SUNDT

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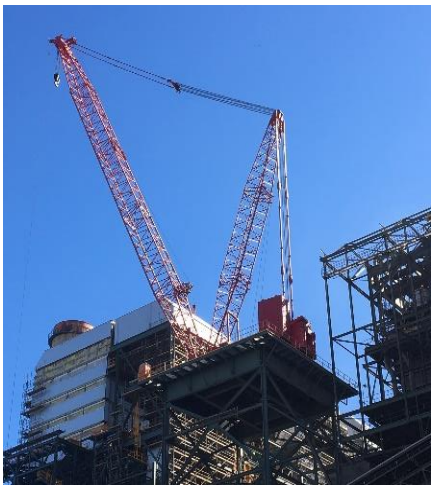
CRANE AND RIGGING MANUAL

Rev. 3; February 1, 2021



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1.0 PURPOSE AND SCOPE

The purpose of this Crane and Rigging Manual is to provide Sundt Authorized Operators, Qualified Riggers, Assembly/Disassembly Directors, Qualified Crane Managers, Site Managers, Project Managers, and HSE personnel with the requisite policy, procedure, standard, and regulation information needed to perform their duties as they pertain to crane operation and rigging on Sundt projects and sites.

This Manual and its policies and procedures apply to all Sundt projects, including Sundt employees, subcontractors, visitors, and vendors.

Any deviation from this Manual and requirements must be approved by the appropriate Group HSE Manager and Group Operations Manager.

2.0 REFERENCES

- OSHA Construction Standards, Subpart H: 29 CFR §1926.251
- OSHA Construction Standards, Subpart R: 29 CFR §1926.753
- OSHA Construction Standards, Subpart CC: 29 CFR §1926.1400 – §1926.1501
- OSHA General Industry Standards, Subpart N: 29 CFR §1910.179 – §1910.184
- ANSI/ASSE A10.42-2000 (R2010) (latest revision): Safety Requirements for Rigging Qualifications and Responsibilities
- All applicable ASME B30 Standards, specifically:
  - 30.2, 30.3, 30.4, 30.5, 30.6, 30.7, 30.9, 30.10, 30.11, 30.17, 30.20, 30.21, 30.23, 30.26, and 30.27
- All applicable state and local standards

3.0 ROLES AND RESPONSIBILITIES

NOTE: All required documentation may be submitted electronically to any identified recipients.

3.1 SUNDT CRANE COMMITTEE

3.1.1 Committee Members

The Committee shall include the following standing members:

- Industrial Group HSE Manager
- Transportation Group HSE Manager
- Building Group HSE Manager
- Concrete Division HSE Manager
- Representative from Equipment Services
- Representative from Craft Workforce Development
- Representative from Industrial Group Operations (As assigned by Group President)
- Representative from Transportation Group Operations (As assigned by Group President
- Representative from Building Operations (As assigned by Group President)
- Representative from Concrete Division Operations (As assigned by Division Vice President)

The Committee may request subject matter experts to attend as needed.

3.1.2 Committee Chair

A Chairperson for the Committee will be assigned by the Director of Health, Safety, and Environment (HSE).

The Committee shall elect a Co-Chairperson to assist the Chairperson and serve in his or her absence.

The responsibilities of the Chairperson include:

- Schedule and facilitate Crane Committee meetings,
- Assign someone to take notes,
- Update and maintain this Manual as determined by the Committee, and
- Sign-off/approve decisions of the Committee as needed.

3.1.3 Committee Responsibilities and Duties

This Committee is tasked with the following:

- Develop, review, and approve policies for crane and rigging activities,
- Review this Manual annually or any time policies are amended or updated,
- Approve Qualified Crane Managers and Assembly/Disassembly Directors for Sundt,
- Approve training and education courses for crane management, operation, rigging, and other crane activity, and
- Assist in investigations of crane related incidents and review the results of those investigations.

The Committee shall meet at least quarterly.

3.2 QUALIFIED CRANE MANAGER (QCM)

NOTE: Each Group shall have an identified QCM if there is crane activity which falls under Sundt's scope of responsibility and direct control. This does not include cranes controlled by subcontractors. The QCM *does not* have to be on-site unless one of the following criteria are met:

- The project is conducting a critical lift that meets the following criteria:
  - Lifts over 90% of capacity at set up and configuration,
  - Picks involving more than two pieces of mobile equipment, or
  - Any lift over the general public.
- Any time requested by the Group HSE Manager or the Project Director.

3.2.1 QCM Qualification Criteria

Qualified Crane Managers are assigned and approved by the Sundt Crane Committee, and shall meet the following criteria:

- Must have passed the core written test for crane operation through the NCCCO, the NCCER, or other Sundt Crane Committee approved operator certification organization;
  - NOTE: The valid period for the test may be expired;
- Successful completion of the current Sundt Qualified Rigger and Qualified Signal Person training;
- Must have successfully completed a training or educational course as approved by the Sundt Crane Committee on crane management, lift direction, etc. after January 1, 2018, or shall complete an approved course within 180 days of assignment of responsibility.
- Have at least five total years of verified experience in crane and rigging operations, including two years *supervising* operators and crane activity.

Applications for QCM must be submitted to the Sundt Crane Committee by the Group or Division that is requesting that the candidate be considered for QCM status. The ***Sundt Qualified Crane Manager Application*** is the appropriate form for submittal.

- QCM Application must be approved by the Sundt Crane Committee Chairman OR Co-Chairman, AND two other standing members of the Committee.

3.2.2 Duties

Provide project support for the following as needed:

- Ensure operators are certified, competent, and qualified per this Manual for the crane or derrick to which they are assigned.
- Evaluate certified operators employed by Sundt to ensure they are qualified to operate the crane(s) to which they are assigned. Evaluation shall be conducted per §1926.1427(f).
- Assignment of operators to cranes/derricks (may be delegated to a designee).
- Ensure each operator receives a copy of this Sundt Crane and Rigging Manual and successfully completed the open-book test (may be delegated to a designee).
- Assist sites with multiple cranes to develop crane plot map as needed (may be delegated to a designee).
- Ensure there is a site-specific crane management program that addresses crane-to-crane proximity and communication requirements when applicable.
- Ensure cranes and derricks are inspected per this Manual and any applicable standards and regulations (may be delegated to a designee).
- Ensure riggers are qualified pursuant to this Manual and any applicable standards and regulations (may be delegated to a designee).
- Ensure signal persons are qualified pursuant to this Manual and any applicable standards and regulations (may be delegated to a designee).
- Review all Critical Lift Plans and Permits.
- Act as Lift Director for any critical lifts or assign a competent person to that role and provide assistance as a qualified person.
- Serve as the designated competent person for personnel basket hoisting activities or identify a designee who possesses the required knowledge and experience to fill that role.

3.3 ASSEMBLY/DISASSEMBLY DIRECTOR

For any cranes owned by Sundt Construction, the A/D Director shall be identified and assigned by the Sundt Crane Committee. For rented or leased equipment, the equipment vendor shall provide the A/D Director.

The erecting and stowing of *swing-away jibs* can be completed under the direction of a Sundt Qualified Crane Manager OR Authorized Operator if that individual meets the qualifications for the position *and* has experience in erecting and stowing swing-away jibs.

It is the responsibility of any identified and assigned Assembly/Disassembly Director to perform only the assembly and disassembly activities for which he or she is properly trained, educated, and qualified to perform and oversee.

Sundt Construction will strictly adhere to the directions and specifications for crane assembly and disassembly that are provided by the manufacturer or vendor for the specific crane or derrick being assembled or disassembled.

3.3.1 A/D Director Qualification Criteria

Sundt A/D Directors are assigned and approved by the Sundt Crane Committee, and must meet the following criteria:

- 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.
- Have verifiable experience in crane assembly/disassembly activities;
- Have knowledge of the applicable assembly/disassembly procedures; and
- Review the information on crane assembly and disassembly provided by the manufacturer for specific cranes to be assembled/disassembled and complete the Operator's Manual Review Form.

NOTE: A single employee can act as both an Authorized Operator/Crane Competent Person and the A/D Director if that individual meets the criteria for *both positions*.

3.3.2 Duties

The A/D Director shall:

- Review the appropriate procedures prior to the commencement of assembly/disassembly (if necessary)
- Instruct the assembly/disassembly crew on their tasks, the hazards associated with their tasks, and hazardous locations that must be avoided
- Protect assembly/disassembly crew members that are out of the operator's view by ensuring thorough communication with the operator
- Prohibit assembly/disassembly crew members to work under suspended loads or in an area where unintended dangerous movement of components could occur
- Ensure that capacity limits of the crane(s), components (including rigging), lifting lugs, and accessories are not exceeded
- Address other assembly/disassembly hazards (e.g. site and ground bearing conditions, blocking material, center of gravity, wind and weather, etc.)
- Ensure that all rigging is overseen by a Qualified Rigger during the assembly/disassembly process
- Ensure a post-assembly inspection is performed to verify the crane is assembled per the manufacturer's specifications.

3.4 PROJECT MANAGER

Ensure all crane activity is conducted in compliance with this Manual and all applicable federal, state, and local laws and regulations.

Ensure equipment is inspected and maintained pursuant to this Manual, manufacturers' directives and recommendations, and applicable standards and regulations.

3.5 LIFT DIRECTOR

The Lift Director is the senior-most superintendent or manager assigned to oversee crane and rigging activity for the project. Designation of Lift Director shall be approved by the assigned QCM for the Project/Group/Division.

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.

When a critical lift involves multiple cranes/derricks, the Lift Director must be on site and shall meet the requirements of both a Qualified Crane Manager (**Section 3.2**) and an Authorized Operator/Crane Competent Person (**Section 3.6**) ***OR*** meet the requirements of an Authorized Operator/Crane Competent Person and be assisted by a QCM.

For multiple crane/derrick critical lifts, the Lift Director shall:

- Ensure the Sundt Critical Lift Plan and Permit is properly completed.
- Ensure any required engineering support is in place, including drawings and specifications.
- Assign responsibilities to operators, riggers, and signalpersons during critical lift operations.

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, chainfalls, 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 PROJECT HEALTH, SAFETY, AND ENVIRONMENTAL (HSE) MANAGER

NOTE: If project does not have an assigned HSE Manager, these responsibilities shall be assigned to other project team members by Project Manager.

Assist QCM to ensure operators are certified and qualified to operate the assigned equipment.

Review rigger and signalperson credentials to ensure employees are qualified and/or competent for their position and assigned tasks.

Assist in development of Site-Specific Crane Plans.

Maintain files on all operators that include copies of all documentation identified in this Manual.

- The ***Sundt Crane Operator Qualification Review*** is mandatory and will aid in ensuring all documentation requirements are met.

Maintain files for required personnel lift platform (manbasket) documentation.

Audit and assess crane and rigging activities for compliance and safety.

3.9 SUBCONTRACTORS

Subcontractors are responsible for providing the identified positions and competent and/or qualified persons as required herein this Manual for the scope of work to be performed.

Subcontractors bear the sole responsibility for ensuring their employees are certified and qualified in accordance with applicable OSHA standards to perform their assigned duties. Sundt reserves the right to review a subcontractor's certification and qualification processes for all operators and riggers. Subcontractors will be asked to amend or improve any processes that do not meet the minimum requirements established by this Manual.

4.0 OPERATOR AUTHORIZATION

Only those operators certified **AND** qualified pursuant to this policy may operate cranes and/or derricks for Sundt projects.

Each operator shall be in possession of their certification card, physical card, and any Sundt or employer issued qualification card while operating equipment.

All documentation shall be uploaded to the specific Project safety file for retention.

4.1 CERTIFICATION REQUIREMENTS

All crane and/or derrick operators must be certified for the specific type of equipment they will be assigned to operate through the NCCCO, the NCCER, or an alternate operator certification credential approved by the Sundt Crane Committee.

4.2 QUALIFICATION REQUIREMENTS

An operator shall be considered qualified when the following criteria are met:

- Pass a DOT type physical and present a current medical card;
- Be trained by their employer to perform the construction tasks to which he or she is assigned;
- Review the operator's manual and load charts for the assigned crane;

- Be trained by their employer as determined necessary on the anticipated activities and specific make and model of crane he or she will be assigned to operate; and
- Be assessed by their employer as to the required skills, knowledge, and judgement to safely operate the equipment.

4.2.1 Sundt Operator Qualification

Operators employed by Sundt shall meet the criteria listed in **Section 4.2** above and:

- Have at least 3 years of verified experience operating cranes or derricks;
- Successfully pass the ***Sundt Crane and Rigging Manual Exam*** (written and open-book);
- Complete any required Sundt-provided training as outlined in Section 4.2.2;
- and
- The ***Sundt Crane Operator Qualification Review*** shall be completed for each Sundt operator.

4.2.2 Sundt Operator Training

Prior to initial operation, the operator shall receive training from their employer on the following subjects *as they apply* to the crane he or she will be assigned to operate and expected tasks (this list is not all-inclusive):

- Equipment inspection
- Assessment of unstable loads
- Hoisting loads of irregular size
- Personnel hoisting
- Rigging
- Leveling the crane
- Hoisting in tight spaces
- Wind speed determination and required de-rating
- Multi-crane picks
- Hoisting light loads
- Hoisting blind picks
- Training specific to any attachments

4.2.3 Sundt Operator Evaluation

Prior to operating a specific crane on site for the first time, an operator shall undergo an evaluation by the Project's assigned QCM. This evaluation will be to determine the operator's comfort level, experience, knowledge, and basic operational skills for that particular make and model of crane.

This evaluation will be documented using the ***Sundt Crane Operator Practical Evaluation***. The completed evaluation(s) will be maintained by the HSE Department.

5.0 SITE INSPECTION AND UTILIZATION PLANNING

Prior to mobilization of crane(s) and per OSHA 1926 Subpart CC, the Project Manager will ensure the site layout is evaluated, including:

- Assessment of access, roadways, and travel paths,
- Identification of known utility locations,
- Identification of existing facilities and encumbrances, and
- Work area access requirements.

5.1 WRITTEN CRANE PLAN AND NOTEBOOK

If there will be cranes on site at a given time, the Project shall develop a written Site-Specific Crane Plan that includes provisions and details for:

- Coordination meetings,
- Plot and/or grid maps,
- Soil compaction information,
- Identification of QCM
- Receipt and retention of operator certification and qualification information,
- Receipt and retention of crane inspection information,
- Receipt and retention of qualified rigger and signal person information,
- Receipt and retention of rigging information (engineering, inspections, etc.),
- Critical lift details, permits, and plans, and
- Any other pertinent crane and rigging information.

5.2 CRANE COORDINATION MEETING

Any time there are two or more cranes in use on a project and controlled by Sundt management or contractors/subcontractors, the Project Manager shall establish a daily Crane Coordination Meeting to discuss the following:

- Schedule needs,
- Anticipated/planned major crane moves,
- Anticipated/planned major or critical picks,
- Anticipated/planned crane lock outs, and
- Any other pertinent information that has the potential to impact crane operators and supervision.

This meeting shall involve the Lift Director for the Project, all Superintendents and Subcontractor Management, and at least one member of the HSE staff. Information from the meeting shall be shared with all front-line supervision, operators, crane-assigned operators, and signal persons.

5.3 PLOT MAP/GRID MAP

If there will be multiple cranes on site, the Project team shall develop a plot map to evaluate crane staging and set-up locations.

- The Project shall identify the pick radius, capacities, and footprint for each crane so that the information can be laid out on the plot map to plan crane locations to meet needs.

If there will be a tower crane on the site, the Project will develop a site grid map so that specific locations for picking and landing loads can be communicated to the tower crane operator.

5.4 CRANE SCHEDULING BOARD

The Project should develop a crane scheduling board to assist with crane planning and scheduling for multiple crafts, contractors, and/or crews.

The board should include:

- Crane description, including capacity;
- Operator and rigger(s) assigned to crane;
- Major picks for each crane;

- Set up locations for each crane; and
- Craft or supervisor supported (specify time frame).

The information from the board should be provided and communicated to each affected supervisor, the crane operator(s), and assigned riggers.

6.0 CRANE TRAVEL

This section refers to moving a crane to location within the project site. It does not cover pick-and-carry operations or crane delivery activities (by the vendor).

On-site crane moves require pre-move planning. In most instances, this can be accomplished utilizing a pre-task planning process such as the Sundt Task Hazard Analysis. Standard on-site crane moves shall be conducted in accordance with manufacturer specifications (as provided for that particular make and model), under the direction and control of the Authorized Operator, and within the guidelines and recommendations established herein this Manual.

6.1 MAJOR CRANE MOVES

All Major Crane Moves shall be done under the direction and guidance of the Qualified Crane Manager or the Lift Director.

Major Crane Move criteria includes the following:

- Any move of a lattice boom truck crane;
- Any move of a crawler or rough terrain which involves unique conditions such as:
  - 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 10’;
  - 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 TRAVELING UNDER OR NEAR POWER LINES (WITHOUT LOAD)

Please reference OSHA Standard 29 CFR §1926.1411.

At a minimum, the following must be considered and implemented in the move plan when travelling cranes under or near power lines.

The following table outlines the **minimum** clearance that must be maintained when traveling without a load. The clearances in this table are only to be used for this purpose.

Minimum Power Line Clearance Distance While traveling With No Load	
Voltage (nominal kV)	**Minimum Clearance Distance (feet)**
≤ 0.75	4
Over 0.75 to 50	6

Over 50 to 345	10
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 (20') to the power line, a *trained and approved spotter* must be utilized and remain in constant contact with the operator. The spotter must understand clearance requirements, crane height, crane travel methods, and any additional information that can impact safe travel.

Specific duties of the spotter include:

- Be positioned in a location that allows accurate gauging of clearance distances;
- Be able to maintain constant communication with the operator; and
- Give timely information to the operator that will allow him/her to react in time to maintain safe clearance.

If visibility is limited due to ambient lighting, fog, etc., then additional steps shall be implemented to make lines visible.

It is a best practice to install signage, goal posts, line markers, etc. to delineate clearance level.

6.3 MANUFACTURERS GUIDELINES AND SPECIFICATIONS

The Authorized Operator shall review the Operator's Manual for any specific instructions or directions pursuant to travelling or moving the crane.

Travelling with jibs erected deserves special consideration.

Boom cylinders should not be bottomed out or have an angle greater than 40 degrees.

Contact the crane manufacturer for specific conditions not addressed in the Operator's Manual.

6.4 GROUND CONDITIONS

The path of travel shall be walked by the Authorized Operator, the Superintendent over the activity, and any assigned spotter. In the event of a Major Crane Move, the Qualified Crane Manager or designee shall also walk the path of travel.

All suspect ground conditions shall be marked, noted, and addressed in planning. Refer to the Standard Soil Bearing Capacities chart in **Section 7.5.1** for assistance in the assessment of ground conditions.

Soft ground conditions shall be corrected by compaction, or other mechanical means (steel plates or crane mats) must be utilized to ensure a stable path.

The weight of the crane shall be considered when establishing sufficient ground bearing pressure capacity.

Cutting or turning should be kept to a minimum or performed in steps when in loose soil conditions, sand, or mud since the tracks can be over-tensioned and may even break due to material build up between the sprocket and the tracks.

When working in snowy or icy conditions, it is mandatory that potential over-tensioned track situations be taken into consideration and addressed prior to the move.

6.5 UTILITIES

All utilities above ***and*** below ground level must be known prior to the crane move and documented.

Confirm location of utilities with the Project Manager or his/her designee.

Underground utilities shall be given consideration because ground bearing pressure of the crane could have a very detrimental effect on utilities that are close to the surface.

6.6 LEVEL/SLOPE OF GRADE

The level, slope and/or side slope of the crane path to be traversed must be obtained and noted prior to the move. All manufacturer recommendations or specifications pertaining to traversing a slope or grade must be known and at no time will a move be permitted if the manufacturer recommendations cannot be met.

Travel rough terrain cranes with the boom directly over the front and the swing lock engaged. If travelling in tight areas, it may be necessary to swing the boom to allow the crane to pass objects. If swinging is necessary, consult the Operator's Manual of the specific crane for slope and swing restrictions during travel. The boom should be placed back over the front and the swing lock applied as soon as the crane has passed by the obstruction.

6.7 STEEP GRADES

The manufacturer recommendations or specifications will be strictly adhered to. If a steep grade must be traversed and it is possible to make the pick with a shorter boom, the Project Manager or QCM should consider removing some boom prior to the move.

On rough terrain or truck-mounted cranes, the park brake and service brake must be checked and/or adjusted to operate as per the manufacturer specifications. Air pressure must be maintained at the manufacturer's specification. Ensure the crane is free of leaks and that the air pressure can be maintained during extended periods of brake application before attempting to move up or down a grade.

On track cranes, track pad pins and drive chains must be inspected prior to the move.

6.8 HOLD BACK SYSTEM

Contact the Group HSE Manager prior to utilizing hold back systems or equipment.

6.9 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.

6.10 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 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.

6.11 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 direct and supervise assembly/disassembly operations.

No modifications or additions shall be made to any crane or rigging equipment without written direction and approval from the manufacturer OR design and approval from a Professional Engineer.

Any Sundt employee engaged in assembly/disassembly operations shall be provided a copy of the applicable OSHA standards, 29 CFR §1926.1403-§1926.1407, to read and review.

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.

The following brakes, which must automatically set in the event of pressure loss or power failure, are required:

- A hoist brake on all hoists,
- Swing brake,
- Trolley brake, and
- Rail travel brake.

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 or other acceptable demarcation and signage at all times and controlled by the current operator, including persons performing required maintenance. If this is not feasible, special precautions must be implemented (i.e.: staging spotters around crane to protect swing radius).

The operator shall be notified of any maintenance and routine fueling operations.

While the Federal Aviation Administration (FAA) is mostly concerned with the airline industry, it also has some requirements that affect crane operations:

- The FAA shall be notified of any use of a crane over two hundred feet (200') tall. FAA form number 7461-1 shall be completed and filed thirty (30) days in advance of crane set-up and operations.
  - FAA information can be found at https://oeaaa.faa.gov/oeaaa/external/portal.jsp
- When working close to an airport, a crane shorter than two hundred feet (200') may be required to complete and file the FAA form. Contact FAA office for more information.

7.2.1 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**.

7.3 EXCAVATIONS AND UTILITIES

If a crane is set up within a distance, as measured from the location of the crane to the nearest toe of the excavation, that is equal to or less than one-and-a-half times the depth of that excavation plus three feet (3'), a geotechnical engineer shall evaluate the application and recommend any necessary actions. For example, if an excavation is ten feet (10') in depth, a crane must be set up at least eighteen feet (18') [(1.5 x 10') + 3'] from the nearest toe (bottom edge) of the excavation or a geotechnical engineer must be consulted to ensure the ground will bear the pressure of the crane and any load.

If cranes are set up equal to or further away than one-and-a-half times the depth of excavation plus three feet (3'), then a *qualified* person shall inspect the excavation face daily for sluffing or water seepage, as well as the top of the slope for tension cracks or any other signs of distress. If any distress is noted the crane should be moved and a geotechnical engineer shall be consulted.

If operating in the vicinity of underground utilities, a thorough analysis much be completed to verify the depths, types, and structural capabilities of all underground utilities. The analysis shall be

conducted by a *qualified* person with knowledge of utility capacities and impact of ground bearing pressure.

7.4 POWERLINES

It is the *intent* of Sundt that no crane be positioned in a manner that will allow any part of the crane to come within twenty feet (20') of an energized line up to 350 kV. This is established as the *minimum* limited access zone.

- All power lines will be considered energized until proven otherwise.

For voltages in excess of 350 kV, the established limited access zones are:

TABLE 7.4	
Power Line Voltage	Clearance Distance
0-350kV	20 feet
350 kV – 500 kV	25 feet
500 kV – 750 kV	35 feet
750 kV – 1000 kV	45 feet
For voltages greater than 1000 kV, the utility owner/operator or a qualified Professional Engineer can establish adequate clearance distance.	

At no time should a crane be *set up* within the limited access zones listed above unless the power lines are de-energized.

Never lift over the top of power lines.

Prior to A/D or set-up, the A/D Director or Authorized Operator shall determine if any part of the equipment, load line, or load (including rigging and lifting accessories) could get closer than 20 feet to a power line during the A/D process or standard operation.

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 denergization 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:

- Conduct a planning meeting reviewing the activity, the voltage hazard, the required written plans and permits, and required preventive measures. This meeting shall include the operator and all employees who will be in the area around the equipment.
- Use tag lines made from non-conductive material (i.e.: polypropylene rope).
- Erect and maintain elevated barricade, warning tape, or signs that are in plain view of the operator, clearly marking the line of demarcation for the limited access zone.
- Implement at least one of the following:
    - (Preferred) Utilize a limiting device that will disable or prevent certain operation functions, thereby preventing the crane from entering the limited access zone. Function limiting devices can include swing or range limiters.
    - Utilize a dedicated, *qualified* spotter, who shall remain in steady visual and/or audio contact with the crane operator. If this option is selected, the following additional requirements apply:
        - There must be visual aid in place that assists the spotter with identifying clearance distances establishing the limited access zone. Examples of a visual aids include, but are not limited to, a clearly visible line painted on the ground, a clearly visible line of stanchions, a set of clearly visible line-of-sight landmarks (such as a fence post behind the dedicated spotter and a building corner ahead of the dedicated spotter), etc.
        - Spotter must be positioned to effectively gauge clearance distances.
        - Ensure the spotter can provide direct and real-time communication to provide timely information to the operator.
    - Utilize a proximity alarm that clearly and sufficiently alerts the operator when he or she is approaching the limited access zone in a manner that will prevent encroachment.
    - An insulating link/device, as defined in § 1926.1401, installed at a point between the end of the load line (or below) and the load.
- A superintendent or designee shall be present for this activity.

The project shall ensure employees engaged in these activities are trained per OSHA Standard 29 CFR §1926.1408.

Employees performing this activity shall also be trained in the following emergency guidelines:

- If you are in the crane, stay in the crane unless fire or arcing makes it necessary for you to leave. In that case, jump clear of the crane. Do not touch the crane and the ground at the same time because electricity will flow through you.
- Avoid running or taking large steps; if you touch the ground in two places that are far enough part, electricity could flow through you. It is safer to keep your feet close together and shuffle as you move away, keeping both feet in constant contact with the ground until you've reached an area of safety.
- Everyone shall avoid touching the crane and/or the load.
- Be aware that the power may go off and come back on several times.
- If the operator can break contact with the line without pulling it down or breaking it, he/she should do so. Only one attempt shall be made to break contact with the line.
- Notify the utility company of the contact even if no one is injured. Make sure everyone stays away from the area until the utility company says it is safe to return.
- Inspect the crane thoroughly before using it again, especially the ropes.
- At least one crewmember shall be trained in CPR.

7.5 SUPPORTING SURFACE/CRANE FOUNDATION REQUIREMENTS

Crane pads shall be graded, level, compacted, and free of obstructions.

An engineered foundation plan developed by a qualified Professional Engineer is required if the following cranes or conditions exist:

- Any crane set in a ring or equipped with any capacity enhancing attachments (i.e.: a Maxer)
- Any fixed-base or rail-mounted tower crane
- Any crane with a gross capacity ≥ 400 U.S. Tons
- Any anticipated load ≥ 200 U.S. Tons
- Any crane having a main boom length ≥ 300 feet
- Any crane having a main boom plus jib total length ≥ 350 feet
- Any area that would subject to settlement or water influence
- Any crane working near or next to an excavation and set up within a distance equal to or less than the depth of the excavation
- Any crane working on a trestle

An engineered foundation plan is not necessary if any of the following conditions exist:

- The supporting surface has been mass excavated and backfilled to an engineered design; the excavation and compaction must be documented and available for review.
- The crane operation will be conducted by a designated heavy lift contractor who develops his or her own foundation plan, except that any contract must include a clause stating that Sundt has the right to accept or reject that plan.
- A *qualified* third-party engineer has provided documentation proving the soil conditions are acceptable for the anticipated loads.

If there are any doubts about the foundation meeting these requirements, an engineering evaluation and review shall be completed

Barge Operation: If operating a crane from a barge, contact the appropriate Sundt Group HSE Manager for direction.

7.5.1 Standard Soil Bearing Capacities (for reference)

TABLE 7.5.1

Soil Type	Soil Compaction	Approx. Bearing Capacities	
		PSI	PSF
Hardpan or cemented sand & gravel		135	19,400
Gravel, road base, or sand & gravel	Compact	110	15,800
	Firm	81	11,600
	Loose	54	7,700
Sand-coarse to medium	Compact	81	11,600
	Firm	60	8,600
	Loose	40	5,700
Sand-fine, silty, or with a trace of clay	Compact	54	7,700
	Firm	40	5,700
	Loose	27	3,800
Clay	Compact	54	7,700

	Firm	33	4,700
	Loose	13	1,800
Silt	Compact	40	5,700
	Firm	33	4,700
	Loose	27	3,800

7.6 LEVELING REQUIREMENTS

Cranes shall be level per the Operator's Manual.

At a minimum, cranes shall be leveled within manufacturers' tolerance using a four-foot carpenter's level or spirit level.

Cranes shall be leveled each time a crane is moved to a new position.

Cranes shall be checked for level weekly or more frequently if conditions require it.

Tower crane towers shall be plumb to the manufacturer's requirements.

REMINDER: 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.

7.7 OUTRIGGER AND PAD REQUIREMENTS

7.7.1 Outrigger Requirements

Outrigger requirements for truck cranes vary from manufacturer to manufacturer; refer to the Operator's Manual for the specific piece of equipment for proper set-up and use.

Outrigger requirements for rubber tire cranes include:

- Outrigger beams shall be extended per manufacturer guidelines and load charts.
- Outriggers shall be extended to raise the tires fully clear of the ground.
- On-rubber lifts and lifts in which the outriggers will not be fully extended fall under the Sundt criteria for a critical lift. Please refer to **Section 11.2** of this Manual.

7.7.2 Outrigger Pads

Outrigger pads shall be used under outrigger floats unless the crane is set up on an engineered foundation that has been specifically evaluated and approved for those loads and bearing areas.

The outrigger pad shall completely support the float. There shall be no gaps or spaces between the individual pieces that make up the outrigger pad.

Ensure that the outrigger pads are level and the outrigger cylinder and outrigger float are at a 90-degree angle, unless such off-level set-up is allowed by the manufacturer.

Outrigger pads shall be stable. If multiple layers of blocking are required, the stability of the blocking must be reviewed and guaranteed.

Never block directly under the outrigger beam.

Never use concrete or masonry material for blocking or cribbing.

7.7.3 Outrigger Pad Design

When designing or selecting outrigger pads (aka, blocking or cribbing), the following must be taken into consideration:

- Manufacturer requirements;
- Material used for design;
- Gross weight of load to be displaced; and
- Compaction strength and bearing pressure of ground.

Outrigger Pad Size

When determining adequate size for outrigger pad, utilize the ***Sundt Outrigger Pad Calculator***.

You must know the following to use the Calculator:

- Weight of object to be lifted
- Weight of the crane
- Weight of any rigging
- Weight of any accessories or attachments not included in the other weights
- Ground bearing capacity (GBC) of the ground under the outriggers

The QCM must approve any pads that are smaller than the nominal calculated size.

Manufacturer Requirements

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.

7.7.4 Timber/Steel Mats (Crawler Cranes)

When the ground will not support the load under a crawler crane, mats shall be used to build a surface for the crane. Consult a geo-technical engineer for guidance on mat size and structure.

When placing mats for a crane pad or travel route, the mats shall be transverse to the tracks.

If the mat design includes multiple layers, the layer directly beneath the tracks shall be transverse to the tracks. All subsequent layers must be 90 degrees to each other and in a staggered pattern.

Laminated “starter mats” shall not be used to support the crane in poor soil conditions.

8.0 OPERATING CONDITIONS

8.1 CLOSE PROXIMITY TO POWER LINES

This topic is addressed in **Section 7.4** of this Manual.

8.2 WEATHER

The Authorized Operator shall review the manufacturer's notes and instructions on weather and environmental conditions to ensure understanding on which events and conditions will impact safe equipment operation.

8.2.1 Lightning

Each Project should have a Site-Specific Inclement Weather Plan that addresses lightning alerts.

If lightning is detected within 15 miles of the project location, any active load shall be safely landed as soon as possible and the crane secured. The operator may remain with the crane until such time as lightning is detected within 10 miles of the crane's location. Reference reliable weather app or service that tracks lightning strike proximity and timing in the project area.

8.2.2 Wind Considerations

Crane manufacturers identify de-rating (capacity reduction) criteria for operation in windy conditions, usually starting at 20 mph. It is the operator's responsibility to understand the limitations of the equipment as they apply to wind speed and de-rating requirements.

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, Site Manager, or Qualified Crane Manager shall notify all operators that crane activity is suspended until further notice. Operators shall safely land loads as is feasible.

The QCM and the operator shall review the manufacturers' recommendations on operation for the cranes on site and ensure that operation in winds of thirty miles per hour (30 mph) or more are allowed and acceptable based on the loads and crane set-up. Operator shall de-rate crane in accordance with experience and any manufacturer guidelines.

Winds may be stronger at upper elevations than at ground level. When feasible, cranes should be equipped with a functioning wind speed gauge at the top end of the boom to monitor wind speeds.

- If a crane mounted wind speed gauge is not feasible, the Project shall utilize other valid options to determine wind speed at ground level and atop the boom. These options can include properly mounted weather stations or wind detection devices, use of a nationally recognized resource on current weather and wind conditions for the immediate area, or some other approved wind speed detection method.

Operators and riggers must consider the surface area of the load when factoring the effects of wind. The greater the surface area, the more impactful the wind will be on the load.

The boom length is also a factor, as the longer the boom, the greater the surface area that can be affected by wind.

Wind effects can include:

- Wind blowing on the side of the boom can reduce overall boom strength. The crane will react as if it is operating in an out-of-level condition.
- Wind blowing toward the front of the boom will work to push the boom (and load) back toward the cab, effectively acting to push the boom over backward.
- Wind blowing toward the back of the boom will push the boom and load away, increasing the load radius and possibly overloading the crane.

Wind can dramatically effect power lines, blowing them closer than expected to the crane boom, hoist line, etc., so special consideration shall be given when operating near an established limited access zone as identified in **Section 7.4** of this Manual.

8.2.3 Cold Weather Considerations

Working in extreme cold temperatures [below 5º F (-15º C)] can create additional problems, especially when there has been recent precipitation activity such as snow or rain.

Cranes shall be allowed sufficient time to warm up before hoisting and lifting activity can commence.

Components, including outriggers, tracks, and rigging can freeze and suffer damage.

Loads can freeze to the ground, impacting the perceived weight of the load until it is free.

Due to the impact of extreme cold on metal and crane components, crane capacity for critical lifts shall be de-rated by twenty-five percent (25%) when temperatures fall below 5º F (15º C). If temperatures fall below -20º F (-29ºC), the crane shall be de-rated by forty percent (40%), and all duty cycle operation is prohibited.

8.2.4 Water and Wet Conditions

Wet and muddy conditions can create a suction effect on the load to be hoisted, thereby impacting the perceived weight of the load during the initial hoist. Operator shall use a slow, steady pull to lift the load, paying special attention to the registering weight on any load indicating device. The operator and all involved persons must also be aware of the effect when the load breaks free of the suction. The load can swing or even bounce, so care should be taken to maintain a safe clearance from the load itself.

Water can drastically increase the weight of a load if allowed to accumulate and gather atop the load or in crevices, corners, etc. the operator shall note any excess water accumulation and either ensure the water is removed or amend calculations concerning the load weight.

Wet conditions can also affect clutches and brakes, so a thorough pre-lift functional evaluation is important.

8.3 SIDE LOADING

Side loading results when any force pushes or pulls on the boom from the side, rather than from directly in front of the boom.

Side loading on the boom shall be limited to the amount caused by a freely suspended load.

If a freely suspended load can create consistent and relevant side loading, the crane capacity shall be reduced accordingly.

- **NOTE:** Neither OSHA, ANSI, nor most manufacturers provide a de-rating formula or specific criteria, so the operator must make this judgment based on his or her experience, training, and education.

Pulling or dragging a load sideways is specifically prohibited.

8.4 DUTY CYCLE OPERATIONS

Duty cycle operations include concrete placement, work involving clam buckets, drag lines, and magnets, and steel erection activities wherein the hoisting operations are fast-paced and involve repeating the path and movements over and over.

Standard load charts do not cover duty cycle work, therefore the capacity of the crane shall be reduced according to the manufacturer's recommendations. Operators shall note that duty cycle reductions are not uniform for every crane.

8.5 DYNAMIC LOADING

Crane capacities are determined based on static loads (i.e.: loads that are not moving). Every time a crane is hoisting a load, it is considered dynamic due to the hoisting, starting, stopping, and swinging motions, so the operator must consider this when calculating the capacity of the crane at set-up.

Dynamic loading is increased by the rate at which a load is stopped or started, the weight of the load, and the operating speed. The greater the load weight and/or the speed of operation, the greater the dynamic forces on the crane.

9.0 INSPECTIONS

All completed crane inspections shall be maintained on the project and separated by specific crane for ease of recall and reference.

All safety and functional devices shall be in good condition and proper working order prior to operation.

The Operator's Manual shall be available in the crane cab at all times while the crane is in operation.

The following inspections shall be conducted in accordance with OSHA Standard 29 CFR §1926.1412.

Subcontractors shall be responsible for meeting or exceeding these inspection requirements.

9.1 PRE-INSPECTION (TOWER CRANE)

Before each crane component is erected, it must be inspected by a *qualified* person for damage or excessive wear. This qualified person will be determined by the crane vendor.

The qualified person must pay particular attention to components that will be difficult to inspect thoroughly during shift inspections.

If the qualified person determines that a component is damaged or worn to the extent that it would create a safety hazard if used on the crane, that component must not be erected on the crane unless it is repaired and, upon reinspection by the qualified person, found to no longer create a safety hazard.

If the qualified person determines that, though not presently a safety hazard, the component needs to be monitored, the employer must ensure that the component is checked in the monthly inspections.

Any such determination must be documented, and the documentation must be available to any individual who conducts a monthly inspection.

9.2 THIRD PARTY ON-HIRE/ASSEMBLY INSPECTION

Post assembly and prior to being placed into service on site, a third-party inspection is required for all mobile and tower cranes with a rated capacity greater than five tons. This inspection is valid for the duration the crane is assigned to the project, provided all other required inspections are maintained.

This inspection is the responsibility of the crane owner/vendor.

- The Sundt Qualified Crane Manager or Project Manager shall verify the On-Hire inspection has been completed and obtain a copy of the documented inspection for retention with other inspections performed for that crane.

This inspection will be conducted in accordance with OSHA 1926.1412 and 1926.1412(f) (Annual/Comprehensive) after erection and prior to the commencement of hoisting operations.

The third-party inspection cannot be performed or certified by the entity that controls the crane, the vendor or leasing agent, the crane manufacturer, or any individual having a direct or financial interest in the condition of the equipment.

Each certification of a mobile or tower crane shall include examination and testing of the crane structure and its parts as required pursuant to OSHA 1926 Subpart CC, as well as the latest version of ASME B30.3 and B30.5, and manufacturer specifications.

Unless required by the State or other authority having jurisdiction, a load test is not required.

Any deficiencies noted must be corrected and re-inspected prior to any hoisting operations.

Deficiencies which do not require mandatory corrective action or are identified as recommendations for service must be disclosed to Sundt. Sundt will be the sole arbiter regarding the severity of the recommendation and determine if hoisting operations are permitted.

Third party inspection shall be assessed based on any established lift plans to ensure counterweight and set-up is acceptable.

9.2.1 Tower Cranes

Third-party tower cranes inspection will be conducted in accordance with OSHA 1926.1412 and the supplemental requirements of OSHA 1926.1435(f)(3) prior to the commencement of operations.

- A load test using certified weights, or scaled weights using a certified scale with a current certificate of calibration, must be conducted after each erection.
- The load test must be conducted in accordance with the manufacturer's instructions when available. Where these instructions are unavailable, the test must be conducted in accordance with written load test procedures developed by a registered professional engineer familiar with the type of equipment involved.

When a fixed tower crane is relocated to a new position on the same project a new inspection is required.

- This requirement does not apply to the climbing of the tower crane in a fixed location.

9.2.2 Exceptions

A third-party crane inspection may be waived for mobile cranes brought in to perform a specialty (one time) pick, provided the following criteria are met:

- The appropriate Group Operations Manager provides written authorization (via email is acceptable); and
- The Lift Plan is reviewed and approved by the Project Director and the Group HSE Manager.

A third-party inspection is not required for any crane that has undergone and passed the annual inspection process outlined in **Section 9.6** of this Manual within the 30-day period preceding mobilization provided the following conditions are met:

- 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**.

A third-party inspection is not required for any crane that has successfully passed the initial third-party inspection for operation on a Sunt 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 inspection by the A/D Director and appropriate QCM to ensure the crane has been repaired, adjusted, or modified in accordance with the manufacturer's requirements and recommendations.

The inspection must include functional testing of the repaired, adjusted, or modified part/component.

If the crane vendor does not provide a form or document for this inspection, the appropriate QCM may utilize the ***Sundt Comprehensive Crane Inspection Form***, as it is designed for on-hire, off-hire, post-assembly, and monthly inspections. Subcontractors may use their in-house inspection form providing it is comparable in scope to the Sundt Comprehensive Crane Inspection Form.

9.3.1 Structural repairs to Crane or Hoisting Device

When repairs are made to any structural steel members of a crane or hoisting equipment on the project, including but not limited to any welding on the boom, gantry, or mast, the following applies:

- The advice of the crane manufacturers must be received, and approval received before such work is carried out.
- Welding procedures must be obtained or approved by the manufacturer of the equipment.
- The approved repairs must be inspected by a qualified welding inspector and the crane subjected to a load test prior to hoisting operations

9.4 DAILY PRE-USE INSPECTIONS

In accordance with OSHA 29 CFR 1926.1412(d), the operator shall inspect the crane before the start of use for each shift of operation. 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.

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.

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
- 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 of the tower crane up or, if the crane is tied to or braced by the structure, those above the upper-most brace support.
- The upper-most tie-in, braces, floor supports and floor wedges where the tower crane is supported by the structure, for loose or dislodged components.

9.6 ANNUAL/COMPREHENSIVE INSPECTIONS

It is the responsibility of the crane owner/vendor to ensure annual inspections are performed as required and in accordance with OSHA Standard 29 CFR §1926.1412(f).

Additional inspections may be required by state regulation or authority.

The appropriate QCM or Authorized Operator shall verify the annual inspection(s) has been completed and obtain a copy of the documented inspection for retention with other inspections performed for that crane.

9.6.1 Tower Cranes

In addition to the standard annual inspection criteria for all cranes, the turntable and tower bolts on a tower crane shall be inspected for condition and torque.

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 work station 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, Sundt requires fall protection when exposed to falls of six feet (6') or greater during these operations.

10.4 FALL PROTECTION DURING INSPECTIONS

Based on §1926.1423(e)(2), normal daily and monthly inspection requirements, including fluid checks, line and hose inspections, etc., would not require fall protection as those activities are performed from the deck of the crane, however, Sundt requires that every effort be made to eliminate fall hazards.

All inspections performed on a Sundt project shall be evaluated for fall potential, and appropriate actions shall be taken to prevent falls from heights in excess of six feet (6').

Fall prevention and/or protection exposure during inspection and maintenance activities is dependent on the crane make and model, so operators must address this hazard through the pre-task planning process.

The boom, including lattice components, should be considered an adequate anchor point.

At the end of shift, crane bodies should be turned so as to increase the actual access area and working area for the person conducting the inspection the next shift. In most instances, outriggers must be deployed for this to occur.

11.0 OPERATIONS

The ***Operator*** has the final say on all lifts, and ultimate responsibility for the safety of personnel in the area, the equipment, and the load. He or she has full authority to stop the lift and refuse to handle loads until a *qualified* person has determined that safety has been assured.

All manufacturer instructions and procedures shall be followed.

11.1 DAILY LIFT PLAN (GENERAL LIFT)

It is the responsibility of the operator to ensure adequate planning has been undertaken based on the equipment, material to be lifted, load weight and configuration, location of lift, and several other determining factors.

A general lift is any lift that does not meet the criteria of a critical lift as identified in **Section 11.2** of this Manual.

A daily lift plan for general lifts shall be completed when the crane is first set up to pick/hoist a load. If the crane is to be set up in the same location and lift situation for multiple lifts, then the operator shall complete the daily lift plan for the highest capacity lift expected as based on load weight and radius.

If the crane is repositioned OR required to lift an unexpected load that is heavier or at a longer radius than is addressed in the original daily lift plan, then a new daily lift plan must be completed.

The operator shall utilize the ***Sundt Daily Lift Plan*** or other comparable and Group approved lift plan for general lift planning.

The following are basic elements that must be considered for all lifts:

- Weight of the load
- Radius of lift
- Crane capacity
- 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:

- Any lift in excess of seventy-five percent (75%) of the crane's capacity at the configuration and set-up;
  - Any lift in excess of 90% of the crane's capacity at configuration and set-up requires a plan approved and stamped by a third-party Professional Engineer (PE), as well as the approval of the appropriate Sundt Group HSE Manager.
  - **NOTE: This specific critical lift criteria does not apply to tower cranes.**
- Any lift involving multiple cranes or a single crane and any other piece of mobile equipment; plan must be approved and stamped by a third-party PE.
  - EXCEPTION 1: A simple, straight up and down hoist pick involving two cranes that are attached to engineered lift points (anchors, lifting lugs, engineered pad eyes, etc.) and does not include additional rigging, sling angles in excess of 60 degrees, or rotating or traveling of load. To clarify, this is a pick where the only required activity is the hoisting and/or booming up and down of the load by each crane such as the simple loading or unloading of material from a truck, flatbed, etc., or the simple standing of a vessel that does not require the load to be swung while multiple cranes are attached. However, the established critical lift plan must be reviewed and approved by the applicable Group HSE Manager.
    - This exception to the PE requirement cannot include any other critical lift criteria (e.g.: weight in excess of 100,000 lbs., on-rubber, pick and carry operations, lifts over process areas, etc.).
  - EXCEPTION 2: The standard dual crane hoisting and setting of pre-cast girders with engineered anchor points, including cast in-place lifting lugs, as performed by the Transportation and Concrete Groups, even if the pick involves swinging the boom or minor walking of the load by the cranes involved. However, the established critical lift plan must be reviewed and approved by the appropriate Group HSE Manager.
  - The use of more than two pieces of mobile equipment for a single lift also requires the approval of the appropriate Sundt Group HSE Manager.

- Any lift in which the crane's outriggers cannot be fully extended or the 360º load chart cannot be utilized;
    - On-rubber lifting requires the approval of the appropriate Sundt Group HSE Manager, except for that equipment designed *specifically* for on-rubber lifting.
- 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***, and must be approved by the appropriate Sundt Group VP of Operations and the Group HSE Manager.
- Any lift involving the use of a personnel platform (manbasket);
    - Use of a personnel platform requires completion of the ***Sundt Personnel Platform Lift Plan & Authorization Form*** and the ***Sundt Personnel Platform Inspection & Pre-Lift Checklist***.
- Any lift over a processing area (functioning facility) or personnel, including the general public;
    - Any lift that will be flown over active process areas requires approval of the Sundt Project Manager;
    - Any lift over the general public requires the approval of the appropriate Sundt Group VP of Operations and the Group HSE Manager.
- Any project-specific critical lift criteria not covered here.

11.3 VERIFYING LOAD WEIGHT

It is the responsibility of the operator to know and verify the weight of all loads to be lifted. This is an absolute

The following may be used to verify the weight of a load. This list is not all inclusive.

- Bills of lading that accompany shipped loads and equipment.
- Loads weighed by a certified scale, such as those at weigh stations.
- Shop drawings.
- Catalogs or manufacturer provided information.
- Date plates provided with/attached to load crates and skids.
- The Load Moment Indicator (LMI), if properly calibrated and programmed. Note: LMI's shall not be used as a final determination of load weight.
- Structural steel shapes, pipes, and other standard materials may have a weight per lineal foot that can be used to calculate the load weight.

11.4 BOOM LENGTH AND RADIUS

The operator is responsible for determining the proper boom length and applicable load radius for each load to be lifted.

While the range diagram accompanying the crane should be adequate for determining load radius based on boom configurations, the load radius for any critical lift must be verified using a tape measure or other accurate measuring device.

11.5 BOOM CONTACT

Contact involving the boom and any object, including the load, in a working operation has the potential to collapse the boom.

In the event of contact, the load must be lowered and the boom inspected by a qualified person representing the vendor or manufacturer. If there is any sign of damage, the crane must be evaluated, repairs made, and inspection performed in accordance with **Section 9.2** of this Manual.

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.

A Lift Director shall be assigned to oversee the lift.

The Signalperson shall not relay crane signals through one or more additional signal persons.

ANSI B30.5 standard shall govern all voice communications. All directions to the operator by the signalperson shall be given from the operator's direction perspective. Specifically, "right" shall refer to the operator's right, "left" to the operator's left, etc.

Each voice signal/directive shall include three elements provided in the following order:

- Function and direction
- Distance and/or speed
- Function stop
- Example 1: Swing right 20'…10'…5', 4', 3', 2', 1', Stop
- Example 2: Hoist down slowly, slowly, slowly, Stop

The path the lift will travel shall be reviewed by the Lift Director, assigned signalperson, and Authorized Operator. Any potential for rigging snags or load contact with structural components shall be addressed, and a plan shall be in place to minimize the potential

Spotters shall be used any time a snag or contact hazard exists during blind lifting operations. They shall be positioned away from any potential “line of fire” hazard due to a snag or contact.

Spotters shall have direct line of site communication or radio contact with the operator.

Spotters shall be instructed to give no hand or voice communication to the operator except for a “stop” signal.

When multiple part rigging is used during blind lifts, each connection point shall be evaluated for, and protected against, snagging.

No personnel are to work directly under a blind load. Every effort must be made to avoid placing personnel in a “line-of-fire” situation during blind lifts.

11.8 PICK AND CARRY OPERATIONS

Pick and carry operations on rubber shall be avoided whenever possible. If an alternate way is not possible, a critical lift plan shall be developed for the activity.

- EXCEPTION: If the equipment is specifically designed for picking and carrying on rubber, such as a carry deck crane, the lift shall not require a critical lift plan unless other critical lift criteria are met. The operator shall bear responsibility for the safety of the pick and carry activity.

Per ANSI B30.5, the Sundt QCM shall assign a Lift Director for any pick and carry operation. This person is responsible for making decisions about crane ratings, load position, boom location, ground support, travel route, and speed of movement.

The operator shall refer to the Operator’s Manual and any manufacturer directives for determining if pick and carry is allowable with the specific make and model of crane to be used.

The boom should be centered over the front for a rough terrain cranes over the rear for a truck mounted crane, and over the idler for a crawler. In each case, the boom should be in line with the direction of travel.

If possible, direction of travel should be toward the load. Whether traveling toward the load or with the load trailing, be aware that load swing can impact load radius and affect the stability of the crane, especially on rubber tires.

Jibs, extensions, and power pin sections should be stowed and not in use. Refer to manufacturer guidelines for specific direction.

The surface to be traveled shall be level and compact.

Maximum speed is usually specified by the manufacturer, so check the manufacturer guidelines for direction.

Unless the manufacturer specifies otherwise, engage the swing brake and house lock.

Keep the boom as retracted and low as possible, and the load as close to the crane as feasible. Secure the load to the lower works if safe to do so.

Outriggers should be extended, with floats attached and jacks extended just enough to safely clear the ground or supporting surface.

11.9 TAG LINES AND LOAD CONTROL

Tag lines are required on loads, including those lifted by other mobile equipment or mechanical hoisting equipment [base mounted hoists (tuggers), overhead electrical hoists, chainfalls, etc.] unless 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 accidently 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, that will stop the crane's ability to hoist up, boom down, or extend the boom when activated.

NOTE: Duty Cycle (dragline, clamshell, scrap magnet) and foundation (pile driving, drilling, drilled shafts, and tie-backs) operations are not considered lift crane operations.

11.11 PERSONNEL PLATFORM (MANBASKET) OPERATIONS

The use of equipment to hoist personnel is prohibited except where a project demonstrates that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous or is not possible due to the project's structural design or worksite conditions.

Refer to §1926.1431 for additional regulations pertaining to hoisting personnel, including hoisting personnel in drill shafts, for pile driving operations, and for marine transfer operations.

Use of a personnel lift platform is considered a critical lift and requires completion of the ***Sundt Personnel Platform Lift Plan & Authorization Form*** and the ***Sundt Personnel Platform Inspection & Pre-Lift Checklist***.

The QCM or his or her qualified designee shall serve as the Personnel Lift Authorizer.

The Platform Inspector shall be the QCM or a Qualified Rigger who has completed the NCCER Intermediate Rigging certification and is designated by the QCM.

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 brakes, swing brakes, and operator actuated secondary braking and locking features or automatic secondary brakes must be engaged.

Crane must have a boom angle indicator (readily visible to the operator) and boom hoist limiting device in place and operational.

Equipment with a luffing jib must have a jib angle indicator (readily visible to the operator) and jib hoist limiting device in place and operational.

Equipment with a telescoping boom must be equipped with a device that clearly indicates to the operator the boom's extended length or must have measuring marks on the boom.

The crane must have an operational ant-two block device in place anywhere two-blocking could occur.

The load line hoist drum must have a system, other than the load line hoist brake, that regulates the lowering rate of speed of the hoist mechanism. This system must be utilized when hoisting personnel.

Free fall of the load line is prohibited. The use of equipment in which the boom hoist mechanism can free fall is also prohibited.

Direct attachment of the personnel platform to a luffing jib is prohibited.

11.11.2 Personnel Platform Criteria

The personnel platform must be designed by a professional engineer qualified in structural design.

The welding of the platform and components must be performed by a certified welder familiar with weld grades and materials used in the construction of the personnel platform.

The weight of the personnel platform and its rated capacity must be conspicuously posted on the platform with a plate or other permanent marking.

The system used to connect the platform to the crane must allow the basket to remain within ten degrees (10°) of level regardless of the boom angle.

The suspension system must be designed to minimize tipping of the platform due to movement of the occupants.

The personnel platform must be capable of supporting its own weight and at least five times the maximum intended load. This is excluding the guardrail system and any personal fall arrest system anchorage points.

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 (½").

Personal fall arrest system attachment points must meet anchorage requirements found in §1926 Subpart M.

A grab rail must be installed around the inside perimeter of the personnel platform, except at the access gate/door.

Access gates/doors, if installed, must not swing outward, and must have a device that prevents accidental opening.

Headroom must be sufficient to allow occupants to stand upright.

If exposed to falling objects, overhead protection must be in place. It cannot obscure the view of the operator or occupants unless full coverage protection is necessary.

All exposed edges shall be smooth enough to prevent injury.

11.11.3 Platform Loading and Use

Do not exceed the capacity of the personnel platform.

Personnel platform must only be used to hoist personnel, tools, and necessary materials. It shall not be used to hoist materials when not hoisting personnel.

Materials and tools must be secured to prevent displacement, and evenly distributed within the platform while suspended.

The number of occupants must not exceed the number the personnel platform was designed to hold, and no unnecessary employees are allowed in the basket.

11.11.4 Attachment and Rigging

Hooks used to connect the hoist line to the platform, including those on load blocks, balls, bridle slings, etc., must be the type that can be closed and locked, including when attached.

Shackles used must be alloy anchor type with either a bolt, nut, and retaining pin in place OR with a screw pin that can be secured from accidental removal.

Any other detachable devices shall be of the type than can be closed and locked in the same fashion as those listed above.

If a rope bridle is used to suspend the personnel platform, each bridle leg must be connected to a master link or shackle in a manner that ensures the load is evenly divided among the bridle legs.

Rigging hardware and hooks must be capable of supporting, without failure, at least five times the maximum intended load applied to that particular component. Where rotation resistant rope is used, the sling must be capable of supporting, without failure, at least ten times (10x) the maximum intended load.

Eyes in wire rope slings must be fabricated using thimbles.

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 least five (5) minutes with the test load evenly distributed in the basket. The load test can be performed concurrently with the trial lift as described in **Section 11.11.6**.

After proof testing, the designated competent person must inspect the personnel platform and rigging for defects. If any are found, they shall be corrected and the proof test must be repeated. This process continues until the designated competent person determines the proof test has been passed. Only then can trail lifts and personnel hoisting be performed.

11.11.6 Trial Lift and Inspection

A trial lift with the unoccupied platform must be made from the location where the employees are expected to enter the basket to each location at which the platform is to be hoisted and positioned. If there will be multiple lifts made to various positions, then trial lifts must be made to each location. If the lift sequence involves going from elevated location to elevated location without returning to the original launching point, then the trial lift can follow that same pattern.

The trial lift must be performed immediately prior to each shift in which employees will be hoisted using the personnel platform.

An additional trial lift must be made every time the crane is moved, repositioned, or relocated before personnel will be allowed to be hoisted in the basket. This requirement includes returning to a previously utilized set-up location.

An additional trial lift must be performed if the lift route is changed, unless a competent person determines that the new lift route presents no new factors that could affect safety.

The designated competent person for trial lift and inspection activities shall ensure that:

- Required safety devices and operational aids are in place and functioning properly;
- Nothing interferes with the equipment or personnel platform during the course of the trial lift;
- The lift will not exceed fifty percent (50%) of the crane's rated capacity at any time during the lift; and
- The load radius to be used during the lift has been accurately determined.

Immediately following the trial lift, the designated competent person shall:

- Conduct a visual inspection of the equipment, base support or ground, and the personnel platform to determine if the trial lift has exposed any defect or problem, or produced and adverse effect; and
- Confirm the test weight has been removed upon completion of the trial lift.

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);
- Multiple part lines are not twisted around each other;
- The primary attachment is centered above the personnel platform; and
- If the load rope is slack, the hoisting system must be inspected to ensure ropes are properly seated on drums and in sheaves.

Any condition found during the trial lift and subsequent inspections that compromises safety or does not meet the requirements of this manual and/or §1926.1431 must be corrected before hoisting personnel.

11.11.7 Work Practices and Safety Considerations

Hoisting of the personnel platform must be performed in a slow, controlled manner.

Basket occupants must:

- Keep all body parts inside the platform during raising, lowering, and horizontal movement;
  - This does not apply when positioning the basket or acting as a signal person.
- Not stand, sit, or work from the toprail, midrail, or toe board, or use any other device (box, ladder, material, etc.) to increase their height inside the basket; and
- Not pull the personnel platform out of plumb in relation to the hoisting equipment.

Before employees can enter or exit a suspended platform, the platform must be secured to the structure where the work is to be performed, unless the designated competent person determines that securing the platform would create a greater hazard.

If the personnel platform is secured to a structure, the operator cannot move the load until he or she receives confirmation that the platform has been released.

Tag lines should be utilized when necessary and feasible to control the personnel platform.

When wind speed exceeds twenty miles per hour (20 mph), either sustained or in gusts, the personnel hoisting process shall be terminated.

If there is other inclement weather, the Sundt QCM shall determine if it is safe to continue with personnel hoisting activities. If it is not safe, activities will be terminated.

Employees being hoisted must remain in direct contact with the operator or signalperson as applicable.

When inside the basket, occupants shall utilize a personal fall arrest system anchored to established anchor points inside the platform that meet §1926.502.

- If working over or near water, the requirements of §1926.106 apply.

No other loads may be lifted by the crane while it is hoisting the personnel platform.

Cranes shall not be traveled while hoisting personnel.

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 hoisted, the person responsible for the work being performed, the Sundt Project HSE Manager, and the Sundt QCM.

The meeting must be held prior to the trial lift at each new location, and any time an employee is newly assigned to the operation.

The meeting shall be documented using the ***Sundt Suspended Personnel Platform Checklist***.

11.12 USE OF PERSONNEL BASKET FOR EMERGENCY OPERATIONS

Sundt realizes that it may be necessary to utilize a personnel basket for emergency response. Consult your Group HSE Manager for initial approval.

Use of a personnel basket for this purpose must be addressed in the Work Package JHA and the Project's Written Crane Plan.

If the crane with a personnel basket is the *primary AND sole* source of rescue, then that crane must be on stand-by and not utilized for any other purpose while the employee(s) are working in the hazardous situation or area.

11.12.1 Mobile Cranes

If the Group HSE Manager has approved the use of a personnel basket with a mobile crane for emergency response, all the pre-lift and testing requirements described in **Section 11.11** shall be mandatory. Forms will be completed daily as required.

11.12.2 Tower Cranes

Due to the nature and configuration of tower cranes, the following exceptions to the standard requirements prescribed in **Sections 11.11.5-11.11.8** shall apply:

- A Critical Lift Permit and plan shall be developed and stand for the duration of the use of the personnel basket. The permit shall be placed/secured in the basket.
- A trial lift shall be performed during the first shift of each work week.
  - This trial lift shall be performed with the proof-test weights and include travel and placement at every location the personnel basket may be used for response.
  - The trial lift (date/time) shall be documented on a sheet that is kept with the basket/permit.
  - All rigging and components shall be inspected by the QCM or a Qualified Rigger as identified in **Section 11.11** prior to this trial lift.
  - A pre-lift meeting shall be held prior to this trial lift and include any personnel expected to be involved in an emergency response scenario.

11.13 SPECIAL OPERATIONS

Includes the following:

- Clamshell operation

- 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.
- Option 2: An established Sundt qualified evaluator as approved by the Sundt Crane and Rigging Committee.

12.2 HAND SIGNALS

OSHA has established standard hand signals in OSHA 1926, Subpart CC, Appendix A. A chart of those signals is included in the **Forms Section 17.2** of this Manual.

Hand signals shall only be used when visibility between the operator and signalperson is good enough that the signals can be recognized and produce the desired response. Signalpersons shall make themselves and their hands easily recognizable by operators.

If gloves are worn, they should not blend in with the background.

The signalperson shall also be positioned where he/she will be visible to the operator at all times when the load is moving. The best position is one the operator can see when looking out the front window, rather than a side window. The operator should never have to lean out the door or window to see the signalperson.

Non-standard hand signals may be used if the intended operation or function is not covered by the standard hand signals. If non-standard signals are to be utilized, the operator(s), signalperson(s), and any Lift Director must agree to the signals to be utilized and their meaning.

If the operator is unable to see or understand the signals as they are being communicated, he or she shall safely cease operation until adequate communication or visibility has been re-established.

If the operator becomes aware of a safety problem or concern, he or she shall safely cease operations. Operations shall not be re-established until both the operator and signalperson are in agreement that the problem has been resolved.

Only one person shall be assigned to give hand signals to the operator. The operator shall ignore other signalpersons EXCEPT that any employee can utilize the “STOP” or “EMERGENCY STOP” signal to alert the operator, and the operator must halt operation.

When one signalperson is providing signaling for more than one piece of equipment, the operators and signalperson must establish a system by which the signalperson can effectively communicate to which equipment he or she is signaling. Prior to giving the function/direction, the signalperson shall indicate which crane the forthcoming signal is for.

12.3 VOICE (RADIO) SIGNALING

A radio used to allow the signalperson to communicate with the operator shall be programmed to a dedicated channel, with no chance of outside interference.

The radio(s) shall be tested beforehand to ensure battery life and functionality.

While the load is being hoisted, the signalperson must maintain constant contact by keeping the microphone keyed until such time as the load is landed or operation is suspended or halted.

The radio must allow the operator hands free reception of the communication.

If communication is lost, the operator shall safely cease operation until communication has been re-established.

Each voice signal/directive shall include three elements provided in the following order:

- Function and direction
- Distance and/or speed
- Function stop

Example 1: Swing right 20’…10’…5’, 4’, 3’, 2’, 1’, Stop

Example 2: Hoist down slowly, slowly, slowly, Stop

Operator and signalperson shall meet beforehand to agree to language and voice signals to be utilized.

12.4 COMMUNICATION PROTOCOLS

12.4.1 From Signalperson to Crane

- Assigned signalperson and operator shall be on a dedicated channel.
- Operator shall take signals and direction from assigned signalperson only for standard operation.
- Signalperson shall identify himself or herself when initiating contact at the start of a pick.
- Operator will verbally confirm any direction or signal that is unclear or in direct contrast to an immediately prior signal (example: receiving any direction to move or engage the crane following a previous direction to hold the crane or the load).

12.4.2 From Crane to Crane:

- Any time a crane will be entering the immediate area of another crane with any part of the crane or load, the operator entering the area will communicate directly with the affected operator(s) via a dedicated crane-to-crane radio or channel.
- The communicated information shall include the specific area and expected duration of encroachment.
- At the conclusion of the activity and upon leaving the area, the operator will notify the affected operator(s) via the same dedicated channel.

12.4.3 From Others:

- Operator will take “all stop” or “emergency stop” directions from anyone.
- Operator will only take *operational directions* from the assigned signalperson.

12.4.4 Lockout/Hold and Release:

- Only an assigned signalperson can direct the operator to lock out/hold the crane, and only that same assigned signalperson may release the hold.
- The signalperson shall identify himself or herself when giving direction to lock out/hold and subsequently release the crane.
- The operator shall only take lockout/hold and release direction when the assigned signal person properly identifies himself or herself.

13.0 RIGGING

13.1 QUALIFICATION AND AUTHORIZATION

At this time, rigger *qualification* is based on successful completion of the Sundt Qualified Rigger training or certification from the NCCER, NCCCO, or other Sundt Crane Committee approved rigging course.

Authorization to perform specific duties and responsibilities is determined by the QCM or assigned Superintendent and shall be approved by the applicable Group HSE Manager.

Authorization shall be based on completion of the above qualification process, any certifications held by the employee, and the specific experience of the employee in performing rigging activity. No

employee shall be assigned to rig for a crane without approval from the QCM or assigned Superintendent.

13.1.1 Subcontractors

Subcontractors are responsible for qualifying and authorization of their employees to perform rigging activities. Sundt reserves the right to assess a subcontractor's qualification and authorization process for compliance with the minimum criteria established herein this Manual.

13.2 RIGGING EQUIPMENT AND MATERIALS

All rigging equipment and materials shall meet all applicable ANSI/ASME standards.

The use of rigging material and equipment manufactured in China is prohibited.

It is highly recommended that any wire rope slings be manufactured from wire rope with an Independent Wire Rope Core (IWRC) due to its increased strength, durability, and resistance to heat damage.

All wire rope slings must have Flemish eyes with steel swage sleeves.

All slings and rigging equipment must be tagged or stamped with capacities.

All rigging material should be stored in a location that will prevent exposure to the environment and elements. It is highly recommended that equipment be stored on hooks or racks to prevent damage.

Do not leave rigging material and equipment in work area when task is complete. It should be removed and sored properly.

Do not store synthetic rigging equipment in locations such as a gang box where other equipment that presents a cut hazard is placed atop the synthetic rigging.

13.2.1 Use of Chains for Rigging

Due to difficulties in rigging and inspection, the use of chain slings is prohibited unless specifically mandated by an equipment vendor or engineered critical lift plan, or approved by a Sundt QCM.

Chain slings shall be inspected weekly by a competent person with a caliper or other measuring device to accurately determine presence of wear.

A chain sling shall not be tied back into itself in a knotted configuration.

13.3 LIFTING/RIGGING EQUIPMENT INSPECTION

All inspections shall be conducted by a Qualified Rigger as determined in **Section 13.1**.

Rigging shall be inspected:

- Upon purchase and before first each use; and
- Quarterly, indicated by color coding.

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.

13.3.1 Replacement Criteria for Slings

- Wire Rope Slings
  - Ten randomly distributed broken wires in one rope lay.
  - Five broken wires in one strand in one rope lay.
  - Kinking
  - Bird caging
  - Crushing
  - Damage to rope structure
  - Evidence of heat damage
  - Corrosion
  - Missing or illegible sling identification or capacity information.

- Nylon/Web Slings
  - Holes, tears, cuts, abrasive wear, or snags
  - Crushing
  - Acid or caustic burns
  - Melting or charring of any part of the sling
  - Knots
  - Evidence of cling overloading
  - Broken or worn stitching in load bearing splices
  - Discoloration and stiff or brittle areas (could indicate chemical or ultraviolet/sunlight damage)
  - Any fitting that is damaged, pitted, gouged, bent, twisted, or broken
  - Missing or illegible sling identification

- Synthetic Endless Round Slings
  - Holes, tears, cuts, abrasive wear, or snags that expose the core yarns
  - Exposure to chemicals, including acid or caustic burns
  - Evidence of sling overloading
  - Knots
  - Missing or illegible tags
  - Evidence of heat damage, including burns and weld spatter
  - Any evidence of potential damage to inner core yarns

- Chains

  Any time wear in any link exceeds the allowable limits identified in this table, the assembly shall be removed from service:

Chain Size (Inches)	Maximum Allowable Wear (Inch)
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 to links.
  - Any locking mechanisms such as found on a come-a-long or mechanical winch shall be in good working order.
  - A chainfall/chain hoist shall hold its load unless acted upon by adjusting the operating chain/rope.
  - The hook latch must be in place and prevent attached rigging from accidently slipping out of the hook.
  - Hook structure shall be inspected per the criteria established below under “Hooks”.
  - Mechanical lifting devices should be tested quarterly using a dynamometer to verify capacity and integrity of operation.
  - A designated competent person, as determined by the manufacturer, shall perform a thorough inspection of the equipment annually. If equipment has been subjected to severe usage, then these inspections should be performed quarterly.
  - Chains shall be kept in good condition and mechanical inner components properly oiled and serviced. Contact vendor for assistance.
  - When stored, it’s strongly recommended that chains be stored in buckets and oiled to prevent corrosion.

- Shackles and other hardware.
  - Do not paint hardware unless it is brand new.
  - Remove from service if there is excessive wear (consult ANSI/ASME standards for specific criteria).
    - Specifically for shackles, a 10% reduction in the original dimension anywhere in the body or pin requires removal from service.
  - Must have legible information including manufacturer identification and capacity.
  - Remove from service if there are any cracks, gouges, or nicks.
  - Shackle pins should insert smoothly without forcing.
  - Remove hardware that is malformed, bent, spread, etc.
  - Remove from service if there is evidence of heating, bending, or welding.
  - Remove from service if the hardware does not function properly, including:
    - 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,
    - ASMEC BTH-1 Service Class,
    - Any warning labels required (dangers of overloading, using damaged devices, lifting over personnel, etc.).

13.4 RIGGING OPERATIONS

The rated capacity of rigging equipment shall never be exceeded.

Rigging shall be selected based on the maximum potentially imposed weight to be applied, intended rigging configuration, time period of intended use, and how each piece fits with other rigging equipment to be utilized during the lift or load suspension.

Always err on the side of caution when selecting required capacity to ensure the rigging will withstand any potential load imposed upon it. Consideration should not be given to any safety factors built into the rigging equipment when determining capacity.

Select rigging equipment designed for the intended use. For example, chain hoists (manual, pneumatic, electrical) are designed for vertical application and not for supporting or applying loads at an angle. A come-a-long is better suited for positioning at angles.

Rigging equipment should fit comfortably together without creating added pinch points or stresses. Shackles used to connect web slings shall be so designed and large enough that the sling material can lay flat without bunching or pinching.

- Synthetic endless round slings have a minimum hardware and sling spread requirements. Refer to manufacturers' instructions for minimum hardware requirements.

Slings, including wire rope, shall be protected from damage from sharp edges by use of softeners adequate to prevent the damage. The softener selected should be adequate based on the edge and the rigging. For example, specifically designed softeners or softeners made of nylon are better suited for wire rope rigging than softeners made of less sturdy or soft materials such as hoses or carpet.

Wire rope slings shall be utilized with all structural steel beams and heavier steel members.

- NOTE: If using a single wire rope choker in a choke configuration around steel, consideration shall be given to eliminating the use of a softener if doing so would ensure an adequate "bite" on the steel and eliminate the chance for slippage.

At no point will the hook of a rigging device be attached back to the live line of the device.

When installing wedge sockets, ensure the live end of the rope, the straight side of the socket, and the pinhole all line up.

Any time a load is required to be stationary in a landed position for an extended period of time, the rigger shall direct the operator to dog off the load until further signals are communicated.

13.4.1 Hitch Specifications

Vertical Hitch

This hitch does very little to control the load, therefore single vertical rigging is subject to rotation. If load rotation is not controlled via tag lines or other controlling method, the sling load rating shall be ***reduced by 50%.***

Choker Hitch

Should not be used as a single sling for bundles of materials.

Do not pound down the eye of the choker to further squeeze the load, as doing so will further reduce the sling angle and increase the sling tension.

Double wrapping the choker can be utilized to increase load retention and control, as it allows for 360° of contact with the load.

In most cases, a shackle should be used to create the choker hitch. The shackle shall be rated equal to or greater than the vertical capacity of the sling. The shackle shall be applied so that the pin of the shackle sits in the eye of the sling

Basket Hitch

Should be used in pairs due to lack of load control and retention.

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.

Bolt-type shackles have a slide in pin with a kotter pin hole for securing. These are good for use in long-term or permanent rigging.

Side loading shackles reduces capacity as follows:

- 45° angle – 30% loss of working load limit
- 90° angle (side load) – 50% loss of working load limit

Shackles are not designed to be used when the sling angle is ***less than 30°.***

When attaching more than one sling to a shackle, the slings must sit in the bow (belly) of the shackle, and the shackle shall be large enough to accommodate the slings without stacking.

When attaching a single sling, orientate the shackle to best fit and align the rigging.

13.4.3 Hooks

Tip loading, side loading, or excessively load sling angles can cause hook to deform. Deformation is usually evidenced by the safety latch not functioning properly.

Sling angles below 45° are not permitted in a hook.

The safety latch will not prevent loaded slings from slipping out of hook.

When placing two or more slings in a hook, make sure the angle from the vertical to outmost leg is not greater than 45°, and the included angle between the legs of the slings does not exceed 90°.

A ***shackle or master link*** should be used any time you are ***connecting two or more slings*** to a hook.

13.4.4 Eye bolts

Always lift with a steady, even pull.

Apply the load in the plane of the eye, not at an angle.

If lifting at an angle the capacity shall be reduced as follows:

- 45° - reduce capacity by 70%
- 90° - reduce capacity by 75%

Only eye bolts with shoulders can be pulled at an angle.

13.4.5 Miscellaneous Rigging Hardware

Turnbuckles shall be used for straight line pulls only. A lock nut shall be used to lock the body to the bolt if vibration is a concern. Capacities are available through the manufacturer's catalogue and are specific to the type of turnbuckle rather than the size.

Beam clamps shall be used per manufacturers' directions only.

- If a beam clamp is to be used as a *lifting attachment device* (not an anchorage device), then a written lift plan is required.

Plate clamps or dogs are *prohibited* without the written consent of the appropriate Sundt Group HSE Manager and the Project Manager for the requesting project.

13.4.6 Chain Hoists and Lever Hoists (Come-a-longs)

Operator shall be familiar with the equipment. This includes the operator's manual, instructions, and warning labels.

At no time will a load be hoisted over personnel using chain hoists or come-a-longs.

Check the hoist break once load has been hoisted to ensure it holds as expected.

Only one person may operate the hoist.

Handle extensions, pipes, etc. will not be utilized to operate lever hoists. If operator is unable to operate the lever hoist due to load weight, then a larger hoist is required.

Chain hoists and lever hoists are not suitable for extended elevated staging of equipment or material. They are not intended to take the place of wire rope lashing and cannot be utilized to secure an elevated load for more than 24 hours. Refer to the Sundt ***SWP Dropped Object Prevention SWP*** for further direction and guidelines.

13.4.7 Multiple-Lift Rigging (Christmas-Tree Rigging)

Requires approval of the Sundt QCM, Project Manager, and appropriate Sundt Group HSE Manager.

Rigging specifically designed for multiple-lift operation must be utilized.

A maximum of five members may be hoisted per lift.

Only beams and similar structural members may be lifted.

No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.

All employees involved must be trained in the requirements of this manual and the hazards associated with multiple-lift operations (per OSHA 1926.761(c)(1).

Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, shall be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.

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.

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 lock that restricts rotation of the upper works over the carrier during normal, stationary crane operations.

A-Frame Jib: The outer most attachment of structural channel steel construction which is connected to the fly section and is supported by pendants.

Angle Jib: A multiple section structural steel angle boom tip extension supported by pendants.

Anti-Two Block System: A system of electromechanical devices used to prevent the crane operator from raising the load block or ball high enough to make contact with the boom or jib point sheaves. See Two Block.

Assembly/Disassembly: The assembly and/or disassembly of equipment covered in OSHA 29 CFR §1926.1400. The process of increasing the height of the crane is an erection process.

Assist Crane: A crane used to assist in the assembly/disassembly operation.

Attachments: Any device that expands the range of tasks that can be done by the equipment. Examples include, but are not limited to, an auger, drill, magnet, pile-driver, and boom-attached personnel platform.

Automatic Brake: Drum brake system that is applied automatically any time the drum control lever is in neutral.

Auxiliary Counterweight Pendants: Cables or bars that secure the mast of a crane to the auxiliary counterweight carrier when a super lift attachment is installed on a crane.

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 resistant friction material that causes the drum to stop rotating.

Base Section: 1. The segment of the telescoping boom that attaches to the upper frame by the boom foot pin. 2. The lower most section of a lattice boom, tower boom, luffing boom, or jib.

Basic Boom: Lattice boom attachment made up of only the base and top sections of the boom.

Basic Jib: Jib attachment made up of only the base and top sections of the jib.

Blind Lift: Any lift in which the following condition(s) exist: the crane operator cannot see the load being lifted throughout the lift; the crane operator and the signal person cannot maintain visual contact throughout the lift; and/or the signal person cannot maintain constant eye contact with the load.

Block (Main): The device that transfers the load from the hook to the wire rope lines. The hook can pivot 360 degrees or be pinned to prevent rotation. Usually contains multiple sheaves.

Boom: The inclined spar, strut, or other long structural member which supports the upper hoisting tackle on a crane or derrick.

Boom Angle: The angle above or below horizontal of the longitudinal axis of the boom.

Boom Angle Indicator: An accessory which measures the angle of the boom relative to horizontal.

Boom Bound: A situation where the crane cannot boom up or down due to obstructions.

Boom Chord: A main corner structural member of a boom.

Boom Foot: Base of boom where it attaches to the upper revolving frame.

Boom Hoist: 1.The hydraulic method of raising and lowering the boom to different boom angles. 2. Rope drum and its drive, or other mechanism, for controlling the angle of the boom.

Boom Lattice (Lacing): Structural truss members at angles that support the boom chords of a boom.

Boom Length: The distance along a straight line through the centerline of the boom foot pin to the centerline of the boom head sheave shaft, measured along the longitudinal axis of the boom.

Boom Lift Cylinder: The hydraulic ram that raises and lowers the boom on hydraulic cranes.

Boom Pendants (Lines, Straps): Used to support the boom of a crane. Pendants (sometimes called standing ropes) do not run on sheaves. Pendants can be made from wire rope, steel bars or other materials.

Boom Point Elevation: The upper most tip of the boom when at a specified radius. Used to figure allowable hook height and varies depending on radius of operation. A boom has higher point elevations at shorter radii.

Boom Rest: A frame used to support the boom of a crane when not in use and during travel or transport. Can be found on boom trucks and sometimes barges where cranes are used.

Boom Section: The base, middle, inner mid, outer mid, manual, and tip segments which are used as a part of a telescoping attachment. 2. Individual lattice structures which are pinned together to form the boom attachment. Crane lattice booms are usually in two basic sections, top and base. Such booms may be lengthened by insertion of one or more additional extension sections.

Boom Telescoping Cylinder: Used to extend and retract the sections of a hydraulic crane boom. This cylinder can be mounted internally or externally on the boom.

Boom Top: A special section of a lattice boom that connects the upper point of the boom and houses the sheaves that the wire ropes feed through.

Bridle: A frame equipped with sheaves and connected to the boom by pendants. The bridle is used in conjunction with the boom hoist drum and bail to alter the crane's boom angle. Also called the Equalizer or Bail.

Bull Rigging: Term given to rigging activity involving primarily chain hoists, come-a-longs, and other manually operated mechanical rigging.

Capacity Chart: Developed by the crane manufacturer, the capacity charts outline the cranes capacity for all possible configurations.

Car Body: The crawler carrier upon which the revolving frame is mounted.

Carrier: The portion of the crane located below the turntable bearing.

Carrier Frame: The main structure of the carrier section of the crane.

Carrier Roller: Rollers of track mechanism which are not power driven but are used to guide the track along the top side of the frame.

Carry Deck: A crane designed for material to be stowed and transported on the carrier frame; these cranes are often designed specifically for on-rubber pick and carry operations.

Center of Gravity (C.O.G.): The point at which weight of a load is evenly dispersed and all sides are in balance.

Center Pin: The pin that the car body rotates about. This is where all swing and lift radius measurements must be taken from. The center of all moments and reactions when a lift is being performed.

Central Ballast: Term used to identify counterweights placed on the crane to improve stability.

Certified Operator: An operator who has successfully completed a certification process for a specific type of crane as provided through the NCCCO, the NCCER, or an alternate operator certification credential approved by the Sundt Crane Committee.

Closing Line: The rope reeved from hoist drum to control closing of clamshell bucket, rocket bracket or grapple.

Clutch: A friction, electromagnetic, hydraulic or pneumatic device for engagement or disengagement of power.

Collector Ring (Slip Ring): A device used to transmit the electrical power from the carrier to the upper utilizing a rotating disk to allow rotation of the upper and maintain connectivity. Primarily used in tower cranes.

Competent Person: One who is capable of identifying existing and predictable hazards in his/her surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Connector (Boom): A point at the ends of crane booms used to connect boom sections and inserts together using pins.

Controlled Load Lowering: Lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.

Counter Jib (Tower Crane): The horizontal structure protruding behind the center of the tower crane. Usually variable length, counter jib contains the machinery deck and counterweights used to balance the tower crane. The counter jib is sometimes supported by pendant lines or bars. Also known as the counter deck.

Counterweight: Weight used to supplement the weight of the crane in providing stability for lifting loads.

Crane: Power operated equipment that can hoist, lower or horizontally move a suspended load.

Crane User: The company or entity that employs the crane for actual activity.

Crawler Crane: Type of crane with track crawlers and a lattice boom.

Critical Lift: Any lift meeting the criteria identified in this manual for a critical lift.

Creep: Crane movement limited to 200 feet (60.96m) in a 30-minute period, and not to exceed one mile per hour (1.6 km/h) maximum speed.

Dedicated Pile-Driver: A crane that is designed to function exclusively as a piledriver. These cranes typically have the ability to both hoist the material that will be pile-driven and to pile drive that material.

Deductions: The weights from rigging, stowed jibs, hoist lines, and other weights not associated with the actual equipment or material being lifted. The summation of these weights must be accounted for when determining overall load weight and crane capacity.

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 which would hinder the equipment's ability to lift at normal capacity.

Dog Off: To apply all of the brakes on the crane and lock out the controls. This is done when the crane is not in use or when a load must be supported for an extended period of time.

Drag Rope (Inhaul Rope): Rope for pulling in bucket during dragline operations.

Dragline: Cranes with dragline attachments are generally used to excavate material from below the grade on which the crane is placed. A dragline bucket is loaded by the drag rope pulling it toward the crane, it is lifted and carried by the hoist rope reeved over the boom point sheave, and it's balanced by the dump rope interconnecting the drag and hoist ropes.

Drive Chain: Chain used to transfer power from the horizontal traction shaft to the track drive sprocket.

Drum: A rotating cylindrical spool with side flanges used to wrap the winch rope during the raising and lowering of the load with the winch.

Drum Rotation Indicator: A device that is used to indicate drum motion and can be used to monitor speed.

Encroachment: Where any part of the crane, load line or load (including rigging and lifting accessories) breaches a minimum clearance distance required to be maintained from a power line.

Extension (Boom or Jib): Sections of the boom or jib, which come in various lengths and are used to increase the overall length of the boom or jib.

Fairleader: Combination of sheaves and or rollers mounted at the front of the crane to guide the drag rope.

Fall Zone: The area, including but not limited to the area directly beneath the load, where it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.

Fixed Base (Tower Crane): An immobile structure used to support a tower crane.

Fixed Jib: A jib that is attached to the end of the main boom or a luffing jib.

Fixed Jib Offset Angle: The angle between the longitudinal centerline of the jib and the longitudinal centerline of the boom it is mounted on.

Fly Section: Boom tip extension supported by a pin at its base.

Frame: Structure on which either or upper or carrier machinery is attached.

Free-Fall: Lowering of the hook and/or load without using power. The motion is caused by gravity and must be controlled by a brake.

Freely Suspended Load: Load hanging free with no direct external force applied except by the hoist line.

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 above the cab. Retractable means are usually available to lower to cab height for transportation convenience. Its purpose is to support the boom hoist system.

General Lift: A lift that does not meet the criteria established for a critical lift, or project established critical lift criteria.

Ground Bearing Pressure: Weight of crane divided by the area of the surface directly supporting the crane.

Guide Sheave: A sheave used to guide or carry wire rope to prevent rubbing or wear.

Hoist: Function of lifting and lowering the loads.

Hoist Drum: A rotating cylindrical spool with side flanges used to wrap the winch rope during the raising and lowering of the load with the winch.

Hoist Rope: The wire rope used to reeve the winch and the attachments for lifting loads. See Load Line.

Holding Valve: A valve that locks oil in hydraulic circuits preventing movement such as boom drift.

Hook Block: Block with hook attached used in lifting service. It may have a single sheave for two-or three-part line, or multiple sheaves for four or more parts of line.

Hook Height: The height of the hook from the base/ground when a lift is being performed.

House Assembly: The housing which covers the machinery mounted on the upper revolving frame.

Hydraulic Crane: Type of crane with a hydraulic boom and wheeled base for either legal roads or rough terrain.

Hydraulic Tank (Reservoir): Holds excess hydraulic fluid to accommodate volume changes from: cylinder extension and contraction, temperature driven expansion and contraction, and leaks.

Idler Roller: Rollers of track mechanism that are not power driven but are used to maintain proper tension on the track.

Inner Mid-Section: The segment of a four-section telescoping boom that is attached to the base and outer mid sections.

Insulating Link/Device: An insulating device listed, labeled, or accepted by a Nationally Recognized Testing Laboratory in accordance with 29 CFR 1910.7.

Jack Shaft: Term applied to an intermediate shaft used to transfer power.

Jib: A pendant supported extension attached to the boom or fly head to provide inward reach for handling specified loads. The jib may be in line or offset with the boom.

Jib Backstay Pendants: Standing lines or pendants used to support the jib strut. These pendants connect the jib strut back to the main boom of the crane.

Jib Pendants: Standing lines or pendants used to support the jib. These pendants connect the jib strut to the jib.

Jib Strut (Mast): A short frame mounted on the boom top to provide a means for attachment of the jib support ropes.

Knee Brace: A gusset or strut used to provide rigidity.

Lacing: Transverse and diagonal members of a lattice boom truss structure used to support boom chords.

Lattice Boom: Boom of open construction with angle, or tubular, lacing between main corner members (chords) in the form of a truss.

Lift and Carry: See Pick and Carry

Lift Director: Lead supervisor on the project who is responsible for crane and rigging operations; as required for critical lifts, a person who meets the criteria for both a Crane Competent Person and a Qualified Person and reviews the lift plan in a meeting with all workers who will be involved with the operation.

Lifting Capacity: The amount the crane can safely lift for a given load radius and boom angle under specified operating conditions and crane configurations.

Lift Radius: The horizontal distance from the center pin of the crane to the hook that has to be above the center of gravity of the load. This is considered the operating range of the crane and is the basis for figuring the capacities.

Lift Zone: An exclusion zone established to prevent employees from entering the swing/load path as the crane is in operation. This is preferably established using red barricade, but may be established as needed using horns, whistles, etc. sounded by a ground monitor/rigger.

Limited Access Zone: Zone based on proximity to power lines or energized components; the intent is to limit encroachment and access to the specified zone or distance.

Line Parts (Number): The number of times the wire rope is doubled back on itself to allow for greater lift capacities. Usually in even numbers basic setups consist of single, two, four, and eight times.

Line Pull: The rope pull generated off a rope drum or lagging at a specified pitch diameter.

Line Speed: The rope velocity at a winch drum or lagging at a specified pitch diameter.

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.

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.

Middle Section: The segment of a telescoping boom that is located between the base and tip sections.

Midpoint Suspension: Wire rope pendants used to support the center portion of a long lattice boom at lift off.

National Center for Construction Education and Research (NCCER) and National Commission for the Certification of Crane Operators (NCCCO) – Nationally recognized and Sundt approved operator certification entities.

No-Load Stability Limit: The radius or boom angle beyond that the crane can overturn without a load on the hook.

Offset Fly: A fly section that is capable of being pinned at different angles.

Operational Aid: An accessory that provides information to facilitate operation of a crane or that takes control of particular crane functions without action of the operator when a limiting condition is sensed.

Operator Controls: Electric, hydraulic or air operated valves or switches used to control the functions of a crane.

Outer Mid-Section: The segment of a four-section hydraulic boom that is attached to the inner mid and manual sections.

Outrigger: An extendable supporting device used to level the crane and increase stability; includes the **outrigger beam** that extends horizontally to increase span, the **outrigger cylinder** which provides for vertical leveling and stability, and the **outrigger float** that disperses weight in a larger area than diameter of the cylinder.

Outrigger Pad: A flat pad constructed of carbon fiber, wood, metal or similar material that is placed under the outrigger float to further increase the displacement of ground bearing pressure at the outrigger.

Pawl: A pivoting locking lever that will permit movement in only one direction. Movement in the opposite direction can be achieved only by manually releasing the mechanism.

Pendant: A supporting rope, which under tension maintains a constant distance between its points of attachment.

Pendant Lines/Bars: A wire rope or rigid bar used to support booms and jibs on cranes. Sometimes called standing ropes, these lines do not run over sheaves.

Pick and Carry: The crane operation of lifting a load and traveling with it suspended.

Picture Frame Lacing: Transverse lacings found only on the ends of lattice boom.

Pitch Diameter: Root diameter of a drum, lagging, or sheave, plus the diameter of the rope.

Power Take-Off (PTO): Device used for the transfer or transmission of engine power to the operating functions of the crane.

Qualified Evaluator (Not a Third Party): A person employed by the signal person's employer who has demonstrated that he/she is competent in accurately assessing whether individuals meet the qualification requirements for a signal person.

Qualified Evaluator (Third Party): An entity that, due to its independence and expertise, has demonstrated that it is competent in accurately assessing whether individuals meet the qualification requirements for a signal person.

Qualified Operator: An operator who has met his or her employer's criteria for operating a specific crane type, make, and model; qualification is company based and does not transfer from one organization to another. For Sundt, qualification criteria can be found in ***Section 4.1***.

Qualified Person: A person who, by possession of a recognized degree in an applicable field or certificate of professional standing, **OR** who, by *extensive knowledge, training, and experience*, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Qualified Rigger: A rigger who has met his or her employer's criteria for performing rigging activities. For Sundt, qualification is addressed in **Section13.1.**

Qualified Signal Person: A signal person who meets the criteria for a qualified person as determined by the requirements of this manual and OSHA standards.

Rail Traveler (Tower Crane): A self-propelled structure mounted on rail that allows a tower crane to move along the rail increasing the cranes effective radius.

Rated Capacity (Load) Limiter (RCL): A device that automatically monitors radius, load weight, and load rating and prevents movements of the crane that would result in an overload condition.

Rated Load Indicator: See Rated Capacity Indicator.

Rear Stabilizer: Stabilizers mounted toward the rear of the carrier on hydraulic and truck cranes.

Reeving: Passing of ropes over pulleys and/or sheaves.

Rigger: The skilled labor position that attaches the rigging to the crane hook. Must be a Qualified rigger, or under the immediate direction of a Qualified Rigger, for crane operations.

Rigging: The additional wire rope slings, shackles, spreader bars, and other lifting accessories needed to lift a load in a level and balanced matter.

Rigging Mode System Override Switch: A switch that can be used to override any or all of the function limiters (cutouts) that have been activated on the crane during crane rigging/setup.

Ringer: A type of counterweight attachment for crawler cranes, usually a circular rail system, which allows for additional counterweights to be added to the crane allowing for much higher capacities. The crane will have a separate load chart when in this set-up.

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.

Tail Swing: The distance from the centerline of rotation of the upper frame to the extreme rear swing arc of the counterweight.

Telescoping Fly: An extension to the jib section that is stored through its center. Mounted on rollers, this extension is easily erected by telescoping it out of the center of the jib and pinning it into position.

Third Drum (Auxiliary Drum): A third hoist drum, in addition to two main hoist drums often used in pile driving.

Tip Section: The outer most live segment of a telescopic boom. It is attached to a middle or outer mid-section and contains the head machinery of the attachment.

Top Section: The upper most section of a lattice boom or jib that also contains the head machinery of the attachment.

Torque Converter (PTO): A device (which uses hydraulic fluid) used for the transfer or transmission of engine power to the operating functions of the crane.

Tower Attachment: A crane attachment usually adaptable to a basic crane. The attachment consists of a vertical tower with a working boom and/or jib affixed to the upper part of the tower.

Tower Crane: Type of crane that sits on a tower and puts the entire crane at a higher elevation than where the work is being performed, ranges from 6 to 60 tons.

Tower Top: A structure mounted on top of a tower crane used to provide a means to attach the pendants that support the jib and counter jib.

Travel Swing Lock: A mechanical lock that engages with the upper directly over either the front or rear of the carrier only. Use of the travel swing lock is mandatory when traveling or transporting the crane and during pick and carry operations.

Trolley: A carriage carrying the hook block for radial movement along the lower chords of a horizontally mounted tower crane jib. Also used on bridge cranes.

Tubular Jib: Multiple section lattice extension supported by pendants and attached to the main boom head.

Turntable Bearing: A large bearing that attaches the upper to the carrier allowing the upper to rotate on the carrier.

Turret: The upper rotating frame of a boom truck used to mount the boom, boom cylinder and hoist.

Two Block Warning System: A system of electromechanical devices used to warn the crane operator of impending two block condition.

Upper: The portion of the crane located above the turntable bearing.

Upper Boom Point (Rooster Sheave): A sheave assembly that mounts to the tip of the boom top used to gain separation between the main load line and the whip line.

Upper Revolving Frame: The main structure of the upper section of the crane that serves as mounts for other components of the upper.

Whip Line (Aux Line): A secondary hoist line. See Load Line.

Winch Rope: The wire rope used to reeve the winch and the attachments for lifting loads.

Wire Rope: A flexible metal, multi-wired member usually consisting of a core member around whom a number of multi-wired strands that is helically wrapped.

Working Area: The limiting position of any load for safe operation within the working area.

Working Weight: The weight of the crane with a full radiator, half-full fuel tank and attachments installed.

17.0 APPENDICES AND ATTACHMENTS

17.1 REGULATIONS AND STANDARDS

- OSHA 29 CFR 1926.1400
- ANSI B.30

17.2 FORMS

- Sundt QCM Application
- Sundt Crane Operator Qualification review
- Sundt Crane Operator Practical Evaluation
- Sundt Crane and Rigging Manual Exam
- Sundt Major Crane Move Permit
- Sundt Mobile Equipment Electrical Proximity Permit
- Sundt Daily Crane PUI
- Sundt Comprehensive Crane Inspection Form
- Sundt Daily Lift Plan
- Sundt Critical Lift Plan and Permit
- Sundt Personnel Platform Lift Plan & Authorization Form
- Sundt Personnel Platform Inspection & Pre-Lift Checklist
- Hand Signal Chart