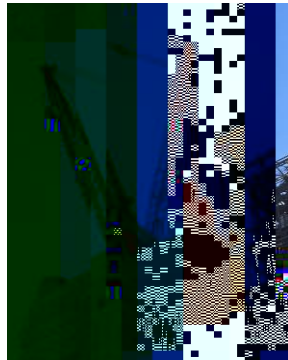
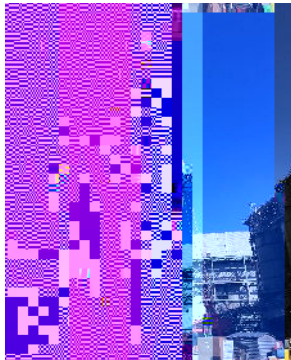




Skill. Grit. Purpose.

# CRANE AND RIGGING MANUAL

Rev. 5; 12/28/2022



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17.1 REGULATIONS AND STANDARDS ..... 69

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1.0 PURPOSE AND SCOPE

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- Must have successfully completed the core competency exam for crane operation through the NCCCO or the NCCER;
- The valid period for the test may be expired.

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### 3.4.2 Duties of Lift Director

Per the American Society of Mechanical Engineers (ASME) B30.5 standard, the Lift Director's responsibilities include:

- Halting crane operations if alerted to unsafe conditions,
- Warranting area preparations are completed before crane operations commence,
- Confirming necessary traffic controls are in place,
- Ensuring workers understand their responsibilities and the associated hazards,
- Appointing signal people and ensuring they meet the applicable requirements,
- Allowing crane operations near power lines only when applicable requirements are met,
- Implementing precautions for special lifting operations, such as multiple crane lifts,
- Ensuring rigging is performed by competent personnel, and
- Guaranteeing the load is properly rigged and balanced.

In addition to the ASME duties identified above, Sundt specific duties include:

- In coordination with Project HQ identified above - 1637M e d, g

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### 3.6 AUTHORIZED OPERATOR/CRANE COMPETENT PERSON

Meet the certification and qualification requirements included in Section 4.0.

Be familiar with the equipment, including load charts, limitations, set up requirements, etc.

Ensure equipment is properly inspected and safe for operation.

Be mentally and physically fit and prepared to operate the equipment, and to respond to unforeseen issues and events.

Oversee the safety of each lift he or she makes.

Stop any lift when there is a question as to whether safety has or may be compromised.

Perform all the required duties for a competent person as they are identified in §1926, Subpart CC.

**NOTE: All references to "operator" in this Manual are intended to denote an Authorized Operator.**

### 3.7 QUALIFIED RIGGER

Meet the qualification requirements listed in Section 13.1 of this Manual.

Be familiar with the equipment, including slings, chain falls, rigging hardware, etc.

Ensure equipment is properly inspected and safe for operation.

Be mentally and physically fit and prepared to operate the equipment, and to respond to unforeseen issues and events.

Oversee the safety of each lift he or she makes.

Stop any lift when there is a question as to whether safety has or may be compromised.

Perform the required duties pursuant to the level of authorization.

**NOTE: All references to "rigger" in this Manual are intended to denote a Qualified Rigger.**

### 3.8

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5.5 ANTI-COLLISION POLICY

This anti-collision procedure shall be implemented any time there are two or more cranes, including tower cranes, or other pieces of mobile equipment that are capable of coming into contact during day-to-day operations.

5.5.1 General

All cranes shall have operator-to-operator capabilities via a dedicated radio channel. Use of cell phones for crane communication is prohibited.

All cranes will be clearly identified for ease of communication. Each tower crane will be numbered (TC1, TC2 .) ~~and each mobile crane will be named/identified in a clear manner to allow quick~~ recognition and communication. Common identifying call signs/names utilize the crane make and

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If a mobile crane or other piece of mobile equipment is set up in a location that has the potential to encroach on the hoist line OR impact the jib or counterweight structure of a tower crane, the tower crane will be locked out/limited as follows:

Lock out/swing limitation must be initiated by the superintendent over the activity that is encroaching into the swing radius of the tower crane and must be approved by the Sundt Project Manager or general Superintendent/Construction Manager.

- The same superintendent who requests the initial lock out/swing limitation OR the Project Manager are the only persons who can give the direction to release the tower crane from the locked out/limited status.

If possible, the tower crane will be locked out using positive swing limiting devices that prevent the jib, counterweight, and/or hoist line from encroaching within 30 of the encroaching equipment. NOTE: The project can designate an encroachment distance greater than 30 if preferred but cannot designate a distance less than 30.

- The tower crane will communicate to the requesting superintendent and the operator of the encroaching equipment when the tower crane is locked out or limiting devices have been activated.

If it is not feasible to lock out the tower crane OR there are no swing limiting devices in place:

- A designated spotter who is also a qualified signal person with radio access to both cranes will be assigned to maintain constant observation and communication access with both cranes to alert both any time the jib, counterweight, or hoist line of the tower cranes comes within 30 of the encroaching equipment; AND
- Visible demarcation shall be implemented 30 from the encroaching equipment that is visible to the tower crane operator.

At the end of each work shift and unless handing duties off to a subsequent shift, operators of



- Significant ground slopes or questionable ground support conditions;
- Moves in less than adequate lighting, including dusk to dawn;
- Travel with live traffic or on active roads;
- Travel into live operating areas (existing facilities);
- Move with the boom elevated (hydraulic);
- Passing under overhead utilities if clearance is less than that prescribed in Section 6.3 below;
- Passing over underground utilities that are not protected by existing or engineered roadway or duct bank; or
- Any other uncommon circumstance or situation.

The planning process shall include the Sundt Major Crane Move Permit and shall be completed by the Qualified Crane Manager or his/her designee.

## 6.2 DRILL RIG MOVE PERMIT

Due to the complexity of design and potential for tipping created by traveling with the mast fully vertical, the Sundt Drill Rig Move Permit must be completed prior to traveling any drill rig in an erected configuration.

This permit shall be completed as part of the daily planning process and be inclusive of all planned moves for the day. Special consideration shall be given to moves that involve the following unique conditions:

- Significant ground slopes (>2%);
- Overhead utilities/power lines;
- Underground utilities;
- Moves of greater than 150 yards;
- Questionable/unimproved ground conditions;
- Moves at night or with limited lighting;
- Crossing under structures, including tower cranes;
- Moves into new operational areas; and
- Any other uncommon circumstance as determined by the Sundt Superintendent over the activity.

The Permit can be completed for single moves or multiple moves within a shift, work week, or other time period as established by the Sundt Superintendent over the activity. Project, Area, or Group HSE Manager shall be consulted before assigning Permit for duration other than a single move.

## 6.3

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Over 345 to 750	16
Over 750 to 1,000	20
Over 1,000	As established by utility owner/operator or registered Professional Engineer who is qualified with respect to electrical power transmission and distribution
Unknown voltage	20

Ensure the effects of speed and terrain on the crane (including boom/mast movement) are considered, as well as understanding the temperature effects on the vertical distance of the power line. The vertical distance should be checked and verified by survey.

If any part of the crane, while traveling, will get closer than twenty feet

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If there are any questions to whether the crane can move up or down a grade assisted or unassisted, call your Group HSE Manager.

#### 6.10 BOOM AND COUNTERWEIGHT POSITION

The boom angle and direction it faces require special consideration during the move, especially when traversing a slope or grade. The crane manufacturer will outline boom angles and direction of boom based on the crane's configuration and grade of the slope.

If, for any reason, ~~the Operator's Manual~~ does not cover crane move specifics, contact the crane manufacturer to get their recommendation before proceeding.

It is imperative that the center of gravity of the crane be kept centered on the car body and the proper boom angle maintained, or it can adversely affect the weight distribution.

#### 6.11 TRAVEL LOCK

At no time will a crane move be permitted or performed without all swing prevention mechanisms engaged, such as swing locks, swing brakes and/or house locks and brakes.

If a situation arises where ~~e the house or cab must be rotated during the move, the Operator's Manual~~ must be consulted to make sure it can be done safely. If the required information cannot be obtained ~~from the Operator's Manual~~, the QCM or his/her designee will contact the manufacturer of the crane to discuss the situation and receive an approved procedure or abandon the operation.

#### 6.12 BLOCK/BALL SECURED

When the crane is travelled, all load blocks and/or balls will be tied back to the appropriate location on the crane along with the appropriate tie back cable unless otherwise stipulated by the manufacturer guidelines.

### 7.0 CRANE SET-UP

#### 7.1 CRANE ASSEMBLY/DISASSEMBLY

Crane assembly/disassembly operations for any crane or derrick shall only be performed under the direction and supervision of an approved A/D Director. For Sundt-owned equipment, the A/D Director shall be approved by the Sundt Crane Committee. The A/D Director for rented equipment shall be provided by the equipment vendor.

**Any Sundt assigned and approved A/D Director shall only utilize the manufacturer's directions and specifications for assembly/disassembly operations.**

Deviation from established and accepted assembly/disassembly plans or the specific direction of the A/D Director is strictly prohibited.

It is the preference of Sundt that projects utilize vendor personnel to ~~o~~ ~~e~~ ~~p~~ ~~t~~ ~~e~~ ~~d~~ ~~a~~ ~~s~~ ~~s~~ ~~e~~ ~~m~~ ~~b~~ ~~l~~ ~~e~~ ~~s~~ ~~o~~ ~~n~~ ~~7~~ ~~-~~ ~~2~~ ~~.986~~ on

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All employees engaged in assembly/disassembly activities shall understand their task, the assembly/disassembly process, and the hazards associated with the activity prior to commencing A/D operations.

Hazards associated with A/D operations include pinch points, body placement, falls, and falling objects. Employees shall be informed of and understand safe locations and body placement, established pinch point hazards, and required fall prevention and protection.

NOTE: When assembling or disassembling components, dunnage shall be utilized under lattice boom sections, luffing jibs, etc. to support and prevent an individual component from falling to the ground in the event of unexpected movement. The intent is to protect the feet and legs of individuals involved in assembling or dismantling those components.

Please see Section 10.0 of this Manual for fall prevention and protection requirements.

#### 7.1.1 Tower Crane Assembly/Disassembly

Refer to 29 CFR §1926.1435(b) for clarification and direction on tower crane assembly, climbing, and disassembly.

The following safety devices are required on tower cranes unless otherwise specified:

- Boom stops on tower cranes with luffing boom;
- Jib stops on luffing boom if equipped with jib attachment;
- Travel rail end stops on both ends of travel rail;
- Rail travel limiting device;
- Integrally mounted check valves on all load supporting hydraulic cylinders;
- Hydraulic system pressure limiting device;
- Deadman control or forced neutral return control (hand) levers;
- Emergency stop switch at the operator's station;
- Trolley end stops must be provided at both ends of travel of the trolley;
- Trolley travel limiting device;
- Boom hoist limiting device;
- Boom hoist deceleration device;
- Load hoist deceleration device;
- Boom hoist drum positive locking device and control.
- Hoist drum lower limiting device;
- Load moment limiting device;
- Load indicating device;
- Hoist line pull limiting device; and
- Wind speed indicator.

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### 7.1.2 Tower Crane Set-Up

On jobsites where more than one fixed jib (hammerhead) tower crane is installed, the cranes must be located such that no crane can come in contact with the structure of another crane.

Cranes are permitted to pass over one another. If two or more tower cranes are set up in a manner that will allow any crane to pass over or under the boom of another crane, the project shall develop and utilize a plot map as described in Section 5.0 and practice the communication directives established in Section 12.4.

### 7.2 CRANE AREA AND ACCESS

The route to the area where the crane will travel must be surveyed for overhead obstructions, bridge weight limits for safe travel of crane and any support trucks, road or path width, including an assessment of road/path shoulders, and room for maneuvers, including turning the crane as needed. Reference Section 6.0: Crane Travel

There must be enough room for crane assembly and setup, as well as sufficient area for crane disassembly after the task is completed.

Check the slope and grade of the ground where the crane will be set up. For an outrigger crane, the ground of the set-up area should be nearly level; for a crawler crane, the ground should be level within 1% grade, equal to a slope of 1-foot rise in 100 feet horizontal, or 0.57 degrees.

**A minimum two feet (2) of swing clearance must be maintained between the superstructure** counterweight and any obstruction. If this is not possible, special precautions must be documented in the Job Hazard Analysis or other pre-task planning process to ensure there is no contact between the crane and the obstruction.

Access to the carriage body and counterweight swing radius shall be protected by red barricade tape

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#### 7.4.1 Encroachment Into Limited Access Zone

If a crane or other mobile equipment must be positioned such that a part of the crane has the potential to enter into a limited access zone as identified in Table 7.4 above, the first and preferential option is to have the utility owner de-energize and ground the lines. The de-energization must be confirmed in writing by the utility owner and visually verified by the Sundt Project Manager.

If the utility owner is unable or unwilling to de-energize and ground the power lines as described above, then the project must develop and complete the Sundt Mobile Equipment Electrical Proximity Permit, including a written plan that identifies how the Project will meet the requirements of this Manual and OSHA Standard §1926.1408 during A/D and normal operations. In addition, the Project shall develop a Sundt Critical Lift Permit for the activity.

NOTE: If the crane activity within a limited approach zone will continue for multiple days, then the Sundt Mobile Equipment Electrical Proximity Permit and accompanying Sundt Critical Lift Permit may be utilized for the duration of the activity if, and only if, there is no change in protective measures, activity, conditions, voltage, identified load radius, and key personnel (operators, riggers, QCM, and spotters).

For any crane activity that presents the potential for encroachment into a limited access zone, the following process is mandatory:

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Authorized Operators shall review all manufacturer requirements for outrigger pad design and placement and adhere to guidelines and directives provided.

Material

Outrigger pad material shall be sturdy enough to evenly distribute the weight applied by the outrigger. Any pad that is deformed, curled, or that will buckle when weight is applied, will not evenly distribute the applied weight and is therefore unacceptable for use.

Preferred pad materials include steel plate and hardwood such as oak.

**Steel plate should have a minimal thickness of 1".**

Wooden pads shall be designed as a solid structure with no spacing or gaps and constructed to adequately handle the weight to be applied.

The use of concrete blocks or materials is prohibited.

If composite material pads are utilized, the pad cannot be bowed or disformed in any way.

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A representative from Operations or HSE shall monitor wind activity.

Any time the wind speed, including gusts, reaches thirty miles per hour (30 mph), the Project Manager,

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## 8.6 BARGE OPERATIONS

Barge operations require additional considerations for listing, yawing, the increased buoyancy of loads

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A third-party inspection is not required for any crane that has successfully passed the initial third-party inspection for operation on a Sundt project, leaves for another assignment, and then returns to a Sundt project provided the following conditions are met:

- The crane returns to a Sundt project within thirty days of initial exit, and
- The crane owner can provide documentation that the crane has undergone daily pre-use inspections as specified in Section 9.4 of this Manual for each day of use OR a monthly inspection as specified in Section 9.5.

An additional third-party inspection is not required for a mobile crane when it relocates to a new location on the project or when one of the following crane reconfigurations occur under the supervision of a Qualified Crane Manager or A/D Director:

- Removal of counterweights for traveling purposes
- Additional counterweights added per the manufacturer's guidelines
- When boom sections are added or removed
- Installation or removal of a jib (NOTE: Extension and stowage of a swing-away jib may be performed under the direction of an Authorized Operator).

### 9.3 REPAIRED, ADJUSTED, OR MODIFIED EQUIPMENT

Prior to being placed back into operation, any equipment that has been repaired, adjusted, or modified in a manner that affects the safe operation of the crane must undergo a documented

Daily crane inspections will be recorded on the Sundt Daily Crane Pre-Use Inspection (PUI) Form. Subcontractors may use their in-house PUI form provided it is comparable in scope to the Sundt Daily Crane PUI.

Operators and maintenance personnel shall be trained in proper use of fire extinguishers.

#### 9.5 MONTHLY INSPECTIONS

In accordance with OSHA 1926.1412(e), an operator or a qualified service/maintenance technician shall perform a monthly inspection of each crane within 35 days of the arrival of the crane to the site, and at least once every 30 days thereafter. Any deficiency or defective part which may impair the safe or functional operation of the crane must be repaired before the crane is placed in service.

In addition to the inspection criteria established for pre-shift inspections, the monthly inspection shall include an examination of:

- All functional operating mechanisms, looking for excessive wear; and
- All ropes, brakes, friction clutches, chain drives, and other parts subject to wear which may be readily inspected.

Monthly crane inspections will be recorded on the Sundt Comprehensive Crane Inspection Form. Subcontractors may use their in-house inspection form providing it is comparable in scope to the Sundt Comprehensive Crane Inspection Form.

##### 9.5.1 Tower Cranes

In addition to standard monthly inspection criteria for all cranes, the following shall be inspected on tower cranes:

- Tower (mast) bolts and other structural bolts (for loose or dislodged condition) from the base

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#### 9.7 RETURN/OFF-HIRE INSPECTION

Prior to being returned to the vendor, any crane rented/leased by Sundt shall undergo a documented inspection performed by the Sundt QCM or designee prior to disassembly to ensure any damage, or lack thereof, is properly noted.

If the crane vendor does not provide a form or document for these inspections, then the Sundt QCM should utilize the Sundt Comprehensive Crane Inspection Form. It is recommended that photos be taken to accompany final inspection and request that the vendor representative sign-off as well.

#### 10.0 FALL PROTECTION

##### 10.1 GENERAL

Fall protection for crane related activities fall under CFR §1926.1423 and 1926.502.

Steps, handholds, ladders, guardrails, railings, and grab rails must be maintained in good condition.

Walking/stepping surfaces, including ladders, must have slip-resistant features.

Exception: Crawler treads used as stepping and walking points.

Fall protection is required for employees on a walking/working surface with an unprotected side or edge more than six feet (6) above a lower level as follows:

When moving from point to point on all booms.

When at a workstation on any part of the equipment, except when the employee is at or near draw-works when the equipment is running, in the cab, or on the deck.

##### 10.2 ANCHORAGE

Personal fall arrest systems must be anchored to any apparently substantial component unless a competent person, based on visual inspection and without an engineering analysis, would conclude that the component would not meet the requirements of §1926.502(d)(15).

Operators, with input from HSE Department, should evaluate potential tie off points to determine which components will provide sufficient anchorage support.

Positioning device systems must be anchored to any apparently substantial component unless a competent person, based on visual inspection and without an engineering analysis, would conclude that the component would not meet the requirements of §1926.502(e)(2).

Fall restraint systems must be anchored to any part of the equipment that is capable of withstanding twice the maximum load the employee may impose upon it during reasonable anticipated conditions of use.

##### 10.3 FALL PROTECTION DURING ASSEMBLY/DISASSEMBLY OPERATIONS

Based on §1926.1423(e)(1)(ii) and §1926.1423(f), fall protection is not required until the fall exposure is ~~fifteen feet (15) or greater for assembly and disassembly operations, however,~~

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- Crane setup
- Size of the load
- Center of gravity of load
- Rigging necessary to lift the load
- Environmental conditions (wind, weather)
- Operator skill
- Communications

#### 11.2 CRITICAL LIFT

A critical lift requires that the company performing the activity develop a lift plan using the Sundt Critical Lift Plan and Permit or an equivalent document approved by the applicable Sundt QCM for that project.

All critical lifts shall be reviewed by the Sundt QCM identified for the project.

Critical Lifts are those meeting the following minimum criteria:

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Any pick-and-carry operation with the exception of a carry-deck type crane.

Any lift in which the crane, rigging, or load could enter an electrically energized limited access zone (**350kV at 20**);

- A critical lift in which the crane, rigging, or load could enter an electrically energized limited approach zone (**350kV at 20**) also requires completion of the Sundt Mobile Equipment Electrical Proximity Plan

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#### 11.6 LOAD MOMENT INDICATOR

The Load Moment Indicator (LMI) is used to indicate the tipping force of the load on the crane. If the load moment is exceeded, the LMI should engage and prevent the crane from continuing further into an overload condition.

Please note that overriding the LMI will allow the crane to exceed the load chart. Late model cranes (manufactured within the last 20 years) are constructed with lighter materials than earlier crane models, so structural failure is a real possibility when exceeding the load chart.

While most cranes have a mechanism (key, switch, etc.) that will allow the operator to override the LMI, doing so is prohibited except in cases of emergency or when directed by the manufacturer. Overriding the LMI requires approval of the Sundt Project Manager, the Sundt QCM, or the Sundt Project HSE Manager.

**EXCEPTION:** The operator may override the LMI during assembly/disassembly operations, in emergency situations to lower the load, or when allowed by manufacturer guidelines.

Any employee, operator or otherwise, who overrides the LMI without the required approvals, or who tampers with, disables, or bypasses the LMI, will be terminated. If that employee is an Authorized Operator, his or her operator qualifications through Sundt shall be revoked, and the NCCCO, NCCER, or any other applicable certifying entity shall be notified of the action.

#### 11.7 BLIND PICK/LIFT

In any lift where the operator cannot maintain visual contact with the Signalperson throughout the duration of the lift, two-way radios with a dedicated channel must be utilized to maintain constant contact.

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the load is controlled without the tag line AND without requiring employees to place hands on the load for control.

OSHA specifically requires tag lines be utilized when:

- Performing steel erection,
- Hoisting close to scaffolds,
- A rotation of the load would be hazardous, and
- Hoisting suspended personnel platforms, if appropriate.

Tag lines shall be secured to the load to prevent the tag line from accidentally disengaging and falling from heights over 6.

Tag lines shall be free of knots that can hang up on ledges or equipment.

Tag lines shall be long enough to allow individuals to control the load without getting under the load. However, the tag line should not be so long as to create a hazard as the load is hoisted into position.

Employees handling tag lines shall be instructed on how to do so safely.

Employees shall not wrap tag lines around their body or body parts, such as an arm or a leg.

An adequate number of employees shall be assigned as needed to control the load.

Polypropylene rope shall be used for tag lines around energized components.

The path of travel for employees handling tag lines shall be kept clear.

#### 11.10 TWO-BLOCKING

Sundt requires all cranes used in lift crane operations be equipped with an operational Anti-Two Block (ATB) device installed on the hoist line(s), i.e., main and whip, which will stop the crane's ability to hoist up, boom down, or extend the boom when activated.

#### 11.11.1 Equipment Set-Up and Criteria

Crane must be on solid, compacted ground and within one percent (1%) of level.

Outriggers shall be fully extended and locked in place.

For suspended personnel platforms, the total load, including the platform, personnel, any tools or equipment going up into the platform, the hook, load line, and rigging, must not exceed fifty percent (50%) of the rated capacity for the load radius and configuration of the crane as set up.

When the occupied personnel platform is in a stationary working position, the load and boom hoist

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The personnel platform must have a guardrail system that meets criteria found in §1926 Subpart M, and must be enclosed, at least from the toe board to the midrail, with either solid construction or expanded metal having openings no greater than one-half inch ( $\frac{1}{2}$ ).

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All bridles and associated rigging used for hoisting personnel shall only have been used for that purpose alone.

#### 11.11.5 Proof Testing

At each project, prior to hoisting employees and after any repairs or modifications, the platform and rigging must be proof tested to one hundred twenty-five percent (125%) ~~of the platform's rated~~ capacity.

The platform must be lowered by controlled lowering, braked, and held in a suspended position for at

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Immediately prior to each lift the personnel platform must be hoisted six inches (6") with the personnel, tools, and materials on board and inspected by the designated competent person to ensure it is secure and properly balanced.

Before the lift can continue, the designated competent person shall determine that:

The hoist ropes are free from defect in accordance with §1926.1413(a);

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Hoisting personnel within twenty feet (**20**) of a power line up to 350 kV, and within fifty feet (**50**) of a power line over 350 kV is prohibited.

#### 11.11.8 Pre-Lift Meeting

A pre-lift meeting must be held to review applicable requirements and procedures to be followed.

It must be attended by the Authorized Operator, the Signal Person (if applicable), the employees to be

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Dragline operation  
Pile driving and drilling shafts  
Demolition work  
Barge work

Special operations often require specialized training and/or certification. Consult the Sundt QCM and the Sundt HSE Department before conducting the above-mentioned operations, or any operation not considered normal crane activity applicable to Sundt project operations.

#### 11.14 LIFT ZONE PROTECTION AND CONTROL

The operator shall ensure that a lift zone is established that prevents employees from walking under an elevated load or being exposed to a falling load.

The preferred method is to establish and delineate an exclusionary zone using red barricade tape with appropriate tags.

The lift zone should encompass those areas over which the load will travel and to which persons in that area would be exposed to a hazard from falling material or loads.

If it is not feasible to establish a barricaded area, then the operator, with the approvals of the Sundt QCM and the Sundt HSE Department, may utilize a ground person to warn and direct employees out of the load path using whistles, horns, etc.

#### 12.0 SIGNALING AND COMMUNICATION

A Signal Person is required for all crane hoisting activity.

#### 12.1 SIGNALPERSON QUALIFICATION

To be qualified, the Signalperson must:

Know and understand the type of signals used at the worksite.

Be competent in using these signals.

Understand the operations and limitations of the equipment, including the crane dynamics involved in swinging, raising, lowering and stopping loads and in boom deflection from hoisting loads.

Know and understand the relevant Signalperson qualification requirements specified in OSHA 1926, Subpart CC (1926.1419-1926.1422; 1926.1428).

Pass an oral or written test and a practical test.

Qualification methods include:

Option 1: Qualification through the NCCER, NCCCO, or an alternate third-party qualifying entity as approved by the Sundt Crane Committee.

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If a sling or equipment is in good shape but is missing the tag, it cannot be used until re-tagged by the manufacturer.

Damaged rigging **shall be immediately removed from service and destroyed, or otherwise tagged "Do Not Use" and secured (locked away) until it can be destroyed.**

Chain or wire rope slings shall not be shortened with knots or bolts or other makeshift devices.

Slings shall not be kinked or knotted.

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1/4	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1-1/8	7/32
1-1/4	1/4
1-3/8	9/32
1-1/2	5/16
1-3/4	11/32

### 13.3.2 Additional Rigging Inspection and Storage Requirements

Chainfalls, lever hoists (come-a-longs), manual winches, etc.

- Housing must be intact and the rated capacity must be legibly marked.
- The chains must be in good condition with no cracks or malformation of links.
- 

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- Pin does not screw in 100%,
- Safety latch does not work, or
- Swivel does not work.

#### Hooks

- Most hooks DO NOT have the capacity displayed. A stock number on the hook should be **compared to the manufacturer's catalogue for capacity.**
- Along with the inspection criteria listed above for rigging hardware, each hook should be inspected for wear at the throat (no more than 5%) and the bow/belly (no more than 10%).
- There should be no malformation or twisting in the hook.
- Safety latches shall be in place and functional.

#### Lifting beams and spreader beams

- Check for signs of welding, heat exposure, and burning.
- Inspect for cracks and structural damage.
- Missing or loose bolts or pins.
- Must have the following information on the bar/beam:
  - ~~Manufacturer's name and address~~,
  - Serial number,
  - Weight of the bar/beam (if more than 100 lbs.),
  - Rated load capacity,
  - ASME BTH-1 Design Class,
  - W BTC .0235(l)-B9857342 ha.987143(79.92.65()43.98275()6.S3.018790r)-3.0104( l)6.0128(e)1(gn)0.003(t1 )-2.99673(bo)C1(as)11.03635(h)1,.01258(

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When using in pairs, rigger must be aware of sling angles and potential for sling to slide during hoisting.

#### 13.4.2 Shackle Types and Uses

Round pin shackles (pin just slides into place) shall not be used for rigging.

Screw pin shackles are most common type and adequate for all rigging activities. This is the preferred shackle for use with a personnel basket, however, the pin must be wired into place and secured.

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The total load shall not exceed:

- The rated capacity of the hoisting equipment specified in the hoisting equipment load charts;
- The rigging capacity specified in the rigging rating chart.

The multiple lift rigging assembly shall be rigged with members:

- Attached at their center of gravity and maintained reasonably level;
- Rigged from top down; and
- Rigged at least 7 feet (2.1 m) apart.

The members on the multiple lift rigging assembly shall be set from the bottom up and have their own tag line attached.

Controlled load lowering shall be used whenever the load is over the connectors.

14.0 **BASE MOUNTED HOISTS**

Under development.

15.0 **OVERHEAD AND GANTRY CRANES**

Under development.

16.0 **DEFINITIONS AND TERMINOLOGY**

NOTE: Not all terms are found within this Manual, but Sundt feels it is beneficial to have a reference point for terminology that may be encountered during reviews of operations manuals, third party inspections, etc.

360° Swing Lock: A positive mechanical locv-1(ty)2.9848(Unders,)11.02026tst rU

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**Back or Boom Stop:** A device used to limit the angle of the boom, jib, or mast at the highest recommended angle. Used on lattice boom cranes to prevent the boom from going over backwards.

**Bail:** A frame equipped with sheaves and connected to the gantry. The bail is used in conjunction with the boom hoist drum and bridle to alter the crane's **boom angle**.

**Ball (Headache):** A smaller block version that is at the end of the whip line for single parted lines only. Extra weight is added to overhaul the wire rope between the drum and the boom point sheaves.

**Band Brake:** Circular external contracting type brake having a strap lined with heat and wear resisu7 p-3.0235he n -10.8199 T.016rfocte boo003.01(n l)-1(a-4.9925

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**De-rating:** Reducing the capacity of a crane, rigging equipment, or other lifting device/equipment based on factors such as wind or weather, rigging configuration, crane activity, attachments, or any other situation

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**Friction Clutch (PTO):** Device (which uses friction discs) used for the transfer or transmission of engine power to the operating functions of the crane.

**Friction Rig:** An older type of control that has different levers for each drum and crane action and a main lever for the brakes system.

**Front Stabilizer:** Stabilizers mounted toward the front of the carrier on hydraulic cranes.

**Function Critical Parts:** A part by nature of its original design or intended function is critical to the safe operation of the crane.

**Function Limiter (Lever Lock):** Devices incorporated into the Anti-Two Block (A2B) system or rated capacity indicator system which will disable the crane function of winch up, telescope out, and or boom down (as applicable) as two-block or overload situations approach.

**Gantry:** A structural frame located to the rear of the upper revolving frame and usually extending

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**List Charts:** Special load charts that give reduced capacities when a crawler crane must work out of level, primarily when working off of barges. Arranged by degrees out of level; a three-degree list means the crane is rated to operate up to three degrees out of level.

**Live Mast:** Frame hinged at or near the bottom foot and extending above the cab for use in connection with supporting a boom. Head of mast is usually supported and raised or lowered by the boom hoist ropes or cylinders.

**Loaded Boom Angle:** The angle between the boom base section and the horizontal with a freely suspended load at the rated radius.

**Load (Total Lifted Load):** The total summation of any weight that acts on the boom except the boom itself. Includes the item being lifted along with the wire rope, the main block, the headache ball, any rigging, any jibs (fixed, stowed, rooster or other), additional boom accessories, spreader beams, or any other object or force that applies a load on the boom.

**Load Chart:** The chart that accounts for the various allowable capacities at differing configurations and radii. Deducts must be applied.

**Load Factor:** Load applied at the boom tip that gives the same moment effect as the boom mass.

**Load Indicator:** A device for measuring and displaying the net load being lifted.

**Load Line:** Another term for Hoist Rope. In crane activity it refers to the main hoist. The secondary hoist is referred to as a Whip Line.

**Load Moment Indicator (LMI):** A device that automatically monitors radius, load weight, and load rating and warns the crane operator of an overload condition. (Aka: Rated Capacity Indicator)

**Load Radius:** Horizontal distance from the axis of rotation to the supporting surface before loading to the center of the vertical hoist line with a load applied. See Radius.

**Lower Works:** The carrier structure of a crane.

**Luffing Attachment:** A crane attachment adaptable to a basic cable crane. The attachment consists of a vertical luffing boom that is capable of being offset, with a luffing jib (usually the basic crane boom) affixed to the upper part of the luffing boom.

**Luffing Boom:** The main boom of the luffing attachment. It is connected to the upper frame of the crane and can be set at certain angles to provide different working ranges for the luffing attachment.

**Luffing Boom Cap:** A structure mounted to the top of the luffing boom where the luffing jib and the fan post are mounted.

**Luffing Jib:** The working boom of the luffing attachment. It is connected to the luffing boom cap.

**Luffing Jib Backstay Pendants:** See Backstay Pendants.

**Main Hoist Line:** The main lifting line of a crane. It is usually parted several times to allow for greater lifting capacities.

**Machinery Deck:** Term used to describe the hoisting unit of a tower crane. Usually contains the hoist drum, transmission and the electrical equipment used to control hoisting.

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**Major Crane Move:** Term used to describe on-site crane moving activity that meets specific criteria and therefore requires additional oversight and planning.

**Mat:** Material, usually of timber or wire construction, for supporting pontoons or tracks on soft surfaces to add stability.

**Mast:** The tower portion of a tower crane. Also refers to a secondary boom that extends to the rear on crawler cranes that allows for higher lifting capacities.

**Mast Pendants:** Cables or bars used to secure the mast of a crane.

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**Rooster Sheave:** A rooster sheave is a very short jib (4-8), which is installed for the whip line of the crane. Its purpose is to separate the ball and the block so that they do not hit each other when raised and lowered past each other. This is also used on clam-shell and pile driving configurations. The weight needs to be accounted for in the deductions if it is in place.

**Self-Erecting:** Term used to describe cranes that can assemble and disassemble themselves for shipping. If a crane is not self-erecting, it must have another crane in order to assemble portions of it. Most crawlers and hydraulic cranes are self-erecting. Tower cranes are not.

**Service Brake:** A foot-operated brake that regulates the amount of air or fluid delivered to the brake chamber, which determines the braking force.

**Shackles:** Screw type or pinned type "links" that allow rigging to be connected to the load or each other. Rated by size and capacity.

**Sheaves:** The pulleys on the tip of the boom that the wire rope is fed through. These allow for the wire rope to be parted (doubled up) several times to allow for greater lift capacities.

**Shim Pack (Wedge Pack):** Wedging mechanism used to secure the crawler side frames to the car body on some crawler cranes.

**Side Frame:** Supporting structure of the track mechanism. Side frames are attached to the crawler car body and may be extendable and/or removable.

**Side Load:** A load applied at an angle to the vertical plane of the boom.

**Signals:** Hand signals between a flag person and the crane operator. Allows for quick and clear communication during a pick.

**Spool:** Term applied to almost any moving cylindrically shaped part of a hydraulic component that moves to direct flow through the component.

**Sprocket:** The driving element of the track mechanism. Receiving power through the drive chain, the sprocket meshes with the track to travel the crawler.

**Superstructure:** The main upper rotating structure of a crane. See Upper Revolving Frame.

**Support Line:** The cable reeved from the second hoist drum for holding the clamshell bucket suspended during dumping and lowering operations.

**Swing:** The rotation of the upper with the carrier remaining stationary.

**Swing Brake:** A brake that is used to resist the rotation of the upper during normal, stationary crane operations.

**Swing Motor:** A hydraulic device that uses a planetary to rotate the upper on the carrier.

**Swing Park Brake:** A self-contained brake used for holding the upper, in any position, during normal, stationary crane operations.

**Swing Radius:** The horizontal distance from the center pin of the crane to the furthest point of the counterweight.

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