impaired by service technicians unless required for the repair operation. Such impaired hoists shall be tagged as out of service until the safety impairment is removed.
- viii. All loads shall be removed prior to any repair work being performed.
- ix. Warning signs and barriers shall be placed under hoist where overhead maintenance creates a hazard.
- x. A barrier or signal person is required if the runway must remain energized to prohibit other hoists from approaching the hoist being worked on or the equipment being used to work on it.
- xi. Pitted or burned electrical contacts shall be corrected only by replacement and in sets.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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3.0 HOIST & CHAINFALL LOAD TEST RESPONSIBILITIES

- a. Rated Load Test: New hoists shall be ordered with certification of a successful load test with a load at least 125 percent of the rated capacity. If load test certification has not been provided by the manufacturer, the test shall be performed under the direction of a Qualified Crane Inspector.

RESPONSIBILITY ACTION

- | | |
|---------------------|--|
| Qualified Inspector | 1. Perform periodic inspection per Hoist & Chainfall Periodic Inspection Criteria (Section 7.0). Assures NDE of hook is current if hook is greater than 10 ton capacity and greater than normal service category*. If the maintenance or inspection is not completed, the equipment shall be CAUTION tagged OUT OF SERVICE until such time as the required actions are completed.
* NOTE: All PPPL lifting equipment falls under normal service use. NDE is not normally required. |
| QRS | 2. Determine load test weights and rigging. |
| | 3. Document load test configuration on Load Test Data Sheet (Chapter 14) and sign. |
| | 4. Arrange to have weights moved to the load test site. |
| | 5. Notify QC of load test. |
| Lift Manager | 6. Approve the Load Test Data Sheet (Chapter 14). |
| Riggers | 7. Perform rigging inspection and report to QRS all items are acceptable. |
| QRS | 8. Verify and sign the Load Test Data Sheet. |
| Riggers | 9. Place rigging. |
| QRS | 10. Perform load test according to the Load Test Data Sheet (Chapter 14). |
| Lift Engineer/QC | 11. Witness and sign the Load Test Data Sheet confirming that load test was performed as documented. Lift Engineer may N/A witness. |
| QRS | 12. Submit Load Test Data Sheet to Operations Center for filing. |

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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4.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE CRITERIA INTRODUCTION

- A. Periodic Inspections of Hoists and Chainfalls are performed per Section 7.0 of this Chapter and include manufacturer's recommendations. Use the Hoist Mechanical Inspection Report & Maintenance (Section 8.0) as the checklist. Checklists are the official PPPL records of inspections and are maintained for 3 years, Periodic Hoist and Chainfall Inspection Reports are maintained for the life of the crane.

5.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
Hoists and Chainfalls	OPS CTR.

Table 7-1 Record Storage Requirements

6.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)		FAILURE
	> 1 mo. & < 1yr.	= 1 yr.	
Hoists & Chainfalls	Rope/Chain	Hoist Insp. Rpt. & Rope/Chain	Rope/Chain Insp. & Load Test

Table 7-2 Required Inspections (Must be ensured prior to each use)

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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7.0 HOIST AND CHAINFALL PERIODIC INSPECTION/TESTING CRITERIA

PERIODIC INSPECTIONS

PERIODICITY: DAILY, MONTHLY AND ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN OPS CTR FOR LIFE OF EQUIPMENT

INSPECTION CHECK LIST:

- a. Daily inspections include the following:
 - 1) Use the Hoist/Chainfall ODCL, Section 11.0.
 - 2) Controls and operating mechanisms for proper operation.
 - 3) Hoist upper-limit switch, as applicable, for proper operation.
 - 4) Lines, valves, and other parts of air systems for leakage.
 - 5) Hooks for cracks, deformation, and damage from chemicals (see Chapter 9, "Hooks," for additional hook requirements).
 - 6) Hoist rope for kinking, crushing, birdcaging, and corrosion.
 - 7) Hoist chain for nicks, gouges, distortion, wear, cracks, and corrosion.
 - 8) Synthetic web strap for abrasive wear, knots, cuts, or tears, broken stitching, acid or caustic burns, melting or charring, or weld splatter.
 - 9) Hook latch, if used, for proper operation.
- b. **For Hoists**, in addition to the requirements listed in a. above, periodic inspections of hoists shall include the following:
 - 1) Bolts, rivets, nuts, and pins for being loose or absent.
 - 2) Check for fasteners identified by DOE as "suspect" (See Section 7.0, and check QA web page <<http://www-local.pppl.gov/qa/SCI/SCI.shtml>> or contact QA for further information).
 - 3) Cracked or worn drums or sheaves.
 - 4) Worn, corroded, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers locking, and clamping devices.
 - 5) Excessive wear on motor or load brakes.
 - 6) Excessive wear of chains, ropes, synthetic web strap, load sprockets, drums, sheaves, and chain stretch.
 - 7) Deterioration or damage of end connections and terminations of wire rope, load chains, and synthetic web.
 - 8) Hooks damaged from chemicals, cracks, any visibly apparent bend or twist from the plane of the unbent hook, or any distortion causing an increase in throat opening of 5% not to exceed 1/4 inch unless otherwise recommended by the manufacturer. See Chapter 9 for additional hook requirements.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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**7.0 HOIST AND CHAINFALL PERIODIC INSPECTION/TESTING CRITERIA
(continued)**

- 9) Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining members.
 - 10) Suitable crack-detecting inspections for hooks, such as dye-penetrant or magnetic-particle inspections (performed when required by the inspector).
 - 11) Electrical apparatus for signs of pitting or any deterioration of controller contactors, limit switches, and push-button switches.
 - 12) Supporting structures and trolleys, if used, for continued ability to support the imposed loads.
 - 13) Warning labels for illegibility or absence.
- c. **For wire rope**, in addition to the requirements listed for Daily Inspections, periodic inspections of hoists shall be performed. A qualified inspector shall inspect running rope at least annually. This inspection shall include examination of the entire length of rope, without detaching it from the hoist drum. More frequent intervals shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. The qualified inspector shall carefully note any deterioration, such as described below, resulting in appreciable loss of original strength and determine whether further use of the rope constitutes an acceptable risk.
- 1) Reduction of rope size below nominal diameter, whether due to loss of core support, internal or external corrosion, or wear of outside wires. (see Table 7-3).
 - 2) A number of broken outside wires and the distribution or concentration of such broken wires.
 - 3) Worn outside wires.
 - 4) Sections of rope that are normally hidden during inspection or maintenance procedures, such as parts passing over sheaves (these are points most subject to deterioration).
 - 5) Corroded or broken wires at end connections.
 - 6) Corroded, cracked, bent, worn, or improperly applied end connections.
 - 7) Kinking, crushing, cutting, or unstranding.

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7.0 HOIST AND CHAINFALL PERIODIC INSPECTION/TESTING CRITERIA
(continued)

Table 7-3. Maximum allowable rope reductions.

Rope diameter	Maximum allowable reduction from Nominal diameter
Up to 5/16 in.(8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over 3/4 in. to 1 1/8 in. (29 mm)	1/16 in. (1.6 mm)
Over 1 1/8 in. to 1 1/2 in. (38 mm)	3/32 in. (2.4 mm)

- i. No precise rules can be given for determining the exact time to replace wire rope because many factors are involved. Safety depends largely on the use of good judgment by an appointed person in evaluating remaining strength in a used rope, after allowance for deterioration disclosed by inspection. Safety of rope operation depends on this remaining strength.
- ii. Conditions such as the following shall be reason for questioning rope safety and considering replacement:
 - In hoist ropes, 12 randomly distributed broken wires in one rope lay, or 4 broken wires in one strand in one rope lay.
 - Wear of one-third of the original diameter of outside individual wires.
 - Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
 - Evidence of heat damage from any cause.
 - Reductions from nominal diameter greater than those shown in Table 7-3.
 - The qualified inspector shall give special attention to end fastenings and shall examine ropes frequently at socketed fittings; on the development of two broken wires adjacent to this point, resocket or replace the rope. Resocketing shall not be attempted if the resulting rope length will be insufficient for proper operation. Those portions of the rope subjected to reverse bends and operation over small-diameter drums or sheaves shall be closely examined.
 - Replacement rope and connections shall have a strength rating at least as great as the original rope and connections furnished by the hoist manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the hoist manufacturer, or a qualified person.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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**7.0 HOIST AND CHAINFALL PERIODIC INSPECTION/TESTING CRITERIA
(continued)**

- d. **For roller chain**, in addition to the requirements listed for Daily Inspections, periodic inspections of hoists shall be performed. A qualified inspector shall do the following during periodic inspections:
- 1) Test the hoist under load in raising and lowering directions, observing the operation of the chain and sprockets. If the chain binds, jumps or is noisy, clean and properly lubricate it. If the trouble persists, inspect the chain and mating parts for wear, distortion, or damage.
 - 2) If wear or suspect stretching is observed, measure the chain according to the hoist manufacturer's instructions. If instructions are not available, proceed as follows:
 - i. Suspend the hoist in normal position and apply a light load of approximately 100 lb (46 kg).
 - ii. Select a 12-in. (305 mm) section of chain that normally travels over the load sprocket.
 - iii. Determine elongation by measuring with a caliper from the edge of one chain pin to the corresponding edge of another pin. If elongation exceeds $\frac{1}{4}$ in. (6.3 mm) in 12 in. (305 mm) compared to new or unstretched chain values, replace the chain.
 - iv. Inspect for twists. Replace if the twist in any 5-ft (1.52 m) section exceeds 15 degrees.
 - v. Check for straightness in a plane perpendicular to the plane of the rollers. Replace if the chain has a bow exceeding $\frac{1}{4}$ in. (6.3 mm) in any 5-ft (1.52 m) section.
 - 3) Make additional inspections by removing the chain from the hoist and cleaning it thoroughly. Carefully examine deficiencies such as those listed below and determine whether they constitute a safety hazard. Any deficiencies are reason for questioning chain safety and considering its replacement.
 - i. Pins turned from original position.
 - ii. Rollers that do not run freely with light finger pressure.
 - iii. Joints that cannot be flexed by easy hand pressure.
 - iv. Side plates that are spread open.
 - v. Corrosion, pitting, or discoloration.
 - vi. Gouges, nicks, or weld spatter.
 - 4) Do not attempt to repair roller chain by welding or heating.
 - 5) Ensure that replacement chain is the same size, grade, and construction as the original chain furnished by the hoist manufacturer unless otherwise recommended by the hoist manufacturer due to working conditions.
 - 6) Never use discarded or new roller chain for slings.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

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**7.0 HOIST AND CHAINFALL PERIODIC INSPECTION/TESTING CRITERIA
(continued)****TESTING****a. Operational Tests**

Certification from the manufacturer is required indicating completion of an operational test. All modified or repaired hoists or hoists that have not been used within the preceding 12 months shall be tested before being placed in service. All tests shall be done by a qualified inspector or under the direction of that inspector as detailed in the following paragraphs.

1) Electric- or Air-Powered Hoists

- i. Check lifting and lowering (testing through complete rated lift length is not required).
- ii. Check operation of brakes.
- iii. Determine the trip-setting of limit devices by tests under no-load conditions. Conduct tests first by hand, if practical, and then under slowest speed obtainable. Test with increasing speeds up to maximum speed.

2) Hand-Chain-Operated Hoists

- i. Check all functions of the hoist, including lifting and lowering, with the hoist suspended in an unloaded state.
- ii. After testing unloaded, apply a load of at least 50 lb (23 kg) multiplied by the number of load-bearing parts of chain to the hoist to check proper load control.

3) Manual-Lever-Operated Hoists

- i. Check all functions of the hoist with the hoist suspended in an unloaded state.
- ii. After testing unloaded, apply a load of at least 100 lb (46kg) multiplied by the number of load-bearing parts of load line to the hoist to check proper load control.

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

TCR-ES-MECH-007,R2-001

8.0 HOIST MECHANICAL INSPECTION REPORT & MAINTENANCE CHECKLIST

CRANE/HOIST #:	CAPACITY:	MAKE:	LOCATION:
STATUS CODE: S = Satisfactory U = Unsatisfactory			

All items shall be inspected and lubricated annually.

ITEM	S/U	COMMENT	ITEM	S/U	COMMENT
Bridge			Trolley drive		
Alignment			Wheels, driver		
Girders (camber)			Wheels, idler		
Rails			Wheel bearings		
Walks, ladders, railings			Axles and couplings		
Truck to girder connection			Motor coupling		
Trucks			Gear reducer		
Wheels, driver			Gear reducer oil seals		
Wheels, idler			Axle pinion		
Wheel bearings			Axle gear		
Axles and couplings			Cam followers/guides		
Squaring shaft			Energy absorbing bumpers		
Squaring shaft bearings			End stops		
Squaring shaft couplings			Hoist(s)		
Motor coupling			Hook		
Gear reducer			Hook bearing		
Gear reducer oil seals			Sheaves		
Axle pinion			Sheave bearings		
Axle gear			Equalizer sheave		
Runway alignment			Rope/chain		
Cam followers/guide			Rope anchors		
Runway end-stops			Drum grooving		
Railway sweeps/safety lugs			Drum shafts		
Energy absorbing bumpers			Motor pinion		
Monorail			Motor gear		
Girder			Intermediate pinion		
Girder supports			Intermediate gear		
Sway braces			Drum pinion		
End stops			Drum gear		
Misc.			Hoist case bearing		
Clearances overhead 3"			Mechanical load brake		
Clearances lateral 2"			Friction discs		
Rated load markings:			Pawl		
Each side of crane bridge			Pawl shifter		
Each hoist/load block			Ratchet or band		
Fasteners-no suspects found			Motor coupling		
			Hoist case coupling		

Needs Immediate Action:**Notes:**Check One: ☐ (PASS – SATISFACTORY TO USE with new sticker) ☐ (FAIL – TAGGED OUT)

INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____

CHAPTER 7 HOISTS & CHAINFALLS INSPECTION, MAINTENANCE AND TESTING

TCR-ES-MECH-007,R2-001

9.0 HOIST BRAKE AND ELECTRICAL INSPECTION REPORT

CRANE/HOIST #:	CAPACITY:	MAKE:	LOCATION:
STATUS CODE: S = Satisfactory U = Unsatisfactory			

All items shall be inspected and lubricated annually.

ITEM	S/U	COMMENT	ITEM	S/U	COMMENT
Brakes			Controls		
M.H. brake shoes and discs			<i>For Magnetic Control</i>		
M.H. brake linings			Master switches		
M.H. brake linkage			Pushbutton station		
M.H. brake coil			M.H. contactors		
A.H. brake shoes or discs			A.H. contactors		
A.H. brake lining			Trolley contactors		
A.H. brake linkage			Bridge contactors		
A.H. brake coil			M.H. overhead relays		
Trolley brake shoes or discs			A.H. overhead relays		
Trolley brake lining			Trolley overhead relays		
Trolley brake linkage			Bridge overhead relays		
Trolley brake coils			M.H. limit switch contacts		
Bridge brake shoes or discs			A.H. limit switch contacts		
Bridge brake lining			<i>For Manual Drum Control</i>		
Bridge brake linkage			M.H. finger tips		
Bridge brake coils			M.H. segments		
Hydraulic brake bleeder			A.H. finger tips		
Motors			A.H. segments		
Bridge motor bearings			Trolley finger tips		
Bridge motor brushes			Trolley segments		
Bridge motor rings			Bridge finger tips		
Trolley motor bearings			Bridge segments		
Trolley motor brushes			Resistors		
Trolley motor rings			M.H. resistors		
M.H. motor bearings			A.H. resistors		
M.H. motor brushes			Trolley resistors		
M.H. motor rings			Bridge resistors		
A.H. motor bearings			Mainline		
A.H. motor brushes			Mainline switch		
A.H. motor rings			Fuses (Sizes.....)		
Misc.			Power wiring		
			Control wiring		
			Trolley collectors		
			Runway collectors		
			Bridge conductors		
			Runway conductors		

Needs Immediate Action:

Notes:

Check One: ☐ (PASS – SATISFACTORY TO USE with new sticker) ☐ (FAIL – TAGGED OUT)

INSPECTOR (PRINT): _____ SIGNATURE: _____ DATE: _____

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CHAPTER 7 HOISTS & CHAINFALLS

11.0 OPERATOR'S DAILY CHECK LIST (ODCL) – HOISTS AND CHAINFALLS **TCR-ES-MECH-007,R2-001**

CRANE NO.		CAPACITY	TYPE	LOCATION	SHIFT 1 2 3		
OPERATORS NAME:				<i>INSTRUCTIONS: Check all items. Inspect and indicate as: satisfactory - S, unsatisfactory - U, or not applicable - NA</i>			
1. WALK AROUND INSPECTION			S/U/NA	2. MACHINERY INSPECTION			S/U/NA
a	Foundations			a	Monthly Hook/Chain/Rope within previous 30 days *		
b	Access			b	Load Control Brake		
c	Secured Items			c	Covers Secure		
d	Rail Sweeps			d	Upper Sheaves *		
e	Housekeeping			e	Wire Rope *		
f	Warning Tags/Signs			f	Hook(s) *		
g	Fire Extinguisher in room			g	Electric Motors		
				h	Electrical Panels		
				i	Electrical Guards		
				j	Festoon System		
				k	Exposed Electrical Hazards		
				l	Trolley Stops *		
				m	Pendant Buttons *		
				n	Upper Limit/Main *		
				o	Lower Limit/Main		
INSTRUCTIONS - Inspect all applicable items each shift of operations. Suspend all operations immediately upon observing any unsafe condition or an unsatisfactory condition for asterisked (*) items and immediately notify supervisor and the Lift Manager. Record all abnormal conditions under "Remarks" below. Call the area QRS to perform Hook and Chain or Wire Rope Inspection if not current. (within the last 30 days)				OPERATOR'S NAME: PRINT: SIGN: DATE:			
REMARKS:				❖❖❖❖❖❖❖❖			
				MONTHLY HOOK AND CHAIN OR WIRE ROPE INSPECTION		QRS Inspector (Signature): DATE:	

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

TCR-ES-MECH-007,R2-001

1.0 INSPECTION AND TESTING RESPONSIBILITIES

RESPONSIBILITY	ACTION
----------------	--------

Equipment Owner	1. Know where equipment is at all times and provide equipment for inspection.
Area QRS	2. Upon initial receipt, all rigging will be marked with a unique serial number and specifically for synthetic roundslings its initial length (with 5% of its maximum capacity applied) and listed in the area QRS database. 3. Maintain rigging in site storage location as required by Section 5.0. 4. Maintain the inspection records for periodic inspection for the life of the equipment. 5. Maintain due date to inspect equipment annually on Inspection Status List. 6. Determine if each sling is to be kept in service. <ol style="list-style-type: none"> If the sling is not to be kept in service, request the equipment owner to CAUTION tag item OUT OF SERVICE. If the sling is to be kept in service continue to step 7.
Qualified Inspector	7. Determine when during the calendar year each inspection is due. 8. Arrange for a qualified inspector to perform the inspection. 9. Perform required periodic inspection as per Section 5.0, Section 6.0 or Section 7.0 as appropriate. 10. Record the inspection of the Sling Inspection Form (Section 8.0) 11. Determine if deficiencies are found remove the sling from service.
QRS	12. File inspection reports.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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**2.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE
CRITERIA INTRODUCTION**

- a. Periodic Inspections of wire rope slings and synthetic slings are performed per Section 5.0, Section 6.0 or Section 7.0 as appropriate. Note: All annual inspections shall be completed between the period of January 1st and March 31st of the calendar year. Apply a color stripe to the sling indicating the annual inspection was performed. **Note:** The following convention will be used. Colors: Black, Red, Orange, Yellow, Green, Blue, Violet, and White will be used in the order stated. For calendar year (CY) 2008 black will be used, for CY 2009 Red, and so on.

3.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
Wire Rope Slings	Area QRS
Synthetic Slings	Area QRS
Chain Slings	Area QRS

Table 8-1 Record Storage Requirements

4.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	<1 mo.	> 1 mo. & < 1yr.	= 1 yr.	
Slings	Visual		Annual Inspection with Records	Replace

Table 8-2 Required Inspections (Must be ensured prior to each use)

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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**5.0 SYNTHETIC SLING PERIODIC INSPECTION/MAINTENANCE &
STORAGE CRITERIA/CRITICAL LIFT CRITERIA****PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN QRS SITE RIGGING
INVENTORY/TESTING LOG**INSPECTION CHECK LIST:**

- a. All slings shall be visually inspected before each use by a qualified rigger handling the sling.
- b. Annual inspection shall be made by a certified inspector whose qualification to perform specific inspection activities has been determined, verified and attested to in writing and inspection records (See Section 8.0) shall be kept on file and readily available.
- c. During all inspections, hooks shall be inspected per the criteria found in Chapter 9 of this Standard.
- d. Synthetic roundslings shall be removed from service if any defects, such as the following, are visible:
 - 1) Missing or illegible sling identification.
 - 2) Acid or caustic burns
 - 3) Evidence of heat damage.
 - 4) Holes, tears, cuts, abrasive wear, or snags that expose the core yarns.
 - 5) Broken or damaged core yarns.
 - 6) Weld splatter that exposes core yarns.
 - 7) Roundslings that are knotted.
 - 8) Discoloration and brittle or stiff areas on any part of the sling, which may mean chemical or UV damage.
 - 9) Fittings that are pitted, corroded, cracked, bent, twisted, gouged or broken
 - 10) Hooks whose condition meets the removal criteria of Chapter 9.
 - 11) Other conditions, including visible that may cause doubt as to the continued use of the sling.
- e. Written inspection records, utilizing the identification for each sling as established by the user, should be kept on all slings. These records should show a description of the new sling and its condition on each subsequent annual inspection.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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**5.0 SYNTHETIC SLING PERIODIC INSPECTION/MAINTENANCE & STORAGE
CRITERIA/CRITICAL LIFT CRITERIA (continued)****SYNTHETIC SLING MAINTENANCE AND STORAGE**

- a. Synthetic slings shall not be stored where the temperature exceeds 200°F.
- b. Synthetic slings shall not be stored in direct sunlight.
- c. Slings should be kept clean and free of dirt and abrasive grit.
- d. Slings can be cleaned with mild soap and water. Allow sling to dry properly before placing back in storage or service.

CRITICAL LIFTS:

- a. Synthetic-web slings used for critical-lift service shall have an initial proof test of 200 percent of the vertical rated capacity. If proof testing cannot be verified, the sling(s) shall be proof tested (Chapter 14) before being used to make a critical lift.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

TCR-ES-MECH-007,R2-001

6.0 WIRE ROPE SLING PERIODIC INSPECTION, MAINTENANCE & USE CRITERIA**PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN QRS SITE RIGGING
INVENTORY/TESTING LOG**INSPECTION CHECK LIST:**

- a. All slings shall be visually inspected each day they are used. In addition, an annual inspection shall also be performed. During all inspections, hooks shall be inspected per the criteria found in Chapter 9 of this Standard. Annual inspections shall be performed by a certified inspector whose qualification to perform specific inspection activities has been determined, verified and attested to in writing. Any deterioration which could result in an appreciable loss of original strength shall be carefully noted, and determination made whether further use of the sling would constitute a safety hazard. Inspection records shall be kept on file and readily available.
- b. Conditions, such as the following, shall be sufficient reason for questioning sling safety and for consideration of replacement:
 - 1) Missing or illegible sling identification
 - 2) For strand-laid and single-part slings, ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
 - 3) For cable-laid slings, 20 broken wires per lay.
 - 4) For six-part braided slings, 20 broken wires per braid.
 - 5) For eight-part braided slings, 40 broken wires per braid.
 - 6) Severe localized abrasion or scraping.
 - 7) Kinking, crushing, birdcaging, or any other damage resulting in damage to the rope structure.
 - 8) Evidence of heat damage.
 - 9) End attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected.
 - 10) Severe corrosion of the rope, end attachments, or fittings.
 - 11) For hooks removal criteria as stated in Chapter 9.
 - 12) Other conditions, including visible damage, that cause doubt as to the continued use of the sling.
- c. Slings shall be stored in racks or in designated locations when not in use.
- d. Slings should be wiped clean periodically to remove as much dirt and abrasive grit as possible, and be re-lubricated to extend their useful life.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

TCR-ES-MECH-007,R2-001

**6.0 WIRE ROPE SLING PERIODIC INSPECTION, MAINTENANCE & STORAGE
USE CRITERIA (continued)**

- e. Slings should never be stored in damp or dirty places, or in places exposed to corrosive materials or weather. For long-term storage, they should be cleaned and lubricated.
- f. Wire-rope slings used for critical-lift service shall have an initial proof test. If proof testing cannot be verified, the wire-rope sling(s) shall be proof tested before being used to make a critical lift.
- g. Wire-rope sling eyes with thimbles shall be made with a thimble having a ratio of thimble diameter (D) to rope diameter (d) of 3 or more (D/d greater than or equal 3).
- h. Do not use wedge sockets or wire-rope clips on slings used for critical lifts.
- i. Ensure that working loads of wire-rope slings do not exceed their rated capacities.
- j. Do not splice slings together.
- k. Use thimble eyes for slings to be joined end-to-end.
- l. Locate sling eyes so that
 - 1) Adequate clearance is maintained between the attached slings and other parts or surfaces of the component or equipment.
 - 2) There is no interference with the functioning of hoisting, rigging, or handling equipment.
 - 3) Maximum accessibility to the eye is maintained.
 - 4) Attached slings can converge over the center of gravity of the lift.
 - 5) Proper stability can be maintained during lifting and positioning of the item at the installation site.
 - 6) The plane of the slinging eye is coincident with the plane of the sling under loaded conditions within ± 5 degrees.
 - 7) Sling angles are not less than 45 degrees with the horizontal.
- m. In addition to marking requirements listed for ordinary lifts, other items may need to be marked as determined on a case-by-case basis, such as the reach, type, weight of the sling assembly, and rated capacity.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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**7.0 CHAIN SLING PERIODIC INSPECTION, MAINTENANCE & USE
CRITERIA****PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN QRS SITE RIGGING
INVENTORY/TESTING LOG**INSPECTION CHECK LIST:**

- a. All slings shall be visually inspected each day they are used. In addition, an annual inspection shall also be performed. Annual inspections shall be performed by a certified inspector whose qualification to perform specific inspection activities has been determined, verified and attested to in writing. During all inspections, hooks shall be inspected per the criteria found in Chapter 9 of this Standard. Any deterioration which could result in an appreciable loss of original strength shall be carefully noted, and determination made whether further use of the sling would constitute a safety hazard. Inspection records shall be kept on file and readily available.
- b. Conditions, such as the following, shall be sufficient reason for questioning sling safety and for consideration of replacement:
 - 1) Missing or illegible sling identification.
 - 2) Cracks or breaks.
 - 3) Excessive wear, nicks or gouges. Minimum thickness on chain links shall not be below the listed values in table 8.3.
 - 4) Stretched chain links or components.
 - 5) Bent, twisted or deformed chain links or components.
 - 6) Excessive pitting or corrosion.
 - 7) Lack of ability of chain or components to hinge (articulate) freely.
 - 8) Evidence of heat damage.
 - 9) Weld splatter.
 - 10) Severe corrosion of the chain, end attachments, or fittings.
 - 11) For hooks removal criteria as stated in Chapter 9.
 - 12) Other conditions, including visible damage, that cause doubt as to the continued use of the sling.
- c. Slings shall be stored in racks or in designated locations when not in use.
- d. Slings should be wiped clean periodically to remove as much dirt and abrasive grit as possible, and be re-lubricated to extend their useful life. Chains should not be lubricated when in use.
- e. Slings should never be stored in damp or dirty places, or in places exposed to corrosive materials, excessive temperatures, kinking or weather. For long-term storage, they should be cleaned and lubricated.

CHAPTER 8 SLINGS (SYNTHETIC, WIRE ROPE AND CHAIN) INSPECT AND TEST

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**7.0 CHAIN SLING PERIODIC INSPECTION/MAINTENANCE & STORAGE
CRITERIA/CRITICAL LIFT CRITERIA (continued)**

- f. Chain slings used for critical-lift service shall have an initial proof test. If proof testing cannot be verified, the chain sling(s) shall be proof tested before being used to make a critical lift. As a minimum, the proof load shall be equal to the rated capacity, but shall not exceed:
- 1) For single and multiple leg chain slings, each leg shall be proof loaded to a minimum of 2 times the single leg vertical hitch rated load.
 - 2) The proof load for components attached to single legs shall be a minimum of 2 times the single leg vertical hitch rated load.
 - 3) Master links for double leg bridle chain slings, single basket slings and master coupling links connected to two legs shall be proof loaded to a minimum of 4 times the single leg vertical hitch rated load.
 - 4) Master links for triple and quadruple leg bridle chain slings and double basket bridle chain slings shall be proof loaded to a minimum of 6 times the single leg vertical hitch rated load.
- g. Ensure that working loads of chain slings do not exceed their rated capacities.
- h. In addition to marking requirements listed for ordinary lifts, other items may need to be marked as determined on a case-by-case basis, such as the reach, type, weight of the sling assembly, and rated capacity.

Nominal Chain or Coupling Link Size		Minimum Allowable Thickness at any Point on the Link	
In.	mm	In.	mm
7/32	5.5	0.189	4.80
9/32	7	0.239	6.07
5/16	8	0.273	6.93
3/8	10	0.342	8.69
1/2	13	0.443	11.26
5/8	16	0.546	13.87
3/4	20	0.687	17.45
7/8	22	0.75	19.05
1	26	0.887	22.53
1 1/4	32	1.091	27.71

Table 8-3 Minimum Allowable Thickness at any Point on the Link

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[illegible]

CHAPTER 9 HOOKS INSPECTION AND TESTING

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Note: This chapter addresses load hooks installed on cranes and hoists.

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CHAPTER 9 HOOKS INSPECTION AND TESTING

TCR-ES-MECH-007,R2-001

1.0 INSPECTION AND TESTING RESPONSIBILITIES**RESPONSIBILITY ACTION**

- | | |
|---------------------|---|
| Equipment Owner | 1. Know where equipment is at all times and provide equipment for inspection. |
| Area QRS | 2. Maintain the inspection records for periodic inspection.

3. Maintain due date to inspect equipment annually on Inspection Status List.

4. Determine if each hook is to be kept in service. <ul style="list-style-type: none"> a. If the hook is not to be kept in service, request the equipment owner to CAUTION tag item OUT OF SERVICE. b. If the hook is to be kept in service continue to step 5. 5. Determine when during the calendar year each inspection is due.

6. Arrange for a qualified inspector to perform the inspection. |
| Qualified Inspector | 7. Perform required periodic inspection as per Section 5.0.

8. Record the inspection.

9. Determine if deficiencies are found, and, if so, remove the hook from service. |
| QRS | 10. File inspection reports. |

CHAPTER 9 HOOKS INSPECTION AND TESTING

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**2.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE
CRITERIA INTRODUCTION**

- a. Periodic Inspections of hooks are performed per Section 5.0.

3.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
Hooks	Area QRS

Table 9-1 Record Storage Requirements

4.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	<1 mo.	> 1 mo. & < 1yr.	= 1 yr.	
Hooks	Visual	Hook Insp	NDE/yr. - > 10 ton & > normal service. Annual Inspection with records	Replace

Table 9-2 Required Inspections (Must be ensured prior to each use)

NOTE: Annual hook NDE not normally required since PPPL cranes all fall within normal service category.

CHAPTER 9 HOOKS INSPECTION AND TESTING

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5.0 HOOK PERIODIC INSPECTION CRITERIA**A. FREQUENT INSPECTIONS**

FREQUENT VISUAL INSPECTIONS

- a. Visual Inspection of Hooks for:
 - 1) Distortion such as bending, twisting or increased throat opening
 - 2) Wear, cracks, nicks or gouges
 - 3) Proper latch functioning (if provided)
 - 4) Hook attachment and securing means
 - 5) Self locking hooks for proper operation

B. PERIODIC INSPECTIONS

PERIODICITY: MONTHLY ODCL AND ANNUALLY

DOCUMENTATION: RECORDS REQUIRED – ODCL WITH AREA QRS; PERIODIC
CRANE INSPECTION REPORT IN OPERATIONS CENTER
FOR LIFE OF EQUIPMENT

INSPECTION CHECK LIST (performed by a qualified inspector):

- a. A qualified person shall examine deficiencies and determine whether they constitute a safety hazard.
- b. The inspection shall include the requirements of the Frequent Inspection.
- c. Hooks having any of the following conditions shall be removed from service until repaired or replaced:
 - 1) Deformation – Any visibly apparent bend or twist from the plane of the unbent hook.
 - 2) Throat opening – Any distortion causing an increase in throat opening exceeding 5 percent, not to exceed $\frac{1}{4}$ inch (or as recommended by the manufacturer).
 - 3) Wear – Any wear exceeding 10 percent (or as recommended by the manufacturer) of the original section dimension of the hook or its load pin.
 - 4) Cracks.
 - 5) If a latch is provided and it becomes inoperative because of wear or deformation or fails to fully bridge the throat opening, the hook shall be removed from service until the device has been repaired or replaced and the throat opening has been assessed as described above.
 - 6) Any self-locking hook that does not lock.

CHAPTER 9 HOOKS INSPECTION AND TESTING

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5.0 HOOK PERIODIC INSPECTION CRITERIA (continued)

- d. If hooks are painted, a visual inspection should take the coating into consideration. Surface variations can disclose evidence of heavy or severe service. The surface condition may call for stripping the paint in such instances.
- e. Hooks in severe service (operation at heavy service coupled with abnormal operating conditions, (i.e., extreme temperatures, corrosive atmospheres, etc.)) may show the need for a nondestructive testing.
- f. Dated and signed inspection records shall be kept on file and shall be readily available

CHAPTER 9 HOOKS INSPECTION AND TESTING

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6.0 NON-DESTRUCTIVE TESTING (NDT)

DOCUMENTATION: Dated and signed NDT records, traceable to the hook by a serial number or other identifier, shall be kept on file as long as the hook remains in service and shall be readily available to appointed personnel.

NDT Methods:

- a. Use magnetic-particle testing or liquid-penetrant testing methods to inspect for surface intersecting discontinuities.
- b. A qualified inspector or designated person shall perform NDTs in accordance with the following ASTM standards:
 - 1) ASTM E-709.
 - 2) ASTM E-165.
- c. For magnetic-particle testing, a coil, yoke, or wet technique should be used to eliminate the possibility of prod burns or arc strikes.
- d. Perform an NDT with the hook in place unless conditions indicate that disassembly for thread or shank inspection is necessary.

Acceptance Criteria:

A designated person shall document and resolve the following relevant indications:

- a. Arc strikes (welding or electrical).
- b. Surface intersecting discontinuities 0.25 in. long or longer.

Discontinuity Removal:

- a. Two directions of discontinuity, "P" and "T," are shown on Figures 9-1 and 9-2. Discontinuity "P" parallels the contour of the hook, is considered nonserious, and does not require removal. Discontinuity "T," on the other hand, is transverse to the contour of the hook and is more serious; when occurring in zones B, C, or D, discontinuity "T" may reduce the longevity of the hook.
- b. Discontinuities may be removed by grinding longitudinally following the contour of the hook to produce a smooth, gently undulating surface. In zones B and D, such grinding shall not reduce the original hook dimension by more than 10 percent. Such a reduction will not affect the working load limit rating or the ultimate load rating of the hook. In zone C, grinding shall not reduce the original dimension by more than 5 percent.
- c. Under normal and proper application, zone A is an unstressed zone. Therefore, it is not required that discontinuities in that zone be ground out.
- d. The hook shall be reexamined by performing an NDT after grinding to verify removal of relevant discontinuities.

CHAPTER 9 HOOKS INSPECTION AND TESTING

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6.0 NON-DESTRUCTIVE TESTING (NDT) (continued)

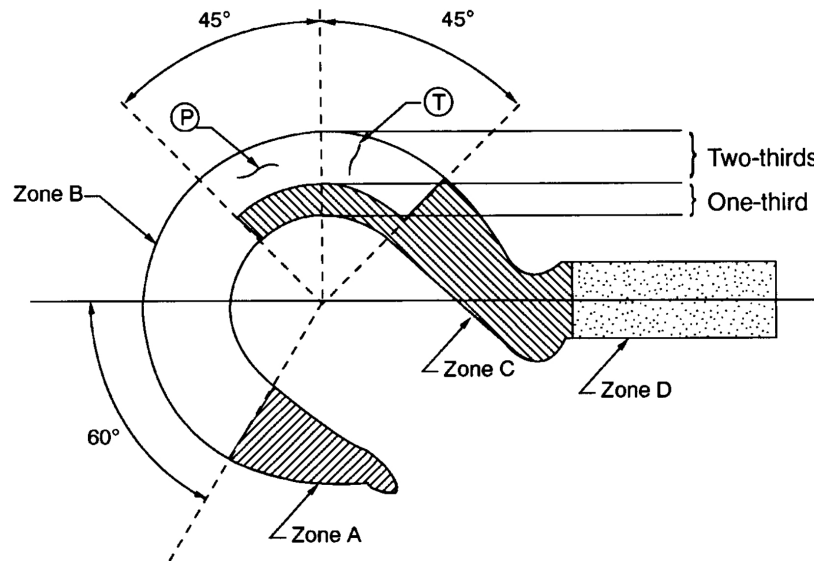


Figure 9-1. Shank hook.

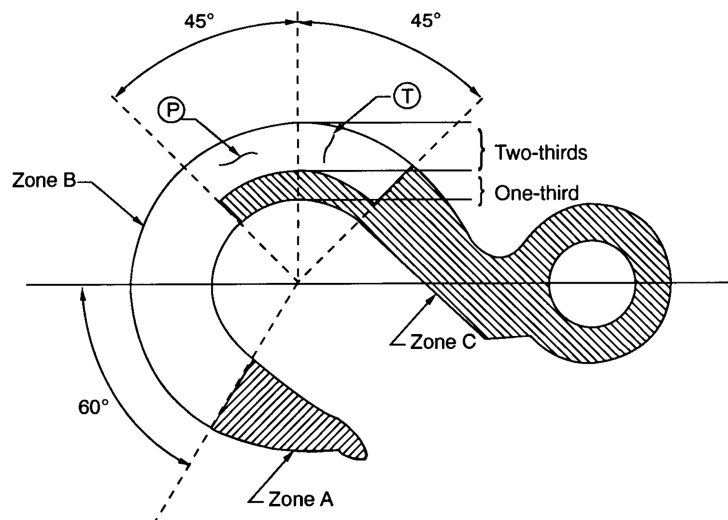


Figure 9-2. Eye hook.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

TCR-ES-MECH-007,R2-001

Note: This chapter addresses hardware such as shackles, eyebolts, eye nuts, links, rings, swivels turnbuckles, and rigging hooks.

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CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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1.0 INSPECTION AND TESTING RESPONSIBILITIES

RESPONSIBILITY	ACTION
Equipment Owner	1. Know where equipment is at all times and provide equipment for inspection.
Area QRS	2. Determine if each item is to be kept in service. a. If the item is not to be kept in service, request the equipment owner to CAUTION tag item OUT OF SERVICE.
	3. Arrange for a qualified inspector to perform the inspection.
Qualified Inspector	4. Perform required periodic inspection as per the appropriate Section shown in the Table of Contents for this chapter. 5. Determine if deficiencies are found, and, if so, remove the item from service.
QRS	6. File inspection reports in area QRS database.

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**2.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE,
CRITICAL LIFT CRITERIA INTRODUCTION**

- a. Periodic Inspections, maintenance, and critical lift criteria of rigging hardware are performed per Section 4.0 through 10.0 as required. Note: All rigging hardware must be inspected prior to use to meet the annual inspection requirement.

3.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	<1 mo.	> 1 mo. & < 1yr.	= 1 yr.	
Rigging Hardware	Visual		Annual Inspection	Replace

Table 10-1 Required Inspections (Must be ensured prior to each use)

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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4.0 SHACKLE PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Shackles shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
 - 1) Missing or illegible manufacturer's name or trademark, size and/or rated load identification.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components
 - 5) Excessive nicks or gouges
 - 6) A 10% reduction of the original or catalog dimension at any point around the body or pin.
 - 7) Incomplete pin engagement
 - 8) Excessive thread damage.
 - 9) Evidence of unauthorized welding.
 - 10) Other conditions, including visible damage, that cause doubt as to the continued use of the shackle.

CRITICAL LIFT:

- a. Shackles used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the shackle(s) shall be proof tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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5.0 EYEBOLT PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Eyebolts shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
 - 1) Missing or illegible manufacturer's name or trademark, size, grade (alloy bolts only) and/or rated load identification.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion.
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - 5) Excessive nicks or gouges.
 - 6) A 10% reduction of the original or catalog dimension at any point around the body or pin.
 - 7) Excessive thread damage or wear.
 - 8) Evidence of unauthorized welding or modification
 - 9) Other conditions, including visible damage, that cause doubt as to continue use.

CRITICAL LIFT:

- a. Eyebolts used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the eyebolts shall be proof tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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6.0 EYENUTS PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Eye nuts shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
 - 1) Missing or illegible manufacturer's name or trademark, size and/or rated load identification.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion.
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - 5) Excessive nicks or gouges.
 - 6) A 10% reduction of the original or catalog dimension at any point around the body or pin.
 - 7) Excessive thread damage or wear.
 - 8) Evidence of unauthorized welding or modification
 - 9) Other conditions, including visible damage, that cause doubt as to continue use.

CRITICAL LIFT:

- a. Eyenuts used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the eyenuts shall be proof tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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7.0 TURNBUCKLES PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Turnbuckles shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
 - 1) Missing or illegible manufacturer's name or trademark and/or rated load identification.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion.
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - 5) Excessive nicks or gouges.
 - 6) A 10% reduction of the original or catalog dimension at any point.
 - 7) Excessive thread damage or wear.
 - 8) Evidence of unauthorized welding or modification
 - 9) Other conditions, including visible damage, that cause doubt as to continue use.

CRITICAL LIFT:

- a. Turnbuckles used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the turnbuckles shall be proof tested before being used to make a critical lift. If proof tested, turnbuckles shall be inspected after the test for the removal conditions stated above.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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8.0 LINKS, RINGS, AND SWIVEL PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Links, rings or swivels shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
- 1) Missing or illegible manufacturer's name or trademark, size, grade (if required to meet rated load) and/or rated load identification.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion.
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - 5) Excessive nicks or gouges.
 - 6) A 10% reduction of the original or catalog dimension at any point.
 - 7) Excessive thread damage or wear.
 - 8) Evidence of unauthorized welding or modification
 - 9) For swivels, lack of ability to freely rotate when not loaded
 - 10) For swivels, loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners or retaining devices
 - 11) Other conditions, including visible damage, that cause doubt as to continue use.

CRITICAL LIFT:

- b. Links, rings, and swivels used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the links, rings, and swivels shall be proof tested before being used to make a critical lift. If proof tested, links, rings, and swivels shall be inspected after the test for the removal conditions stated above.
- c. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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9.0 SWIVEL HOIST RING PERIODIC INSPECTION/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS CRITERIA IS MET PRIOR TO EACH USE**

PERIODICITY: PRIOR TO USE

DOCUMENTATION: NO RECORDS REQUIRED

INSPECTION CHECK LIST:

- a. Swivel hoist rings shall be removed from service if damage such as the following is visible, and shall only be returned to service when approved by a qualified person:
- 1) Missing or illegible manufacturer's name or trademark, rated load identification and torque value.
 - 2) Indications of heat damage including welding spatter or arc strikes.
 - 3) Excessive pitting or corrosion.
 - 4) Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - 5) Excessive nicks or gouges.
 - 6) A 10% reduction of the original or catalog dimension at any point.
 - 7) Excessive thread damage or wear.
 - 8) Evidence of unauthorized welding or modification
 - 9) Lack of the ability to freely rotate or pivot
 - 10) Other conditions, including visible damage, that cause doubt as to continue use.

CRITICAL LIFT:

- a. Swivel hoist rings used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test loads shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the swivel hoist rings shall be proof tested before being used to make a critical lift. If proof tested, swivel hoist rings shall be inspected after the test for the removal conditions stated above.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 10 RIGGING HARDWARE INSPECTION AND TESTING

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**10.0 LOAD INDICATING DEVICES/PRECISION LOAD POSITIONERS
CRITICAL LIFT CRITERIA****CRITICAL LIFT CRITERIA:**

- a. Load indicating devices and precision load positioners used for critical-lift service shall have an initial proof load test per the manufacturer's specifications confirming the load rating. If proof testing cannot be verified, the load indicating device or precision load positioner shall be proof tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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Note: This chapter addresses the requirements for below-the-hook lifting devices used in hoisting and rigging such as spreader bars, lifting yokes, and lift fixtures.

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CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

TCR-ES-MECH-007,R2-001

1.0 INSPECTION AND TESTING RESPONSIBILITIES**RESPONSIBILITY ACTION**

Equipment Owner	1. Know where equipment is at all times and provide equipment for inspection.
Operations Center	2. Maintain the inspection records for periodic inspection for the life of the equipment.
Lift Manager	3. Maintain due date to inspect equipment annually on Inspection Status List.
	4. Determine if each item is to be kept in service. <ul style="list-style-type: none"> a. If the item is not to be kept in service, request the equipment owner to CAUTION tag item OUT OF SERVICE.
	5. Determine when during the calendar year each inspection is due.
	6. Arrange for a qualified inspector to perform the inspection.
Qualified Inspector	7. Perform required periodic inspection as per the appropriate Section shown in the Table of Contents for this chapter.
	8. Record the inspection.
	9. Determine if deficiencies are found, and, if so, remove the item from service.
QRS	10. File inspection reports.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

TCR-ES-MECH-007,R2-001

2.0 BELOW THE HOOK LOAD TEST RESPONSIBILITIES

- a. All new, altered, modified, or repaired lifting devices shall be tested and inspected before use. The results of the test and inspection shall be documented in the equipment history file.
- b. The rated capacity shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated capacity unless otherwise recommended by the manufacturer. Test weights shall be accurate to within -5 percent, +0 percent of stipulated values.
- c. The rated load test shall consist of the following:
 - 1) Hoist the test load a sufficient distance to ensure that it is supported by the lifting device, or apply the required load if the test is made using a testing machine. Personnel shall remain clear of suspended loads.
 - 2) Visually inspect the lifting device for deformation, cracks, or other defects after the load test is completed.

RESPONSIBILITY ACTION

Qualified Individual	1. Perform periodic inspection per Section 7.0 through 9.0 as appropriate.
QRS	2. Determine load test weights and rigging.
	3. Document load test configuration on Load Test Data Sheet (Chapter 14) and signs.
	4. Arrange to have weights moved to the load test site.
	5. Notifies QC of load test.
Lift Manager	6. Approves the Load Test Data Sheet (Chapter 14).
Riggers	7. Perform rigging inspection and reports to QRS all items are acceptable.
QRS	8. Verify and sign the Load Test Data Sheet.
Riggers	9. Place rigging.
QRS	10. Perform load test according to the Load Test Data Sheet (Chapter 14).

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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3.0 STANDARDS & INSPECTION, TESTING & MAINTENANCE, CRITICAL LIFT CRITERIA INTRODUCTION

- a. Periodic Inspections, maintenance, and critical lift criteria of rigging hardware are performed per Section 7.0 through 9.0 as required.

4.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
BTH Lifting Devices	OPS Center

Table 11-1 Record Storage Requirements

5.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	Prior to use	> 1 mo. & < 1yr.	= 1 yr.	
Lifting Devices	Visual		Annual Inspection with records	Replace

Table 11-2 Required Inspections (Must be ensured prior to each use)

6.0 DESIGN OF BELOW THE HOOK LIFTING DEVICES

Below the Hook Lifting Devices shall be designed per ASME BTH-1. Lifting devices at PPPL are designed for unique and specialized purposes and therefore meet the requirements for Design Category A and Service Class 0 (less than 20,000 cycles). The structural design calculations shall meet the “Design Category A and Service Class 0” requirements listed in ASME BTH-1. The design calculations shall list “Design Category A and Service Class 0” on the calculations and drawings for the device. Since all PPPL devices are classified as “Design Class A and Service Class 0”, the device is not required to be marked as such.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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7.0 STRUCTURAL AND MECHANICAL LIFTING DEVICE PERIODIC INSPECTION/TESTING/CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN OPS CENTER
RIGGING INVENTORY/TESTING LOG FOR LIFE OF
EQUIPMENT**INSPECTION CHECK LIST:**

- a. Visual inspection – Daily or prior to use inspect for the following:
 - 1) Structural deformation, cracks, or excessive wear on any part.
 - 2) Loose or missing guards, bolts, fasteners, covers, stops, or nameplates.
 - 3) All operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation.
- d. Check for suspect/counterfeit parts (see Chapter 13).
- e. Cracked or worn gears, pulleys, sheaves, sprockets, bearings, chains, and belts.
- f. Excessive wear of friction pads, linkages, and other mechanical parts.
- g. Excessive wear at hoist-attaching points and load-support shackles or pins.
- h. External evidence of damage to motors or controls.

TESTING:**a. OPERATIONAL TEST**

- 1) Modified or repaired lifting devices shall be tested before initial use to ensure compliance with the requirements of this section (test reports kept on file).
Testing shall include the following:
 - Lifting devices with moving parts shall be tested to confirm that the lifting device operates in accordance with manufacturer's instructions.
- 2) Lifting devices with manually operated or automatic latches shall be tested to verify that the latches operate in accordance with manufacturer's instructions.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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**7.0 STRUCTURAL AND MECHANICAL LIFTING DEVICE PERIODIC
INSPECTION/TESTING/CRITICAL LIFT CRITERIA (continued)****b. RATED LOAD TEST**

- 1) All new, altered, modified, or repaired lifting devices shall be tested and inspected before use. The results of the test and inspection shall be documented in the equipment history file.
- 2) The rated capacity shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated capacity unless otherwise recommended by the manufacturer. Test weights shall be accurate to within -5 percent, +0 percent of stipulated values.
- 3) The rated load test shall consist of the following:
 - Hoist the test load a sufficient distance to ensure that it is supported by the lifting device, or apply the required load if the test is made using a testing machine. Personnel shall remain clear of suspended loads.
 - Visually inspect the lifting device for deformation, cracks, or other defects after the load test is completed.

CRITICAL LIFTS:

- a. Structural and mechanical lifting devices for critical-lift service shall have an initial proof-load test of not less than 125 percent of its rated capacity or as specified by the design standard to which it was built. If proof-testing cannot be verified, the lifting device shall be proof-tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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**8.0 MAGNET (CLOSE PROXIMITY OPERATED) LIFTING DEVICE
PERIODIC INSPECTION/ /CRITICAL LIFT CRITERIA****PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN QRS SITE RIGGING
INVENTORY/TESTING LOG FOR LIFE OF EQUIPMENT**INSPECTION CHECK LIST:**

- a. Visual inspection – Daily/Periodic or prior to use inspect for the following:
 - 1) Lifting magnet face for freedom from foreign materials and for smoothness.
 - 2) Lifting bail or sling suspension for proper condition.
 - 3) Control handle for proper condition and operation.
 - 4) Current indicator, where applicable, for proper condition and operation.
 - 5) Labels, markings, and indicators or meters for legibility.
 - 6) Electrical conductors, if applicable, for loose connections, continuity, corrosion, and damage to insulation.
 - 7) Battery for correct electrolyte level and lack of corrosion of battery posts or connectors, if applicable.
 - 8) Deformation, wear, and corrosion of all members, fasteners, locks, switches, warning labels, and lifting parts.
 - 9) Check for suspect/counterfeit parts (see Chapter 13).
 - 10) Operation and condition of electrical components (i.e., meters, indicators, and alarms).
 - 11) Magnet coil tested for ohmic/ground readings and readings compared to manufacturer's standards.

CRITICAL LIFTS:

- a. General-application magnets are required to satisfy the rated breakaway-force test. The breakaway force measured in this test must exceed 200 percent of the rated load. If the rated breakaway-force test cannot be verified, the lifting device shall be required to satisfy the rated breakaway-force test before being used to make a critical lift.
- b. Specified-application magnets are required to satisfy the rated breakaway-force test. The breakaway force measured in this test must exceed 200 percent of the rated load. If the rated breakaway-force test cannot be verified, the lifting device shall be required to satisfy the rated breakaway-force test before being used to make a critical lift.
- c. Load tests shall be performed per Chapter 14.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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9.0 VACUUM LIFTING DEVICE PERIODIC INSPECTION/ /CRITICAL LIFT CRITERIA**PERIODIC INSPECTIONS**

PERIODICITY: MONTHLY, ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN QRS SITE RIGGING
INVENTORY/TESTING LOG FOR LIFE OF EQUIPMENT**INSPECTION CHECK LIST:**

- a. Visual inspection – Daily/Periodic or prior to use inspect for the following:
 - 1) Structural members for deformation, cracks and excessive wear.
 - 2) The vacuum generator for output.
 - 3) All vacuum pad seal rings for cuts, tears, excessive wear and presence of foreign particles.
 - 4) All vacuum lines and vacuum line connections for leakage, cuts, kinks and collapsed areas of hoses.
 - 5) The vacuum reservoir for leaks and visual damage.
 - 6) The entire vacuum system (lights, gages, horns, bells, pointers, or other warning devices and vacuum level indicators).
 - 7) Motors.
 - 8) Controls.
 - 9) Other auxiliary components.
 - 10) Warning labels are attached.

CRITICAL LIFTS:

- a. Vacuum lifting devices for critical-lift service shall have an initial proof-load test of not more than 125 percent of its rated capacity or as specified by the design standard to which it was built. If proof-testing cannot be verified, the lifting device shall be proof-tested before being used to make a critical lift.
- b. Load tests shall be performed per Chapter 14.

CHAPTER 11 BELOW-THE-HOOK LIFTING DEVICES DESIGN, INSPECTION AND TESTING

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10.0 LIFTING FIXTURE INSPECTION CHECKLIST

Below The Hook Lifting device (lift fixture) Inspection

Fixture number: _____ Serial Number (if applicable): _____

Type/Name (Use): _____ Rated Capacity (SWL): _____ lb

Lifting bars and spreaders shall be checked for signs of incipient failure in bending and shall be replaced if permanently bent more than $\frac{1}{2}$ inch in 10 feet, or twisted more than 5 degrees out of the original plane. Hook and welds shall be examined by a qualified inspector for cracks and signs of failure in tension.

If hook or weld deficiencies are found, a Certified Weld Inspector shall perform test by visual examination, liquid-penetrant examination, or magnetic-particle examination.

The operator or designated person shall carefully examine any deficiencies and determine whether they constitute a hazard. Deficiencies noted during the inspection shall be corrected before the lifting device is used.

1. Structural deformation, cracks, or excessive wear on any part. _____
2. Loose or missing guards, bolts, fasteners, covers, stops, or nameplates. _____
3. All operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation. _____
4. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1 and Chapter 13) _____
5. Cracked or worn gears, pulleys, sheaves, sprockets, bearings, chains, and belts. _____
6. Excessive wear of friction pads, linkages, and other mechanical parts. _____
7. Excessive wear at hoist-attaching points and load-support shackles or pins. _____
8. External evidence of damage to motors or controls. _____
9. Operational/functional test shall be performed where possible _____
10. Supporting Structure _____
11. Warning Labels _____

Pass / Fail
(circle one)

INSPECTOR: _____

INSPECTION DATE: _____

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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Note: This chapter addresses the requirements for miscellaneous lifting devices including, but not limited to, portable A-frames (sometimes referred to as portable gantries), Truck mounted cranes with a capacity of 1 ton or less not covered in ASME B30.5 (Mobile and Locomotive Cranes.) and self contained shop cranes as addressed by ASME PASE (Portable Automotive Service Equipment.)

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**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

TCR-ES-MECH-007,R2-001

1.0 INSPECTION AND TESTING RESPONSIBILITIES

RESPONSIBILITY	ACTION
----------------	--------

- | | |
|---------------------|--|
| Equipment Owner | 1. Know where equipment is at all times and provide equipment for inspection. |
| Area QRS | 2. Upon initial receipt, all rigging will be marked with a unique serial number and listed in the Crane/PASE Inspections Status List database managed by the Lift Manager. |
| OPS Center | 3. Maintain the inspection records for periodic inspection. |
| Lift Manager | 4. Maintain due date to inspect equipment annually on the Crane/PASE Inspections Status List database. |
| | 5. Determine if each item is to be kept in service. <ul style="list-style-type: none"> a. If the item is not to be kept in service, requests the equipment owner to CAUTION tag item OUT OF SERVICE. b. If the item is to be kept in service continue. |
| | 6. Review Crane/PASE Inspections Status List database to determine when during the calendar year each inspection is due. |
| | 7. Arrange for a qualified inspector to perform the inspection. |
| Qualified Inspector | 8. Perform required periodic inspection as per the appropriate Section shown in the Table of Contents for this chapter. |
| | 9. Inspections for Hooks shall be performed as per Chapter 9 and Running Wire Rope as per Chapter 6 of this Standard. |
| | 10. Record the inspection on the form. Placer sticker on lifting device. |
| | 11. Determine if deficiencies are found, and, if so, remove the item from service. |
| | 12. File inspection reports with the Lift Manager. |

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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1.0 INSPECTION AND TESTING RESPONSIBILITIES (continued)

- | | |
|--------------|--|
| Lift Manager | 13. Reviews Inspection report and if acceptable updates the Crane/PASE Inspections Status List database. |
| | 14. Files Inspection report with OPS Center |
| OPS Center | 15. Files Inspection report in respective equipment file. |

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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**2.0 MISCELLANEOUS LIFTING DEVICE LOAD TEST
RESPONSIBILITIES**

- a. Prior to initial use, all new miscellaneous lifting devices including portable A-frames (sometimes referred to as portable gantries), Truck mounted cranes with a capacity of 1 ton or less not covered in ASME B30.5 (Mobile and Locomotive Cranes.) and self contained shop cranes as addressed by ASME PASE (Portable Automotive Lifting Devices.) and those upon which load-sustaining parts have been modified, replaced, or repaired shall be load-tested by a qualified inspector or under the direction of that inspector. A load test (Proof Test) certificate from the manufacturer may be used in lieu of the load test upon approval by the Lift Manager.
- b. A written report shall be furnished by the inspector showing test procedures and confirming the adequacy of repairs or alterations. Test reports shall be kept on file and shall be readily available to appointed personnel.
- c. Test loads shall not be less than 100 percent or more than 125 percent of the rated capacity, unless otherwise recommended by the manufacturer or a qualified person.
- d. Shop cranes built to design specifications are proof-tested by the manufacturer in accordance with ASME PASE, "Portable Automotive Service Equipment". After repair or modification, a qualified engineer (Lift Manager) shall determine if testing is required.

RESPONSIBILITY	ACTION
Qualified Individual	1. Perform periodic inspection per Section 5.0.
QRS	2. Determine load test weights and rigging.
	3. Prepares load test configuration on Load Test Data Sheet (Chapter 14).
	4. Arrange to have weights moved to the load test site. Notifies QC of load test.
Lift Manager	5. Approves the Load Test Data Sheet (Chapter 14).
Riggers	6. Perform rigging inspection and reports to QRS all items are acceptable.
QRS and QC	7. Verify and sign the Load Test Data Sheet.
Riggers	8. Place rigging.
QRS	9. Perform load test according to the Load Test Data Sheet (Chapter 14).

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
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3.0 RECORD STORAGE REQUIREMENTS

EQUIPMENT	PREVENTATIVE MAINTENANCE (PM) AND INSPECTION RECORDS
Miscellaneous Lifting Devices and PASE	OPS Center

Table 12-1 Record Storage Requirements

4.0 REQUIRED INSPECTIONS

ITEM	Time from last use (IDLE)			FAILURE
	Prior to use	> 1 mo. & < 1yr.	= 1 yr.	
Lifting Devices	Visual		Annual Inspection with records	Replace

Table 12-2 Required Inspections (Must be ensured prior to each use)

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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**5.0 MISCELLANEOUS LIFTING DEVICES PERIODIC INSPECTION/
TESTING CRITERIA****PERIODIC INSPECTIONS**

PERIODICITY: ANNUALLY

DOCUMENTATION: RECORDS REQUIRED -- ARCHIVED IN OPS CENTER
RIGGING INVENTORY/TESTING LOG FOR LIFE OF
EQUIPMENT**INSPECTION CHECK LIST:**

- a. Visual inspection – Daily prior to use inspect for the following:
 - 1) All control mechanisms for maladjustment interfering with proper operation.
 - 2) Hook shall be inspected per Chapter 9 of this Standard.
 - 3) Hydraulic systems for proper operation.
 - 4) Wire rope shall be inspected per Chapter 6 of this Standard.
 - 5) Chain for bent links, stretched links, cracks, scores, abrasions or heat damage.
 - 6) All safety devices for malfunction
 - 7) Inspection items identified in manufacturer's operating instructions.
 - 8) Visually inspect for bent, broken, damaged, corroded, cracked or missing parts.
 - 9) Verify the hoist and all components installed on portable A-frames do not exceed the rated capacity of the unit
 - 10) Verify required markings are installed and legible.
 - 11) Perform a function test of trolley and hoist installed on portable A-frames to ensure proper operation.
- b. Additional Inspection – Periodic Inspection items listed in manufacturer's instructions. If manufacturer's instructions are not available, the following items are typically included for inspection:
 - 1) Inspecting for bent, broken, damaged, corroded, cracked or missing parts.
 - 2) Verifying required markings are installed and legible.

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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**5.0 MISCELLANEOUS LIFTING DEVICES PERIODIC INSPECTION/ TESTING
CRITERIA (continued)**

- 3) Ensuring that each lifting device has its rated capacity legibly marked on the structure on each side of the primary beam.
 - 4) Ensuring that the manufacturer's name and model number are permanently and legibly marked on each lifting device.
 - 5) Ensuring trolley or beam clamp working load limits do not exceed the capacity rating of the A-frame. Hoists attached to the A-frame must have a rated capacity equal to or less than all supporting components and be inspected to requirements of Chapter 7. (Down rating of hoist to A-frame capacity is acceptable with administrative controls and markings in place).
 - 6) Ensuring A-frame components from different manufacturers are not inter-mixed with components from other A-frames regardless of similarities in manufacturers or rated capacities.
 - 7) Validating the proper dimensional relationship between trolley wheels and rail when installed on portable A-frames.
 - 8) Observing trolley side plates for any bending or distortion.
 - 9) Checking for missing or loose bolts, nuts and retaining pins or retaining devices. Check for Suspect/Counterfeit parts
- c) Items with forks shall be inspected per the requirements of ES-MECH-010 Forklifts and Walkies for Fork Inspection, Testing and Repairs.

TESTING:

- a. **OPERATIONAL TEST:** The load lifting and lowering mechanisms shall be tested during an initial test and after load testing.

**CHAPTER 12 PORTABLE A-FRAME, SMALL CRANES, PASE AND
MISCELLANEOUS LIFTING DEVICES INSPECTION AND TESTING**

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**6.0 PORTABLE A-FRAME, SMALL CRANES AND PASE INSPECTION
FORM AND MISCELLANEOUS LIFTING DEVICES**

A-frame, crane, or PASE number: _____ Serial Number (if applicable): _____

Type/Name (Use): _____ Rated Capacity (SWL): _____

All portable A-frames, small cranes (1 ton or less) and PASE's (Portable Automotive Service Equipment / Engine Hoist) shall be inspected annually. A qualified inspector shall perform the examination. Deficiencies noted during the inspection shall be corrected before the lifting device is used.

1. Verify that the manufacturer's name and model number are permanently and legibly marked on each lifting device. _____
2. Inspecting for bent, broken, damaged, corroded, cracked, excessively worn or missing parts. _____
3. Check for missing or loose bolts, nuts and retaining pins or retaining devices. _____
4. Loose or missing guards, fasteners, covers, stops, or nameplates. _____
5. All operating mechanisms and automatic hold-and-release mechanisms for maladjustments interfering with operation. _____
6. Check for suspect/counterfeit parts (see Terminology and Definitions, Chapter 1 and Chapter 13) _____
7. Cracked or worn gears, pulleys, sheaves, sprockets, bearings, chains, and belts. _____
8. Hook and latch for deformation, cracks, and wear. _____
9. Excessive wear of friction pads, linkages, and other mechanical parts. _____
10. Excessive wear at hoist-attaching points and load-support shackles or pins. _____
11. External evidence of damage to motors or controls. _____
12. All control mechanisms for maladjustment interfering with proper operation. _____
13. Hydraulic systems for proper operation. _____
14. Wire rope (if present) for kinking, crushing, bird-caging, and corrosion. _____
15. Chain (if present) for bent links, stretched links, cracks, scores, abrasions or heat damage. _____
16. All safety devices for malfunction. _____

Additional checks for A-frames and small cranes:

17. Verify that each lifting device has its rated capacity legibly marked on the structure on each side of the primary beam. _____
18. Verify trolley or beam clamp working load limits do not exceed the capacity rating of the A-frame. Hoists attached to the A-frame must have a rated capacity equal to or less than all supporting components and be inspected to requirements of Chapter 7. (Down rating of hoist to A-frame capacity is acceptable with administrative controls and markings in place). _____
19. Verify A-frame components from different manufacturers are not inter-mixed or with components from other A-frames regardless of similarities in manufacturers or rated capacities. _____
20. Verify the proper dimensional relationship between trolley wheels and rail when installed on portable A-frames. _____
21. Check trolley side plates for any bending or distortion. _____
22. Perform a function test of trolley and hoist installed on portable A-frames to ensure proper operation. _____

PASS / FAIL
(Circle one)

INSPECTOR: _____ INSPECTION DATE: _____

CHAPTER 13 PROCUREMENT REQUIREMENTS

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1.0 PROCUREMENT OF EQUIPMENT OR SERVICES

RESPONSIBILITY	ACTION
Cognizant Engineer/Physicist	1. Prepare requisition. Include requirements from the appropriate Procurement Requirements for the specific equipment being purchased either in an SOW or separately, as an attachment to the requisition. Indicate on requisition that receipt inspection and Lift Manager's review are required. For outside subcontractor crane or rigging services, provide contents of Section 4 of this chapter to prospective bidders.
Lift Manager	2. Review each requisition and approve indicating that the appropriate requirements from the Procurement Requirements in Section 3.X have been included. Approve suppliers of equipment or subcontracted hoisting and rigging services for each Purchase Order or Subcontract.
Procurement	3. Ensure steps 1 and 2 have been completed prior to awarding subcontracts or purchase orders for hoisting and rigging equipment or services. Verify Lift Manager Approval of suppliers.
Receiving	4. On receipt of equipment, contact Lift Manager to have equipment and documentation inspected by a QRS prior to release.
Lift Manager/QRS	5. Inspect equipment and documentation. <ul style="list-style-type: none"> a. Ensure identification (model, serial number, etc.) on documentation and equipment is consistent. b. Look for signs that the equipment is used or refurbished. c. Check for suspect fasteners using the DOE Headmark List. d. Ensure that the documentation includes any required certification(s) and that the values listed comply with those listed in the Procurement Requirements. e. Verify that the item(s) have all markings and features required by the Procurement Requirements.
Lift Manager	6. Add equipment to the Inspection Status Database.
Receiving	7. Ensure all lift equipment is inspected by a QRS or the Lift Manager prior to release to the cognizant Engineer/Physicist.

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2.0 SUSPECT/COUNTERFEIT ITEMS (S/CI)

Suspect/Counterfeit Items (S/CI) include both new items deliberately identified as something (quality, brand, class, grade, etc.) other than they are and used or refurbished items represented as new items.

Among the commonly counterfeited items are:

- High-strength fasteners of SAE Grades 5, 5.2, 8, 8.2 or ASTM A-325 that do not meet the grade specification indicated by their headmark. U.S. Customs has identified some specific manufacturers and published a Headmark List (Figure 1) identifying these suspect carbon steel bolts. They are all to be considered unacceptable. The Suspect Headmark list is available in card format from PPPL QA.
- Counterfeit high-strength stainless steel bolts have been identified at DOE sites. In these cases, bolts had raised grade markings of either 18-8 or 304 plus hand-stamped markings of B8 (indicating heat treatment for higher strength). It turned out these had only been stamped, not heat-treated. While hand-stamping of the B8 designation is allowed, it is unusual and should be cause to consider the bolt suspect unless it has otherwise been authenticated.

All high strength bolts must be purchased with certified test results traceable to the actual bolts by heat, lot, or batch number.

- Overstamped ratings on slings, hooks, flanges, fittings, and other hardware - In these cases hardware, often used, has a new rating stamped over the old rating and re-sold. Sometimes the old rating is ground first and sometimes simply stamped over. Consider all re-stamped ratings as indications of suspect items.
- Manufactured counterfeits – Items manufactured to look like a brand-name component such as a strut painted a similar green to that used by a well-known manufacturer, but not bearing that manufacturer's logo and, on close inspection, not of the same quality.
- Molded case circuit breakers and other electrical components - Typically, used items are cosmetically refurbished and sold as new. The marked rating may differ from the original rating. Familiarity with good breakers is the best way to identify fraudulent ones. Consult AC Power for inspection assistance.

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GENERAL INDICATIONS OF SUSPECT LIFTING MATERIALS:

- Original markings ground off and re-stamped
- Altered markings on identification tags
- Used appearance of items (i.e. straps appear worn, or hook have indications of previous use)
- Parts identified as “China” only, or “Korea,” “Mexico,” “Thailand,” “India”
- No or incomplete documentation (refer to Documentation and Certification Section)
- Red hooks not labeled with Crosby Group markings (“Crosby” or “CG”) Crosby has the Crosby Red Carbon Steel Hook U.S.A. Trademark, Registration#2,108,103.

**GENERAL INDICATIONS OF SUSPECT DOCUMENTATION AND
CERTIFICATION:**

- Use of correction fluid or correction tape
- Type style or pitch change is evident
- Documentation has missing (or illegible) signature, initial, or data
- Document is excessively faded or unclear
- Inconsistent technical data
- Certification or test results are identical between items when normal variations should be expected.
- Document is not traceable to the items procured
- Technical data are inconsistent with code or standard requirements
- Documentation is not delivered as required on the purchase order, or in an unusual format
- Lines on forms are bent, broken, or interrupted indicating that data have been deleted or exchanged by “cut and paste”
- Handwritten entries are on the same document where typed or pre-printed data exist
- Data on a single line are located at different heights

More information about suspect parts is available by contacting PPPL QA or on the web page at: <http://www-local.pppl.gov/qa/SCI/SCI.shtml>

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DOE Headmark List

ANY BOLT ON THIS LIST SHOULD BE TREATED AS DEFECTIVE WITHOUT FURTHER TESTING.



ALL GRADE 5 AND GRADE 8 FASTENERS OF FOREIGN ORIGIN WHICH DO NOT BEAR ANY MANUFACTURERS' HEADMARKS:





GRADE 5



GRADE 8


GRADE 5 FASTENERS WITH THE FOLLOWING MANUFACTURERS' HEADMARKS:

MARK	MANUFACTURER	MARK	MANUFACTURER
 J	Jinn Her (TW)	 KS	Kosaka Kogyo (JP)




GRADE 8 FASTENERS WITH THE FOLLOWING MANUFACTURERS' HEADMARKS:

MARK	MANUFACTURER	MARK	MANUFACTURER
 A	Asahi Mfg (JP)	 KS	Kosaka Kogyo (JP)
 NF	Nippon Fasteners (JP)	 RT	Takai Ltd (JP)
 H	Hinomoto Metal (JP)	 FM	Fastener Co of Japan (JP)
 M	Minamida Sleybo (JP)	 KY	Kyoel Mfg (JP)
 MS	Minato Kogyo (JP)	 J	Jinn Her (TW)
 Hollow Triangle	Infasca (CA TW JP YU) (Greater than 1/2 inch dia.)		
 E	Dalai (JP)	 UNV	Unytite (JP)

GRADE 8.2 FASTENERS WITH THE FOLLOWING HEADMARKS:

MARK	MANUFACTURER
 KS	Kosaka Kogyo (JP)

GRADE A325 FASTENERS (BENNETT DENVER TARGET ONLY) WITH THE FOLLOWING HEADMARKS:

	MARK	MANUFACTURER
Type 1	 A325 KS	Kosaka Kogyo (JP)
Type 2	 A325 KS	
Type 3	 A325 KS	

Key: CA-Canada, JP-Japan, TW-Taiwan, YU-Yugoslavia

CHAPTER 13 PROCUREMENT REQUIREMENTS

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3.0 EQUIPMENT PROCUREMENT REQUIREMENTS OVERVIEW

This section provides reference guidance in preparing purchase requisitions for hoisting and rigging materials and equipment. Nationally recognized standards and specifications are referenced for listed items. However, caution should be used prior to procurement of special items in order to verify appropriate specification or standard reference and requirements. Some specific requirements listed in this section are more restrictive than consensus standard requirements, but are included to ensure materials of adequate quality and workmanship are provided.

Receipt inspections shall be required for all received materials in order to verify compliance of all requirements stated on the purchase order.

This section primarily contains procurement criteria for off-the-shelf items. If the information provided in this section is used in the development of specifications for purchase of cranes or other special handling equipment, the appropriate engineering group should be consulted.

Since this section contains only a partial listing of commonly used rigging hardware, the requisitioner shall review applicable standards or specifications for other items and identify requirements to which the manufacturer shall adhere.

More specific information or requirements may be obtained by consulting the applicable section of this standard or an equipment manufacturer.

The manufacturer shall provide requested documentation as appropriate (e.g., rated load certification, proof-load test certification, material certification). Proof load test certification is essential for items to be used for critical lifts. The documentation shall be signed by the manufacturer's authorized representative.

The requisitioner is encouraged to consult with the Lift Manager to interpret and utilize the requirements of this section to assure that the equipment or services purchased will safely and correctly perform their needs.

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**3.1. MANUAL, ELECTRIC AND
AIR OPERATED HOISTS****3.1.1 GENERAL**

- a. Manual, electric and air operated hoists shall meet or exceed the requirements of ASME/ANSI B30.16.
- b. To the extent that the desired configuration and capacity of electric or air operated hoist is available with a Nationally Recognized Testing Laboratory's listing, it shall be specified to have such a listing. If not, the procurement procedures for such hoists must be coordinated with the Lift Manager.
- c. The rated load shall be marked on the hoist or load block.
- d. The hoist shall be marked with identification as follows:
 - 1. Hand Chain Operated
 - i. Name of manufacturer
 - ii. Manufacturer's model or serial number
 - 2. Electric-Powered Hoist
 - i. Name of manufacturer
 - ii. Manufacturer's model or serial number
 - iii. Voltage of AC or DC power supply and phase and frequency of AC power supply
 - iv. Circuit ampacity (current rating)
 - v. Warning labels per ANSI Z535.4.
 - 3. Air Powered Hoist
 - i. Name of manufacturer
 - ii. Manufacturer's model and serial number
 - iii. Rated air pressure
- e. All manual, electric, or air operated hoists shall have affixed to the hoist or load block a label or labels displaying precautionary information concerning operating procedures.
- f. Load sprockets shall have teeth or pockets to allow engagement of the load chain, shall be

guarded, and provisions shall be made to guard against jamming of the load chain within the hoist mechanism under normal operating conditions.

- g. Manufacturer shall supply instruction manual for each hoist, the manual shall include the following information and instructions:
 - 1. Installation
 - 2. Operation
 - 3. Inspection and Testing
 - 4. Lubrication, maintenance, and repair
 - 5. Wiring diagram (electric powered only; maybe supplied separately)
- h. A load test certificate shall be provided by the manufacturer referencing the specific hoist, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

3.1.2 LOAD CHAIN

- a. Load chain may be either roller or welded link chain.
- b. Load chain shall be pitched so as to pass over all load sprockets without binding.
- c. Load chain shall be proof tested by the chain or hoist manufacturer with a load test of 150 percent of the rated load divided by the number of chain parts supporting the load.
- d. A load test certificate shall be provided by the manufacturer or supplier referencing the specific hoist identification number, date of test and amount of load applied.

3.1.3 HOIST HOOKS

If hooks are of the swiveling type, they should rotate freely. Hooks shall be equipped with latches unless the application makes the use of the latch impractical. When required, a latch shall be provided to bridge the throat opening of the hook and retain, under slack conditions such items as, but not limited to slings, chains, etc. Refer to ASME/ANSI B 30.10.

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3.1.4 LOAD BLOCKS

- a. On hand chain operated hoists, a means shall be provided to guard against load chain jamming in the load block under normal operating conditions.
- b. On electric- or air-powered hoists, load blocks shall be of the enclosed type, and means shall be provided to guard against rope or load chain jamming in the load block under normal operating conditions.

3.1.5 HOIST BRAKES

- a. Hand chain operated hoist(s) shall be so designed that, when the actuating force is removed, it will automatically stop and hold any test load up to 125 percent of the rated load.
- b. Electric-powered hoist, under normal operating conditions with rated load and test conditions with test loads up to 125 percent of rated load, the braking system shall perform the following functions:
 1. Stop and hold the load hook when controls are released;
 2. Limit the speed of load during lowering, with or without power, to a maximum speed of 120 percent of rated lowering speed for the load being handled;

3. Stop and hold the load hook in the event of a complete power failure.
- c. The braking system shall have thermal capacity for the frequency of operation required by the service.
- d. The braking system shall have provisions for adjustments where necessary to compensate for wear.
- e. Air-powered hoist, under normal operating conditions with rated load and test conditions with test loads up to 125 percent of rated load, the braking system shall perform the following functions:
 1. Stop and hold the load hook when controls are released;
 2. Prevent an uncontrolled lowering of the load in the event of a loss of air pressure;
 3. The braking system shall have thermal capacity for the frequency of operation required by the service;
 4. The braking system shall have provision for adjustments where necessary to compensate for wear.

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3.2. MANUALLY OPERATED HOISTS

3.2.1 GENERAL

- a. Manually operated lever hoists shall:
 1. Meet or exceed the requirements of ASME/ANSI B30.21.
 2. Have the rated load marked on the hoist or load block.
 3. Be tested by the manufacturer with a test load of at least 125 percent of the rated load.
 4. Have identifications for controls to indicate function or direction of motion.
 5. Be marked with identification as follows:
 - i. Name of manufacturer
 - ii. Manufacturer's model or serial number
 6. Have affixed to the hoist or load block in a readable position, a label or labels displaying precautionary information concerning operating procedures.
- b. Load sprockets shall have pockets or teeth to allow engagement of the load chain, shall be guarded, and provisions shall be made to guard against jamming of the load chain with the host mechanism under normal operating conditions.
- c. A load test certificate shall be provided by the manufacturer referencing the specific hoist, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

- b. Load chain shall be proof tested by the chain or hoist manufacturer with a load test of 150 percent of the hoist rated load divided by the number of chain parts supporting the load.
- c. If a load is supported by more than one part of load chain, the tension on the parts shall be equalized.

3.2.3 LOAD BLOCKS

Load blocks shall have means to guard against load chain jamming in the load block under normal operating conditions.

3.2.4 LOAD CONTROLLING MECHANISM

- a. Shall be equipped with a load controlling mechanism, which shall perform the following functions under normal operating conditions with test loads up to 125 percent of the rated load.
 1. Stop and hold the load when the lever force is removed and the lever stroke completed.
 2. Provide for incidental movement of the load when lifting or lowering.
 3. Friction brake shall have provision for adjustment where necessary to compensate for wear.
- b. Manufacturer shall supply instruction manual for each hoist, the manual shall include the following information and instructions:
 1. Operation
 2. Inspection and Testing
 3. Lubrication, maintenance, and repair

3.2.2 LOAD CHAIN

- a. Load chain may be either roller or welded link type and shall be pitched so as to pass over all sprockets without binding.

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3.3. SHOP/FLOOR CRANES

3.3.1 GENERAL

- a. Shop/floor cranes shall meet or exceed the requirements of ASME PASE, Safety Standard for Portable Automotive Lifting Devices.
- b. Operating controls shall be designed in such a manner that they are readily visible and accessible to the operator and so that the operator will not be subjected to pinch points, sharp edges, or snagging hazards. The operation of controls should be clear to the operator either by position, function, labeling or combination thereof.
- c. The release system shall require intentional positive action by the operator for release to prevent accidental lowering.
- d. Shop/floor cranes shall have a positive means to prevent the load from being lowered or raised beyond the design limit of travel.
- e. Shop/floor cranes not equipped with internal load limit devices shall be capable of performing a proof test of 150 percent of the rated capacity.
- f. Shop cranes equipped with internal load limiting devices shall, when the load limiting device is deactivated, be capable of performing a proof test of 125 percent of rated capacity.
- g. A load test certificate shall be provided by the manufacturer referencing the specific crane, date of test, and amount of load applied. The proof test certificate shall be signed and dated by the manufacturer's authorized representative.
- h. Because of the potential hazards associated with the misuse of equipment of this type, no alterations shall be made to the product.
- i. Shop/floor cranes shall be provided with a load hook and/or chain at the end of the boom extension that has a capacity capable of sustaining the proof load of the unit. The load hooks shall be provided with a latching mechanism.
- j. Shop/floor cranes shall have required product warnings and markings.

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**3.4. BELOW THE HOOK
STRUCTURAL AND
MECHANICAL LIFTING
DEVICES**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

3.4.1 GENERAL

- a. The design shall conform to requirements of ASME B30.20 and ASME BTH-1.
- b. A load test, not to exceed 125 percent of the rated load unless otherwise recommended by a manufacturer shall be provided. Rated load should not be more than 80 percent of the maximum load sustained during the test.
- c. A load test certificate indicating the date of load test, amount of load applied, and confirmation of lifter load rating shall be supplied. The proof test shall be signed by the manufacturer's authorized representative.
- d. Welding shall be in accordance with ANSI/AWS D14.1.

- e. Guards for exposed moving parts such as, but not limited to gearing, projecting shafts, and chain drives that constitute a hazard under normal operating conditions should be guarded.
- f. Electrical equipment and wiring shall comply with Article 610 of ANSI/NFPA 70.

3.4.2 MARKINGS

- a. All new structural and mechanical lifting devices shall be marked with, but not limited to, the following information:
 1. Manufacturer's name and address
 2. Serial number
 3. Lifter weight, if over 100 lb (45 kg)
 4. Cold current (amps) (when applicable)
 5. Rated voltage (when applicable)
 6. Rated load (as described in section 14.2.2.a)
 7. ASME BTH-1 Design Category
 8. ASME BTH-1 Service Class
- b. If the lifting device is made up of several lifters, each detachable from the group, these lifters shall also be marked with their individual rated loads.

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3.5. WIRE ROPE**3.5.1 GENERAL**

- a. Wire rope shall meet or exceed the requirements of Federal Specification, RR-W-410E for wire rope, Military Specification MIL-DTL-83420 for air craft cable and MILW-83140 for non-rotating stainless steel wire rope.
- b. Wire rope shall be made in the United States by a member of the Wire Rope Technical Board¹ (except stainless steel, and unless recommended otherwise by a crane or hoist manufacturer). Stainless steel wire rope shall be made in the United States and shall be 302 or 304 grade stainless steel unless otherwise recommended by a crane or hoist manufacturer.
- c. Wire rope shall have documentation from the manufacturer traceable to the material furnished and signed by the manufacturer's authorized representative. Documentation shall reference as a minimum the purchase order number, the diameter, number of strands, core, lay, grade, manufacturer's lot/run number, material number and the nominal breaking strength of a sample.
- d. Wire rope shall be shipped lubricated and with a protective covering (i.e., plastic or cardboard).

¹

Bridon American Corp.	Exeter, PA
Loos and Co., Inc.	Pomfret, CO
Strand Core, Inc.	Milton, FL
Washington Wire Rope	Houston TX
WireCo WorldGroup	Chillicothe, MO
Wire Rope Works, Inc.	Williamsport, PA

Note: This list is up-to-date as of the date of publication. Further information is available from the WRTB at (703)299-8550, at wrtb@usa.net, or <http://www.wireropetechnicalboard.org>

CHAPTER 13 PROCUREMENT REQUIREMENTS

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3.6. CHAIN SLINGS**3.6.1 GENERAL**

- a. Chain slings shall meet or exceed requirements of ASME/ANSI B30.9 and 29 CFR 1910.184.
- b. Alloy steel chain slings shall have permanently affixed durable identification stating size, manufacturer's grade, rated load and angle upon which the rating is based, reach, number of legs, and sling manufacturer.
- c. Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links or other attachments shall have a rated load of at least equal to that of alloy steel chain with which they are used.
- d. All welded components in the sling assembly shall be proof tested, either as components or as part of the sling assembly.
- e. Hooks attached to chain slings shall meet the requirements of ASME/ANSI B30.10.
- f. The welded components of all new slings shall be proof tested by the component or sling manufacturer to 200 percent of the rated load.
- g. The proof load for multiple leg bridle slings shall be applied to the individual legs and shall be 200 percent of the rated load of a single leg sling.
- h. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

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3.7. SYNTHETIC WEB SLINGS

3.7.1 GENERAL

- a. Synthetic slings shall meet or exceed the requirements of 29 CFR 1910.184 and ASME/ANSI B30.9.
- b. Synthetic web slings shall be manufactured from webbing specifically constructed for overhead lifting.
- c. Synthetic sling webbing shall have the following characteristics:
 1. Sufficient certified tensile strength to meet the sling manufacturer's requirements;
 2. Uniform thickness and width;
 3. Full woven width, including selvage edges;
 4. Webbing ends shall be sealed by heat, or other suitable means, to prevent raveling.
- d. Thread used in the manufacture of synthetic web slings shall be of the same type yarn as the sling webbing.
- e. Stitches shall be lock-stitched and preferably continuous. When not continuous, it shall be back stitched at the ends to prevent raveling.
- f. The load carrying splice shall be sewn with a pattern of sufficient strength to justify the manufacturer's rated capacities.
- g. Synthetic web slings shall have a minimum design factor of 5.
- h. End fittings shall have sufficient strength to sustain twice the rated load of the sling without permanent deformation.
- i. Each sling shall be permanently marked with the following:

1. Manufacturer's name or trademark.
2. Manufacturer's code or stock number.
3. Type of synthetic web material.
4. Rated loads for the type of hitches used.

NOTE: Hand written, or ink embossed markings are not acceptable. Sling tags shall be indelibly marked and the lettering shall not wear off with use. The markings shall remain legible for the life of the sling.

- j. The manufacturer shall have on file a written system of sling traceability as well as a quality control procedure. Traceability should be specific mill lots.
- k. Fabric wear pads should be sewn into the bearing points of the sling eyes. Leather wear pads are not recommended.
- l. Product warnings relative to the proper use, care, and maintenance shall accompany the shipment.
- m. Single leg and endless synthetic web slings shall be proof tested to 200 percent of the rated load.
- n. Multiple leg bridle slings shall have the proof load applied to the individual legs. The proof load shall be two times the vertical rated load of a single leg sling.
- o. A load test certificate (LTC) shall be provided for each sling supplied. The LTC shall reference as a minimum, the PO number, date of proof test, amount of load applied, sling capacity, and sling identification number. The LTC shall be signed by the manufacturers authorized representative.

NOTE: Sling lengths shall be within a specified tolerance. Synthetic sling manufacturers' normal length is ± 1 percent of the sling length. If closer tolerance is required, it will be specified on the purchase order.

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**3.8. SYNTHETIC ROUND
SLINGS****3.8.1 GENERAL**

- a. Slings should meet or exceed requirements of the Web Sling and Tiedown Association, Inc.
- b. Synthetic roundslings including those incorporating welded fittings shall be proof tested to 200 percent of the vertical rated capacity.
- c. A load test certificate (LTC) shall be provided for each sling supplied. The LTC shall reference at a minimum, date of proof test certificate, amount of load applied, sling capacity and sling identification number. The LTC shall be signed and dated by the manufacturer's authorized representative.
- d. The core(s) shall be formed from one or more ends of yarn, wound together on a plurality of turns. The core(s) should be uniformly wound to ensure even distribution of the load.
- e. The cover(s) should be of the same fiber type as the load bearing core(s). When the cover is a different fiber type than the load bearing core, follow the manufacturer's recommendations for use.
- f. The cover should be made from one length of material.
- g. When the core and cover are of the same fiber, the thread should also be of that fiber type. When the core and cover are of different fiber types, the thread should be of the same fiber type as the core.
- h. All stitching shall be lock-stitched type and should be continuous. When not continuous, they shall be back stitched or overstitched to prevent raveling.
- i. The design factor for new synthetic roundslings and incorporated fittings shall be a minimum of five (5).
- j. Each synthetic roundsling shall be permanently marked or labeled showing:
 - 1. Name or trademark of manufacturer.
 - 2. Manufacturer's code or stock number.
 - 3. Rated capacities for the three basic hitches. (vertical, choker, vertical basket)
 - 4. Core fiber type – if cover(s) is of a different fiber type, both fiber types shall be identified.
 - 5. Length (reach) – bearing point to bearing point.
- k. Each manufacturer shall internally identify their product with name or trademark for traceability.

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3.9. WIRE ROPE SLINGS

3.9.1 GENERAL

- a. Wire rope slings shall meet or exceed the requirements of 29 CFR 1910.184 and ASME/ANSI B30.9.
- b. Wire rope purchased to fabricate slings shall be made in the United States by a member of Wire Rope Technical Board (Except stainless steel). Stainless steel wire rope shall be made in the United States and shall be 302 or 304 grade stainless steel.
- c. Wire rope shall meet the requirements of Federal Specification RR-W-410E or Military Specification MIL-W-83420.
- d. Wire rope shall have documentation from the manufacturer traceable to the material furnished and signed by the manufacturer's authorized representative. Documentation shall reference as a minimum, the diameter, number of strands, core, lay, grade, manufacturing lot/run number, master reel number and nominal breaking strength of sample.
- e. Wire rope slings shall be shipped lubricated and with a protective covering (i.e., plastic or cardboard).
- f. Slings should be either 6 x 19 or 6 x 37 classification, unless otherwise authorized by the Lift Manager.
- g. Slings should be made of wire rope produced from EXIPS (Extra Improved Plow Steel) with an IWRC (Independent Wire Rope Center). Consideration may be given to other grades or types of wire rope, dependent upon the type of expected service due to the type of load, hitch, or environment, with approval of the Lift Manager.
- h. Shall have a minimum of 5 to 1 safety factor.
- i. Shall be individually tagged with a durable tag, including the following information:
 - 1. Manufacturer's name or trademark WLL (Working Load Limit)
 - 2. Rated load for the type of hitch used and the angle upon which it is based
 - 3. Diameter or size
- j. Shall have a load test certificate (LTC) for each sling supplied. The LTC shall reference as a minimum, date of proof test certificate, amount of load applied, sling capacity, lot/run number. The LTC shall be signed and dated by the manufacturer's authorized representative.
- k. Single leg hand tucked slings shall have a proof load equal to the rated load, but shall not exceed 125 percent of the rated load.
- l. Mechanical spliced single leg and endless wire rope slings, and swaged socket or poured socket assemblies shall be load tested to 200 percent of the rated vertical load.
- m. The proof load for multiple leg bridle slings shall be applied to the individual legs and shall be either 125 percent for hand tucked splice or 200 percent for mechanical splice, times the vertical rated load of a single leg sling of the same size, grade, and construction of rope. Any master link to which multiple leg slings are connected shall be proof loaded to 200 percent of the force applied by the combined legs.
- n. Multiple leg bridle slings shall be tagged with a durable tag on the master link indicating the working load limit for the total combined legs for each individual sling in a vertical configuration. The purchase order number or serial number and the manufacturer's ID should be supplied.

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3.10. EYE BOLTS**3.10.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Eyebolts shall be fabricated to meet or exceed the requirements of ASME B30.26.
- b. Eyebolts used for hoisting shall be fabricated from forged carbon or alloy steel and shall have sufficient ductility to permanently deform before

losing the ability to support the load at temperatures at which the manufacturer has specified for use.

- c. Eye bolts used for lifting service shall be marked with the manufacturer's name or trademark, size or rated load, and grade for alloy eyebolts.
- d. The safe working load shall have a safety factor of 5.
- e. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

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3.11. HOOKS**3.11.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Hooks used for lifting service shall meet or exceed the requirements of ANSI/ASME B30.10.
- b. Manufacturer's identification shall be forged cast, or die stamped on a low stress non-wearing area of the hook.
- c. When proof tests are used to verify the manufacturing process, material, or configuration, hooks shall be able to withstand proof load application, without permanent deformation when the load is applied for a minimum of 15 seconds. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.
- d. Supplier performance testing of hooks shall not be required, except where necessary to conform to requirements for the equipment of which they are a part of.
- e. If a proof test is not provided, the entire assembly unit with hook shall be proof tested.

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3.12. SWIVEL HOIST RINGS**3.12.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Swivel hoist rings shall be fabricated to meet or exceed the required of ASME B30.26
- b. Excluding bushings and bearings, swivel hoist rings shall have sufficient ductility to

permanently deform before losing the ability to support the load at temperatures at which the manufacturer has specified for use.

- c. Swivel hoist rings used for lifting service shall be marked with the manufacturer's name or trademark, rated load, and torque value.
- d. The safe working load shall have a safety factor of 5.
- e. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

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3.13. LINKS AND RINGS**3.13.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Links and rings shall be fabricated to meet or exceed the requirements of ASME B30.26.
- b. Links and rings shall have sufficient ductility to permanently deform before losing the ability to

support the load at the temperature that the manufacturer has specified for use.

- c. The design factor for links and rings shall be a minimum of 5.
- d. Prior to initial use, welded rings or links shall proof tested by the manufacturer. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.
- e. Rings or links shall be marked by the manufacturer with the manufacturer's name or trademark, size or rated load and grade (if needed to identify the rated load).

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3.14. SHACKLES**3.14.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Shackles shall be fabricated to meet or exceed the requirements of ASME B30.26.
- b. Shackles shall have sufficient ductility to permanently deform before losing the ability to support the load at the temperature that the manufacturer has specified for use.
- c. The design factor for shackles up to and including a 150 ton rated load shall be a minimum of 5. The design factor for shackles over 150 ton rated load shall be a minimum of 4.
- d. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.
- e. Each shackle body shall be permanently and legible marked by the manufacturer. Raised or stamped letters on the side of the bow shall be used to show:
 1. Manufacturer's name and trademark.
 2. Size.
 3. Rated capacity.
- f. Pins for shackles shall be marked by the manufacturer with raised or stamped letters showing:
 1. Name or trademark of manufacturer
 2. Grade, material type or load rating

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3.15. TURNBUCKLES**3.15.1 GENERAL**

All hooks and below the hook components to be used for a critical lift shall be required to pass a proof load test per DOE 1090 Section 2. Tests to be administered according to Chapter 14 of this standard and using loads based on relevant sections of ASME B30 for all hooks and below the hook components. All purchased rigging components are required to be able to pass these tests.

- a. Turnbuckles shall be fabricated to meet or exceed the requirements of ASME B30.26.

- b. Turnbuckles used for hoisting shall have sufficient ductility to permanently deform before losing the ability to support the load at temperatures at which the manufacturer has specified for use.
- c. Turnbuckles used for lifting service shall be marked with the manufacturer's name or trademark, and size or rated load.
- d. The design factor for turnbuckles shall be a minimum of 5.
- e. A certificate of proof test shall be provided by the manufacturer or supplier referencing the specific sling identification number, date of test, and amount of load applied. The proof test shall be signed by the manufacturer's authorized representative.

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4.0 REQUIREMENTS FOR PROCURING HOISTING AND RIGGING (H & R) SERVICES

PPPL requires conformance with all applicable OSHA and ASME B30 Standards regarding powered industrial truck, Aerial lifts, Fall Protection, and Hoisting and Rigging applications. Procurement shall ensure the following requirements are passed down to all sub-tiered contractors and the PPPL Technical Representative shall ensure that the PPPL Lift Manger is notified in a timely fashion to verify compliance with all requirements. A checklist is provided at the end of this document for convenience. Please note that failure to abide by the suggested advance notice may result in disallowance of the crane onsite. These shall include but are not limited to:

OSHA 1910 Subpart N

1910.178 - Powered industrial trucks.

1910.179 - Overhead and gantry cranes.

1910.180 - Crawler locomotive and truck cranes.

1910.184 - Slings.

OSHA 1926 Subpart L

1926.453 - Aerial lifts.

1926.454 - Training requirements.

OSHA 1926 Subpart M – Fall Protection**OSHA 1926 Subpart N - Cranes, Derricks, Hoists, Elevators, and Conveyors**

1926.550 - Cranes and derricks.

1926.554 - Overhead hoists.

OSHA 1926 Subpart CC – Cranes and Derricks in Construction

Subset of typical ASME B30 series for hoisting and rigging operations:

ASME Standard

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

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

B30.3 Tower Cranes

B30.5 Mobile and Locomotive Cranes

B30.9 Slings

B30.10 Hooks

B30.16 Overhead Hoists (Underhung)

B30.17 Cranes and Monorails (with Underhung Trolley or Bridge)

B30.20 Below-the-Hook Lifting Devices

B30.21 Lever Hoist

B30.23 Personnel Lifting Systems

B30.26 Rigging Hardware

BTH-1 Design of Below the Hook Lifting Devices

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In addition to these standards, PPPL requires the following:

- 1) Procedural Steps - Prior to award, proposing H&R subcontractor shall provide details of all H&R procedures, including references to Lift Plans and proposed equipment to be used.
- 2) Lift Plans - Prior to any lift or rigging, H&R subcontractor shall provide a lift Plan See sample in section 4.4) for review and approval, including:
 - a. Plan view of lift with dimensions, including any nearby structures or power lines. Ensure that all crane locations are identified with dimensions to loads (picking and setting).
 - b. Section View rigging sketch with dimensions and listing all slings and hardware and their capacities. Load angle factors should be calculated and provided on sketch.
 - c. Crane load charts as applicable
 - d. Forklift capacities as applicable and assure that the load weight and CG does not overextend the capacity of the forklift.

NOTE: A generic lift plan may be provided for similar items with the same rigging arrangement but rigging shall be sized for the largest worst-case load.

- 3) Lift Execution
 - a. Any item to be lifted that weighs more than 80% of the capacity of the crane shall be witnessed by PPPL. Load cells may be required. For planning purposes, proper notice shall be given.
 - b. All items to be lifted shall have known weights. If a weight estimate needs to be made, the estimate calculation shall be provided in writing.
 - c. Lifts of items valued at more than \$100,000 or have a program impact of more than one month are considered critical lift. A critical lift plan shall be drafted and approved by the Responsible Engineer and the Lift Manager. The Lift Manager and QA shall witness the lift.
 - d. Hard Hats, safety shoes and gloves shall be used during lifts.
 - e. ASME Hand Signals with clear lines of sight shall be used at all times.
 - f. Slings shall be in good condition. Kinked or bent wire rope shall not be used. Highly worn and frayed synthetic slings are also unacceptable and shall not be used.
 - g. Any unusual conditions shall be brought to the PPPL contract representative's attention immediately.
 - h. Anyone has stop work authority.

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- 4) Mobile Crane Certifications – Prior to any lift or rigging, H&R subcontractor shall provide Crane Certifications for review, including:
- Evidence of recent periodic inspection.
 - For subcontracted mobile cranes, current annual inspection and current monthly wire rope and brake inspection (sample form attached in section 4.2).
- NOTE: Mobile cranes shall be free from leaks and all safety limits must be operational.
- 5) Mobile Crane Operator Qualifications – Prior to any mobile crane lift, the H&R subcontractor shall provide the designated crane operators qualifications including:
- NJ Mobile Crane Operators License.
 - NCCCO Mobile Crane qualification
 - Discussion of recent and frequent experience with proposed crane.
- 6) Overhead Crane Operator Qualifications (if applicable) – Prior to any overhead crane lift, the H&R subcontractor shall provide the designated crane operators qualifications including:
- Overhead crane certification
 - Resume of recent and frequent experience with similar type/class crane.
 - Annual medical examination as required per ASME B30.2 ch2-3.1.2 for cab crane operation if applicable.
- 7) Qualified Rigger and Qualified Signal Person Certifications – Prior to any lift or rigging, H&R subcontractor shall provide Qualified Rigger and Qualified Signal Person Certifications in accordance with 1926 Subpart CC (1926.1400). (See attached example)
- 8) PPPL requires strict adherence to OSHA. Standard 29 CFR 1910.179(n)(3)(vi) for overhead and gantry cranes states that “The employer shall require that the operator avoid carrying loads over people.” OSHA Standard 29 CFR 1926.550(a)(19) for mobile cranes states “All employees shall be kept clear of loads about to be lifted and of suspended loads.”
- 9) Forklift Operator Experience – Prior to any forklift operation, H&R subcontractor shall provide a forklift operator certificate. Include a narrative of operator experience, with number of years experience.
- 10) A 125% proof load test certificate shall be provided for all subcontractor provided below the hook lifting devices and lift beams.
- 11) The following requirements checklist is provided for convenience. Failure to abide by the suggested advance notice may result in disallowance of the crane onsite.
- 12) The following Sub-Contractor Checklist will be used by a PPPL qualified operator to verify that the machine is in good operating condition with all safety devices functioning correctly.

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CHECKLIST OF REQUIREMENTS FOR PROCURED HOISTING AND RIGGING SERVICES

Note: Failure to abide by the suggested advance notice
may result in disallowance of the crane onsite.

Contract Number: _____

Work Planning Number: _____

PPPL Technical Representative: _____

Subcontractor contact Person: _____

Phone: _____ FAX: _____

1 Week in advance

Prejob onsite discussion (>1 week in advance): _____

PPPL Dig Permit – Site underground survey performed: _____

Item Being Lifted: _____ \$ Value: _____

Lift Plan Provided: _____

Special (e.g. Electrical) considerations: _____

Weight: _____ Dimensions: _____ CG Known: _____

Radius: _____ Height: _____ Obstructions: _____

3 Days in advance

Crane Make and Model: _____

Owner: _____

Load Chart pertinent to this lift (copy provided): _____

Periodic Inspection (copy provided) Date: _____

Monthly hook and wire rope form (copy provided) Date: _____

Crane Operator: _____

NJ License Expiration Date: _____

NCCCO Expirations Date: _____

Medical: _____

Rigging supplied by: _____

Qualified Rigger Certification(s) provided: _____

Qualified Signal Person Certification(s) provided: _____

Or signed OSHA §1926.1400 Qualification Form provided: _____

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Sub-Contractor Equipment Checklist

Project Name: _____ WO Number: _____
 Equipment Make: _____ Model: _____
 Operator Name: _____ Qualification Date: _____

	Checked & Passed	Checked & NOT Passed	N/A	Comments/Corrective Actions
Annual Inspection Tag				
Operating Manual				
Back-up Alarm				
Installed Safety Features				
Hydraulic Cylinder-Leaks etc.				
Parking Brake System				
Cab Interior/Exterior				
Bucket or Blade				
Tires/Tracks				
Horn				
Steering Mechanism				
Coupling Devices				
Seat Belts				
Operating Controls				
Lights				
Reflectors				
Windshield Wipers				
Defroster/Defogger				
Fire Extinguisher				
Attachments Placard				

NAME: _____
 Signature: _____

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Date: _____

**4.2. MONTHLY HOOK, RUNNING ROPE, & BRAKE INSPECTION FOR MOBILE
CRANES (Suggested Form)**

Equipment: _____

Owner: _____

Inspector (Print): _____

Rope Identification: _____

Result of inspection (Circle):

Rope: PASS FAIL _____

Hook: PASS FAIL _____

Brakes: PASS FAIL N/A _____

Comments (if any): _____

Signature: _____ Date: _____

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"Running rope" monthly inspection requirement references

§ 1926.1413

"Wire rope – inspection" –

§ 1926.1413(a) Shift Inspection.

(1) A competent person must begin a visual inspection prior to each shift the equipment is used, which must be completed before or during that shift. The inspection must consist of observation of wire ropes (running and standing) that are likely to be in use during the shift for apparent deficiencies, including those listed in paragraph (a)(2) of this section. Untwisting (opening) of wire rope or booming down is not required as part of this inspection.

§ 1926.1413(b) Monthly Inspection.

(1) Each month an inspection must be conducted in accordance with paragraph (a) (shift inspection) of this section.

(2) The inspection must include any deficiencies that the qualified person who conducts the annual inspection determines under paragraph (c)(3)(ii) of this section must be monitored.

(3) Wire ropes on equipment must not be used until an inspection under this paragraph demonstrates that no corrective action under paragraph (a)(4) of this section is required.

(4) **The inspection must be documented** according to § 1926.1412(e)(3) (monthly inspection documentation).

§ 1926.1412(e)(3) Monthly Documentation.

(i) The following information must be documented and maintained by the employer that conducts the inspection:

(A) The items checked and the results of the inspection.

(B) The name and signature of the person who conducted the inspection and the date.

(ii) **This document must be retained for a minimum of three months.**

§ 1910.180(g)

"Rope inspection." –

§ 1910.180(g)(1)

"Running ropes." **A thorough inspection of all ropes in use shall be made at least once a month and a certification record** which includes the date of inspection, the signature of the person who performed the inspection and an identifier for the ropes shall be prepared and kept on file where readily available. All inspections shall be performed by an appointed or authorized person. Any deterioration, resulting in appreciable loss of original strength shall be carefully observed and determination made as to whether further use of the rope would constitute a safety hazard.

§ 1910.180(d)(6)

"Inspection records." **Certification records** which include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the crane which was inspected **shall be made monthly on critical items in use such as brakes, crane hooks, and ropes.** This certification record shall be kept readily available.

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**4.3. QUALIFIED RIGGER AND QUALIFIED SIGNAL PERSON
(Suggested Form)**

Dear _____ FAX: _____

Please certify that the following people are qualified per OSHA § 1926.1400 for performing lifts with the following equipment:

Mobile Crane Make and Model: _____

Owner: _____

Qualified Rigger(s) and Qualified Signal Person per OSHA § 1926.1400

Qualified Rigger(s) (Print): _____

Qualified Signal Person (Print): _____

The above listed people are employees of

Company Name

and certified to meet the qualification standards listed in OSHA § 1926.1400

Signature: _____ Date: _____

Company position: _____

Please sign and email back to Mike Viola mviola@pppl.gov

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Qualified Rigger, Signal Person, and Employer Training references (Partial)**§ 1926.1400 Rigger qualifications.****§ 1926.1401 Definitions.**

Qualified person means 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.

Qualified rigger is a rigger who meets the criteria for a qualified person.

§ 1926.1403 Assembly/Disassembly – general requirements (applies to all assembly and disassembly operations)...

(r) *Rigging*. In addition to following the requirements in 29 CFR 1926.251 and other requirements in this and other standards applicable to rigging, when rigging is used for assembly/disassembly, the employer must ensure that:

(1) The rigging work is done by a **qualified rigger**.

§ 1926.1428 Signal person qualifications.

(a) The employer of the signal person must ensure that each signal person meets the Qualification Requirements (paragraph (c) of this section) prior to giving any signals. This requirement must be met by using either Option (1) or Option (2) of this section.

(4) Know and understand the relevant requirements of § 1926.1419 through §1926.1422 and §1926.1428.

(5) Demonstrate that he/she meets the requirements in paragraphs (c)(1) through (4) of this section through an oral or written test, and through a practical test.

§ 1926.1419 Signals – general requirements.**§ 1926.1420 Signals – radio, telephone or other electronic transmission of signals.****§ 1926.1421 Signals – voice signals – additional requirements.****§ 1926.1422 Signals – hand signal chart.****§ 1926.1424 Work area control.****§ 1926.1425 Keeping clear of the load.****§ 1926.1430 Training.**

The employer must provide training as follows:

(a) Overhead powerlines. The employer must train each employee specified in §1926.1408(g) and § 1926.1410(m) in the topics listed in § 1926.1408(g).

(b) Signal persons. The employer must train each employee who will be assigned to work as a signal persons who does not meet the requirements of § 1926.1428(c) in the areas addressed in that paragraph.

(c) Operators.

(d) Competent persons and qualified persons. The employer must train each competent person and each qualified person regarding the requirements of this subpart applicable to their respective roles.

CHAPTER 13 PROCUREMENT REQUIREMENTS

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4.4. LIFT PROCEDURE TEMPLATE

PPPL Contract No. or Procedure No. L - _____

TITLE: _____**Note: LIFT DATA SHEET NEEDED TO PERFORM THIS LIFT**

PREPARED BY (Qualified Engineer): _____ DATE: _____

A. INTRODUCTION

Describes component to be lifted, classification and reason for classification.

B. PREREQUISITES

Cognizant Person will attest on the Lift Data Sheet that any installation, disassembly, or removal procedures required to allow the equipment to be moved have been completed.

C. PRECAUTIONS

Include in the procedure only those precautions that are directly applicable:

1. Protection of slings and equipment from edges.
2. Protection of finished surfaces from damage.
3. Areas needed to be roped off.
4. Security guards, if necessary.
5. Adjacent equipment protection needed.
6. Ensure the items in the lift are free from any connection or obstruction.

D. PROCEDURE FIELD CHANGES

Procedure field change can be made on site if approved by the PPPL Lift Engineer by revising an existing or developing a new Lift Data Sheet. Revised lift data sheets also require written approval of the Lift Manager.

E. LIFT DATA SHEET INSTRUCTIONS

The Lift Data Sheet provides the specification for the hoisting and rigging aspects of the lift and shall be initiated by a qualified engineer.

Reference any drawings/sketches in Lift Data Sheet. Include as attachments any required drawings. These can be marked up blue prints or a sketch. Sketch inclusions: (see attached example also)

1. Identification of the items to be moved, the weight, dimensions, and center of gravity of the load, and any hazardous or toxic materials that are present.
2. Identification of operating equipment to be used by type and rated capacity.

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3. Rigging sketches that include (as applicable):
 - Identification and rated capacity of slings, lifting bars, rigging accessories, and below-the-hook lifting devices. Calculate and provide the rated capacity of equipment in the configuration in which it will be used.
 - Load-indicating devices.
 - Load vectors.
 - Lifting points.
 - Sling angles.
 - Boom and swing angles.
 - Methods of attachment.
 - Crane orientations.
 - Other factors affecting equipment capacity (e.g. load path sketch, key point heights, floor or soil bearing capacity).
4. Operating procedures and special instructions to operators including rigging precautions and safety measures to be followed as applicable. Show floor plan with path of intended travel. Note lift points and travel (by cart/forklift) path.
5. If the rigging team is an outside contractor, provide the names and copies of qualification of team members.

F. PROCEDURE

Assure all prerequisites and precautions have been completed. Indicates the technical requirements to protect the equipment and personnel during the lift and QC shall assure that all Prerequisites are complete. List steps and order if applicable.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

CHAPTER 13 PROCUREMENT REQUIREMENTS

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4.5. SUBCONTRACTOR LIFT DATA SHEET

LIFT TITLE:	Effective Date:	Date Performed:
LIFT PROCEDURE NO. <u>L -</u>	Approved:	Comments:
AREA: _____	<u>LIFT MANAGER</u>	
Sheet No (if applicable) _____		
DISASSEMBLY PROCESS COMPLETED (Print and Initial) Cognizant Person(COG): _____		
Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Lift Height, Flight Plan Sketch of equipment shall include: Dimensions, Anchor Bolts Removed, Allowable Tilt restrictions, etc.		
WEIGHT: _____ METHOD DETERMINED BY: _____		
APPROVED: _____ (Print and Initial) Crane Operator (Rigged to sketch) Cognizant Person (Equipment ready to lift)		

CHAPTER 13 PROCUREMENT REQUIREMENTS

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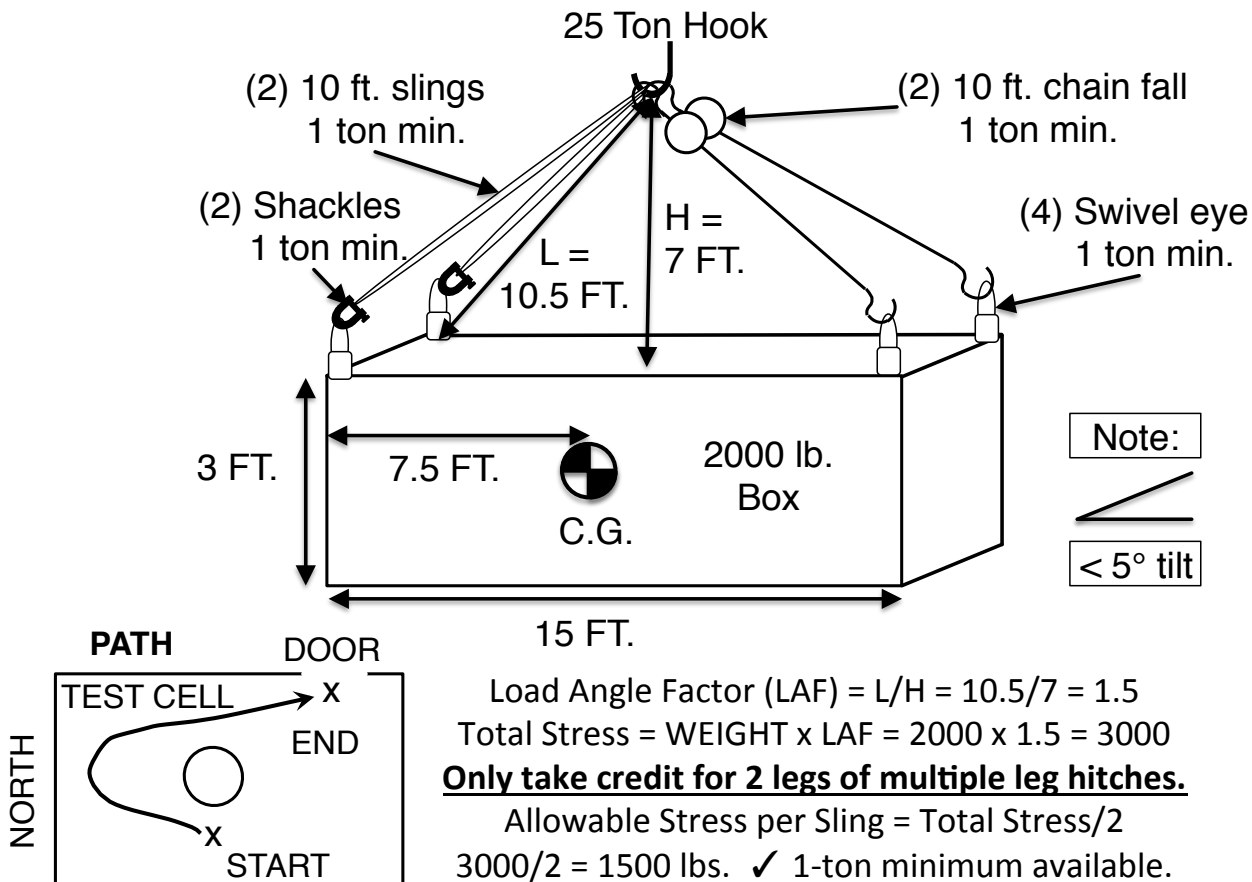
4.6. SAMPLE COMPLETED SUBCONTRACTOR LIFT DATA SHEET

LIFT TITLE: Light box lift	Effective Date:	Date Performed:
LIFT PROCEDURE NO. L - PPPL PO 12345	Approved:	Comments:
AREA: C-Site East of MG building	LIFT MANAGER	
Sheet No (if applicable) 1		

DISASSEMBLY PROCESS COMPLETED (Print and Initial) Cognizant Person (COG)):

Sketch of rigging shall include: Crane Capacity, Hook Load, All Rigging, Lift Height, Flight Plan

Sketch of equipment shall include: Dimensions, Anchor Bolts Removed, Allowable Tilt restrictions, etc.



WEIGHT: 2000 METHOD DETERMINED BY: Scale

APPROVED:

(Print and Initial) _____

Crane Operator
(Rigged to sketch)

COG
(Equipment ready to lift)

CHAPTER 14 LOAD TESTING

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CHAPTER 14 LOAD TESTING

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1.0 PERFORMING LOAD TESTS**RESPONSIBILITY ACTION**

- | | |
|---|---|
| Qualified Rigging Specialist | 1. Prepares a Load Test Data Sheet for the item in need of a load test. A sketch of the load test configuration with all relevant data such as: component capacities, load weight, crane rating, etc. |
| Lift Manager | 2. Reviews the Load Test Data sheet for appropriate safety and rigging considerations. Approves or Disapproves the Data Sheet as appropriate. |
| Quality Control/
Lift Engineer/Qualified Crane Inspector | 3. Observes the performance of the Load Test assuring confirmation of the lift to the requirements of the Data Sheet. Note: The Lift Manager may N/A the requirement for the Lift Engineer to witness. |
| Qualified Rigging Specialist | 4. Performs the Load Test in conformance with the Load Test Data Sheet. |
| | 5. Records maintained for the life of the specific equipment. Records are stored in the Operations Center for equipment and rigging fixtures. Load tests for rigging accessories are kept in the QRS files. |
| | 6. Performs post load test periodic inspection as required by the individual piece of equipment (see applicable Chapter). |

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2.0 LOAD TEST DATA SHEET

Equipment ID(s) _____ Prepared by: _____

Qualified Rigging Specialist / Date

Equipment Name(s) _____ Approved by: _____

Lift Manager / Date

Show sketch of load test configuration with all relevant data such as: component capacities, load weight, crane rating etc.

Data (i.e.test weight, lift angle, radius):

WITNESSES:

Quality Control: _____ DATE: _____

Lift Engineer: _____ DATE: _____

Post Load Periodic Test Inspection: SAT / UNSAT (circle as appropriate)

QRS: _____ DATE: _____

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