

Operation and Maintenance of Offshore Cranes

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Foreword

This recommended practice is under the jurisdiction of the API Subcommittee on Drilling and Production Operations and was developed in cooperation with the Offshore Operators Committee. Detailed requirements for the design and construction of offshore cranes are given in API 2C.

The principles provided herein on the operation, inspection and maintenance of offshore cranes are based in part on an understanding of the cranes' design and construction. Therefore, this document should be used in conjunction with API 2C.

Conformance to the intent of the programs and practices recommended herein is intended to result in cranes that operate safely and efficiently between inspection periods and in accordance with a company's safety and environmental management system (see API 75).

Each crane owner, qualified crane operator, qualified inspector, and qualified rigger is encouraged to follow the recommendations outlined herein, and to modify or supplement them with any practices or procedures which are more appropriate for the type and duty cycle—both past and future—of the crane, provided the minimum recommendations and the intent of the programs stated herein are met.

The material in this publication represents the contribution of industry representatives of crane users, crane manufacturers, wire rope manufacturers and ancillary crane device or component manufacturers. It is based on industry experience and expertise involving worldwide operations.

It should be understood that the crane operating and maintenance practices cover a wide range of crane types and configurations. Not all practices are applicable to all cranes. When applying this document, care should be taken to review each item as stated, and use those items specifically applicable to the crane's type, usage, and duty-cycle. It may be necessary to modify a procedure due to a particular crane requirement. This modification would be wholly acceptable as long as the original intent of the practice or procedure is met.

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

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Operation and Maintenance of Offshore Cranes

1 Scope

1.1 This recommended practice establishes general principles for the safe operation and maintenance of offshore pedestal-mounted revolving cranes on fixed or floating offshore platforms, offshore support vessels, jackup drilling rigs, semi-submersible drilling rigs and other types of mobile offshore drilling units (MODUs). This document also provides requirements and recommendations for personnel training, lift planning, pre-use inspection, and testing of temporary cranes that are erected offshore.

1.2 Typical applications can include, but are not limited to the following.

- a) Offshore oil exploration and production applications; these cranes are typically mounted on a fixed (bottom-supported) structure, floating platform structure, or ship-hulled vessel used in drilling and production operations for offshore minerals and energy.
- b) Shipboard applications; these lifting devices (rated for 10,000 lbs [4536 kg] or more) are mounted on surface-type vessels and are used to move materials, containers, ROVs, diving bells, pipeline, subsea components, and other materials on the vessel, between vessels, into the sea, or to the sea bed.
- c) Heavy-lift applications; cranes for heavy-lift applications are mounted on barges, self-elevating vessels or other vessels, and are used in construction and salvage operations above and below the sea surface.

1.3 Equipment (e.g. davits, launch frames) used only for launching life-saving appliances (life boats or life rafts) are not included in the scope of this recommended practice.

1.4 Lifting devices not covered by this document should be operated, inspected, and maintained in accordance with the manufacturer's recommendations.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API RP 2A-WSD, *Recommended Practice for Planning, Designing and Constructing fixed Offshore Platforms—Working Stress Design*

API Spec 2C, *Offshore Pedestal-mounted Cranes*

API Spec 9A, *Specification for Wire Rope*

API RP 9B, *Application, Care and Use of Wire Rope for Oil Field Service*

ASME ¹, B30.9, *Slings*

AWS ², D1.1, *Structural Welding Code—Steel*

WRTB ³, *Wire Rope Sling User's Manual*

¹ ASME International, 2 Park Avenue, New York, NY 10016-5990, www.asme.org.

² American Welding Society, 8669 NW 36 Street, #130, Miami, Florida 33166-6672, www.aws.org.

WRTB, *Wire Rope User's Manual*

WSTDA RS-1 ⁴, *Recommended Standard for Synthetic Polyester Roundslings*

WSTDA WS-1, *Recommended Standard for Synthetic Web Slings*

3 Terms, Definitions, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1.1

authorized surveyor

A person who works for a third-party certifying authority who is hired to inspect the crane.

3.1.2

auxiliary hoist line

whip line

A secondary hoist rope (if present) on a crane.

3.1.3

anti-two-blocking

A means to protect hoist ropes, structural components, and machinery from damage that can occur when two sheave groups (e.g. load block and boom tip) come into contact as the hoist cable is drawn in.

3.1.4

bearing raceway

The surface of the bearing rings which contact the rolling element (balls or rollers) of the swing-bearing assembly.

3.1.5

boom

A member hinged to the revolving upper-structure and used for supporting the hoist tackle.

3.1.6

boom angle

The angle above or below horizontal of the longitudinal axis of the base boom section.

3.1.7

boom angle indicator

An accessory that indicates the angle of the boom above horizontal.

3.1.8

boom hoist

A mechanism responsible for raising and lowering the boom.

3.1.9

boom length

The straight-line distance from the centerline of boom foot-pin to the centerline of the boom-point main load hoist sheave pin, measured along the longitudinal axis of the boom.

³ Wire Rope Technical Board, 7011A Manchester Blvd., #178, Alexandria, VA 22310-3203, www.wireropetechnicalboard.org.

⁴ Web Sling Tie Down Association, 2105 Laurel Bush Road, Suite 201, Bel Air, MD 21015, www.wstda.com.

3.1.10**boom stop**

A device used to prevent the boom from falling backwards in the case of high winds or a sudden release of load.

3.1.11**boom tip extension****jib**

An extension attached to the boom point to provide added boom length for lifting specified loads.

3.1.12**brake**

A device used for holding, retarding, or stopping motion.

3.1.13**bridle sling**

A multi-leg sling attached to a single point ring.

3.1.14**cab**

An enclosure for the operator and the machine operation controls.

3.1.15**certifying authority**

A third-party organization used to certify and approve the design, fabrication, equipment and operation of the crane.

3.1.16**clutch**

A means for engagement or disengagement of power.

3.1.17**counterweight**

Weight used to supplement the weight of the machine in providing stability for lifting working loads and usually attached to the rear of the revolving upper-structure.

3.1.18**crane**

Power-operated equipment that can hoist, lower, slew and horizontally move a suspended load.

3.1.19**crane owner**

The individual, partnership, firm, or corporation who owns the crane.

NOTE For the purposes of this document, a crane owner can be the lease operator (i.e. oil company), drilling or well service contractor, vessel owner, or company that provides temporary crane service.

3.1.20**critical component**

Any component of the crane assembly devoid of redundancy and/or auxiliary restraining devices whose failure would result in an uncontrolled descent of the load or uncontrolled rotation of the upper-structure.

3.1.21**derate**

To reduce the lifting capacity of a crane due to damage or deterioration of a critical component.

3.1.22**designated**

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

3.1.23**enclosure**

A structure that provides environmental protection for the machine.

3.1.24**fixed platform**

A bottom-supported stationary structure without significant movement in response to waves and currents in operating conditions.

EXAMPLE Fixed platforms with jacket and pile supports, jack-up rigs, and submersible bottom-supported rigs are similar in that they are effectively stationary.

3.1.25**gantry****mast**

A structural frame, extending above the machinery deck or upper-structure to which the boom support ropes are reeved.

3.1.26**hands-on proficiency**

A physical means of verifying a person's dexterity, coordination, and familiarity with rigging and overall machine functions and characteristics.

3.1.27**hoisting**

The process of lifting.

3.1.28**hoist rope**

Wire rope involved in the process of lifting.

3.1.29**hook block**

Block with a hook attached used in lifting service.

NOTE A hook block can have a single sheave for double or triple line or multiple sheaves for four or more parts of line.

3.1.30**hook load**

The load being lifted, including the weight of all rigging.

3.1.31**hook rollers**

A means to connect the upper structure to the foundation or pedestal by using rollers to prevent the revolving upper structure from toppling.

3.1.32**in-service**

When a crane is capable of operating in a safe manner in accordance with the capacities shown on the posted load chart.

NOTE In-service conditions can be with the boom out of the boom rest or in the boom rest (stowed).

3.1.33**king pin**

Vertical pin or shaft that acts as a rotation-centering device and connects the revolving upper-structure and base mounting.

3.1.34**king post**

A fixed tubular member that acts as a centerline of rotation for the revolving upper structure and as the connective member to the platform.

3.1.35**lifting authority**

An individual with the appropriate knowledge, training, skills and experience to carry out the responsibilities as determined by the crane owner or Person in Charge (PIC).

3.1.36**load line****hoist line**

The main hoist rope.

3.1.37**load ratings**

Crane ratings in pounds (kilograms) established by the manufacturer.

3.1.38**log**

A means to record activities conducted.

EXAMPLE Record, a record book, a logbook, a computerized database, or an electronic data collector.

3.1.39**luffing**

The operation of changing boom angle in a vertical plane (in effect changing the working radius).

3.1.40**offboard/dynamic lift**

A crane lifting a load from or to anywhere not on the platform/vessel that the crane is mounted on (from/to supply boats, for example).

3.1.41**out-of-service**

When a crane is not capable of operating in a safe manner.

NOTE Out-of-service conditions can be with the boom out of the boom rest or in the boom rest (stowed).

3.1.42**overhaul ball**

The weight on a single part line used to pull the wire rope off the drum with gravitational assistance.

3.1.43**pawl****dog**

A mechanical device that prevents motion in one or more directions.

3.1.44**pedestal****base**

The supporting substructure upon which the revolving upper-structure is mounted.

3.1.45**pendant line**

A standing (not running) rope of specified length with fixed end connections.

3.1.46**pull test**

A load that is applied to the crane structure that will not exceed 100 % of the crane's onboard rated capacity as identified on the crane's load chart.

NOTE This is not a load test as described in 4.7.2 and Annex D.

3.1.47**qualified**

A person who, by possession of a recognized degree, 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.

3.1.48**qualified crane operator**

A person who performs the act or process of raising or lowering a load using a mechanical or non-mechanical crane.

3.1.49**qualified crane inspector**

A person who conducts the necessary inspection of cranes based on usage, condition, and performance to ensure conformance with manufacturer's specifications, regulatory requirements (as applicable), any other pertinent criteria, and the provisions of this RP.

3.1.50**qualified rigger**

Anyone who attaches or detaches loads or loose gear to lifting devices.

3.1.51**rated capacity**

The rated load or safe working load (SWL) at specified radii as established by the manufacturer which are the maximum loads at those radii for the conditions specified.

3.1.52**rerate**

The act of changing the lifting capacity or operations of a crane.

NOTE Refer to 5.5.

3.1.53**restricted service**

The usage of a crane or lifting device with limited operational deficiencies that have been evaluated and approved by responsible parties (e.g. crane owner, inspector, etc.).

3.1.54**reeving**

A rope system where the rope travels around drums and sheaves.

3.1.55**roller path**

The surface upon which the rollers that support the revolving upper-structure bear.

NOTE A roller path can accommodate cone rollers, cylindrical rollers, or live rollers.

3.1.56**rolling element**

The balls or rollers contained between the rings of the swing bearing.

3.1.57**rope**

Wire rope, unless otherwise specified.

3.1.58**rotation-resistant rope**

A wire rope consisting of an inner layer of strand laid in one direction covered by a layer of strand laid in the opposite direction.

NOTE A rotation-resistant rope has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.

3.1.59**running rope**

A rope which travels around sheaves or drums.

3.1.60**safe working load****SWL****rated capacity**

The maximum rated load within crane rated capacity for the given operating conditions.

3.1.61**sling**

An assembly that connects the load to the material handling equipment.

3.1.62**static/onboard lift**

A crane lifting a load from and to the deck of the platform/vessel that the crane is mounted on.

3.1.63**swing****slewing**

Rotation of the upper-structure for movement of loads in a horizontal direction about the axis of rotation.

3.1.64**swing bearing****swing circle**

A combination of rings with balls or rollers capable of sustaining radial, axial, and moment loads of the revolving upper-structure with boom and load.

3.1.65**swing-circle assembly**

The swing-circle assembly is the connecting component between the crane revolving upper structure and the pedestal for cranes of certain types.

NOTE The swing-circle assembly allows crane rotation and sustains the moment, axial, and radial loads imposed by crane operation.

3.1.66**swing gear****ring gear**

External or internal gear with which the swing pinion on the revolving upper-structure meshes to provide swing motion.

3.1.67**swivel**

A load-carrying member with thrust bearings that allows the load to rotate.

3.1.68**tailgate meeting****toolbox talk**

Work team meetings held at the work site prior to the job starting to review potential hazards and discuss aspects of planned operations.

NOTE Normally consists of crew members and any supervisor or technical resources required to perform the work.

3.1.69**temporary crane**

aka self-erecting, leapfrog or bootstrap cranes

A lifting device that is not part of the original platform design and installed for a specific application or task and will not remain as a permanent part of the facility.

NOTE A temporary crane can be certified to API 2C or other justification by engineering analysis, review and materials of construction.

3.1.70**two-blocking**

The condition when the lower load block, hook assembly or fastline ball contacts the upper load block or boom-point sheave assembly.

3.1.71**wire rope**

A flexible, multi-wired member usually consisting of a core member around which a number of multi-wired strands are “laid” or helically wound.

3.1.72**working load**

The external load in pounds (kilograms), applied to the crane including the weight of load-attaching equipment such as load block, shackles, and slings.

NOTE The maximum allowable working load for a given condition is the safe working load (SWL).

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

JSA	job safety analysis
JSEA	job safety environment analysis
LOTO	lock-out, tag-out
MODU	mobile offshore drilling unit
NDE	nondestructive examination
OIM	offshore installation manager
OTM	over-turning moment
PIC	person in charge
PFD	personal flotation device
PPE	personal protective equipment

PTW	permit to work
SDS	safety data sheet [formerly known as material safety data sheet (MSDS)]
SWL	safe working load

4 Operation

4.1 Crane Operator and Rigger Qualifications and Operating Practices

4.1.1 Crane Operators

Only the following personnel should operate cranes:

- a) qualified crane operators who have met the requirements of 4.1.2;
- b) trainees under the direct supervision of a qualified crane operator;
- c) appropriate maintenance and supervisory personnel, when it is necessary for them to do so in the performance of their duties;
- d) qualified inspectors in the performance of their inspection duties.

4.1.2 Qualifications for Crane Operators

4.1.2.1 Crane operators shall meet the requirements of a qualified crane operator in 8.2 and Annex H.3.

4.1.2.3 The employer shall ensure that crane operator qualifications are maintained, at a minimum every 4 years, through requalification. This shall also include current vision and medical condition evaluations as in accordance with 4.1.2.1.

4.1.3 Riggers

Load rigging shall only be performed by a qualified rigger.

4.1.4 Qualification for Riggers

Riggers shall meet the minimum requirements of a qualified rigger contained in 8.1 and Annex H.2

4.1.5 Operating Practices

4.1.5.1 The qualified crane operator (herein also called crane operator) is responsible for those operations under his or her direct control. Whenever there is any doubt as to safety, the crane operator should have the authority to stop and refuse to handle loads or continue operations as safety dictates. See Annex A for additional safety considerations.

4.1.5.2 The crane operator should be aware of the operating characteristics of the crane. Mechanical and non-mechanical cranes can require different operating techniques, especially with regards to engine speed, control operation, control arrangement and braking. Upon initial purchase, the crane manufacturer should provide operating instructions or be consulted for specific information.

4.1.5.3 The crane operator should be familiar with the equipment and its proper care. If adjustments or repairs to the crane are necessary, or any deficiencies that impair safe operation are known, the crane should be taken out of service or its operations restricted to eliminate the unsafe condition. See 5.1.1 for restricted service conditions.

4.1.5.4 Before starting the crane, the crane operator should verify the following:

- a) the pre-use inspection outlined in Annex B has been completed;

- b) all controls are in the “off” or “neutral” position;
- c) all personnel are in the clear.

4.1.5.5 For mechanical cranes, the crane operator should operationally test the brakes each time a load approaching the rated load is to be handled. Prior to raising the load, exposed brakes should be warmed and rusted surfaces on the drums cleaned by raising and lowering the boom and load brakes under slight pressure.

4.1.5.6 When handling loads, the crane operator shall not start machine movement unless the load is within his or her range of vision or they are in contact with the appointed signal person who has given the appropriate signal for movement.

4.1.5.7 The crane operator should respond to signals only from the appointed signal person but should obey an emergency stop signal at any time, no matter who gives the signal.

4.1.5.8 The crane operator should verify that the appropriate onboard/static and offboard/dynamic load rating charts are in place for the crane configuration in use (i.e. boom length, load line reeving, counterweight, jib, etc.).

4.1.5.9 Before leaving the control station unattended for a prolonged period, the crane operator should:

- a) land any attached load;
- b) disengage the master clutch, where applicable;
- c) set all locking devices;
- d) put controls in the off or neutral position;
- e) stop the prime mover;
- f) ensure that no component of the crane will interfere with normal helicopter flight operations.

NOTE On unattended control stations, some operations (e.g. wireline) require the crane to be left attached to the suspended load (e.g. lubricator stabbed and resting on the tree connection). This is an acceptable practice as long as the procedures listed above have been followed and a safe work plan has been conducted.

4.1.5.10 The crane should be secured against swinging when not in use.

4.1.5.11 The crane operator should be aware of heat sources such as natural gas engines, flares, or any other heat source that exhausts near the crane. Stress corrosion cracking, paint damage, accelerated corrosion, and loss of lubricant can result in reduced service life of components.

4.1.5.12 If power or a necessary control function fails during operation, the crane operator should:

- a) set all brakes and locking devices;
- b) move all clutch or other power controls to the off or neutral position; and
- c) if practical, land the suspended load by controlled lowering and stopping.

4.1.5.13 Where cranes are positioned in the proximity of helidecks or approach/take-off zones, they should not be operated while the helicopter is landing or taking off. The boom should be positioned and secured against swinging so there is no interference with flight operations. The crane operator should not be at the control station during helicopter landing/take-off operations, unless the crane operator is in direct voice communication with the helicopter pilot.

4.1.5.14 Where cranes are to be used at night, the crane operator should ensure that there is sufficient lighting for safe operation. The load and landing area should be illuminated.

4.1.5.15 Field welding shall not be performed on load hooks or sling hooks. Hooks should not be exposed to excessive heat.

4.1.5.16 The crane operator shall keep and maintain a log of the pre-use inspection with the name, date, and time of inspection. This record should be kept in an appropriate location. See A.1.3 for the appropriate location for storing logs.

4.2 Handling the Load

4.2.1 The Load

4.2.1.1 Crane lifting capacities are based on relative motion conditions between the crane and the load to be handled. All cranes shall have one onboard/static and at least one offboard/dynamic load rating chart, developed specifically for each crane. The charts shall be derived in accordance with the procedures outlined in API 2C that were applicable at the time of manufacture or subsequent editions, at the discretion of the crane owner. Other qualified sources, such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane, as determined by the crane owner, may be used.

4.2.1.2 The appropriate load-rating chart for the configuration in use shall be visible to the crane operator at the control station.

4.2.1.3 The crane operator should verify that the hook load is within the crane's applicable onboard/static or offboard/dynamic rated load at the radius at which the load is to be lifted. See A.1.4 for clarification of hook load.

4.2.2 Attaching the Load

4.2.2.1 The load should be attached to the hook by means of slings or other suitable devices. The latch should be closed to secure loose slings.

4.2.2.2 The hoist rope should not be wrapped around the load.

4.2.2.3 Sling use should be in accordance with the guidelines of 6.3.2 and A.1.5.

4.2.3 Moving the Load

4.2.3.1 Guidance on procedures for moving the load can be found in A.2.

4.2.3.2 No external forces should be applied to suspended loads that will create significant side loading of the boom. Care should be taken when swinging the crane so as to minimize the pendulum action of the hook and suspended load.

4.2.3.3 Cranes should not be used for dragging loads unless properly rigged for a vertical pull not exceeding the rated capacity of the crane or rigging.

4.2.3.4 The crane operator should be aware of the effect of velocity and weight of the load when lowering to minimize shock load.

4.2.3.5 The crane operator shall not hoist, lower or swing while any personnel are on the load or hook (other than in a personnel carrier or basket).

4.2.3.6 The crane operator should avoid moving loads over personnel. Loads that are suspended by use of slings or hoists should be blocked or cribbed before personnel are permitted to work beneath or between them.

4.2.3.7 No fewer than five full wraps of rope should remain on the drum(s) in any operating condition. Due consideration should be given to the hoist manufacturer's recommendations, especially for breakaway anchor-type hoists.

4.2.3.8 When two or more cranes are used to lift one load, one Qualified Crane Operator or Lifting Authority should be responsible for the operation. The responsible crane operator should analyze the operation, and instruct all personnel involved in the proper positioning, rigging of the load and the movements to be made.

4.2.3.9 Appropriate tag or restraining lines should be used where necessary to control the load.

4.2.3.10 When a crane is to be operated at a fixed radius, the boom hoist auxiliary holding device, where fitted, should be engaged, especially in the case of mechanical cranes or those without automatic pawl control.

4.3 Signals

4.3.1 Standard Signals

Signals between the crane operator and the designated signal person should be discernible, audibly or visually, at all times. The crane operator should not respond unless signals are clearly understood.

4.3.2 Hand Signals

Recommended standard hand signals are identified in Figure 1. This figure has been supplemented with hand signals for articulating boom cranes. For articulating boom cranes, some of the hand signals/hand movements may be the same as for a mechanical or telescoping boom crane but the intended action is slightly different, these are noted in the figure. If articulating boom cranes is not mentioned, it means that the hand signal is universal to all cranes. The use of these recommended standard hand signals is encouraged.

4.3.3 Special Signals

For operations not covered in Figure 1, or for special conditions, additions or modifications to the recommended standard signals may be required. In such cases, these special signals should be agreed upon in advance by the crane operator and the designated signal person and should not be in conflict with, or have the potential to be confused with standard signals.

4.3.4 Instructions

If it is desired to give instructions to the crane operator other than those provided by the established signal system, the crane motion should be stopped.

4.3.5 Signaling

When operations are required to be controlled by signals, a designated signal person should be assigned to work with the crane. The designated signal person should:

- a) be qualified by experience with the operations and knowledgeable of the standard hand signals as shown in Figure 1; and
- b) be in clear view of the crane operator to ensure that their signals can be seen or in radio contact with the designated signal person. Their position should give them a clear view of the load, crane, personnel, and area of operation. If the crane operator's view of the primary signal person is obstructed or they do not have radio contact, a secondary signal person should be provided.

4.4 Personnel Transfer

4.4.1 Personnel transfer devices shall be inspected, maintained and refurbished in accordance with the manufacturer's recommendations.

4.4.2 All hooks used for support of personnel shall have an operable latch that can be closed and locked, with a pinned or positive locking device, which eliminates the hook throat opening, shall be used for any personnel lifts. Additionally, a hook with a purposefully designed lifting eye integral to the hook may be used in conjunction with a shackle that may be pinned to prevent opening. These hooks are designed to prevent the personnel basket sling from coming off the hook accidentally.

4.4.3 When making personnel lifts, the load shall be under control in both up and down directions.

4.4.4 All personnel to be lifted on a personnel carrier or basket shall use approved personnel flotation devices (PFD) when being lifted or lowered over water. Personnel riding on net type personnel baskets should stand on the outer rim facing inward or as provided by manufacturer's instructions.

4.4.5 The weight of the loaded personnel carrier or basket should not exceed the personnel rated load as defined by the crane load rating chart and API 2C.

4.4.6 See Annex C for additional information on personnel transfer.

4.5 Refueling

4.5.1 Cranes should not be refueled with the engine running.

4.5.2 Fuel tanks shall be filled in a manner such that fuel spills or overflows will not run onto engine, exhaust, or electrical equipment, and should have spill containment to provide environmental protection.

4.6 Fire Extinguishers

Fire extinguishers shall be kept in the cab or vicinity of the crane and be of a size and type not less than specified by the proper authorities.

Personnel who are expected to respond to fires should be trained in the use of fire extinguishers.

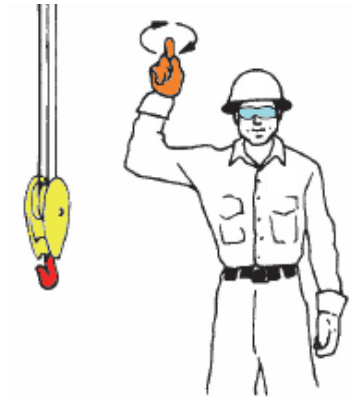
4.7 Load Test

4.7.1 Conditions Requiring Load Testing

A crane load test shall be performed under the following conditions:

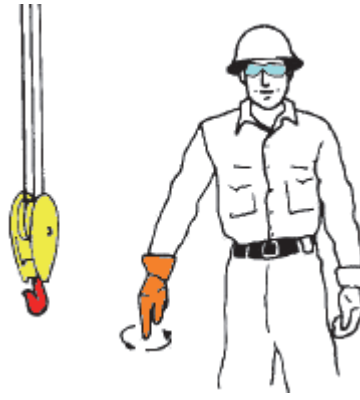
- a) new cranes being placed into service;
- b) cranes that are being permanently relocated;
- c) temporary cranes after each rig-up or relocation.

Crane load testing is not required to determine the fitness of repairs or alterations, provided the repair and replacement procedures are in accordance with 5.3.3.



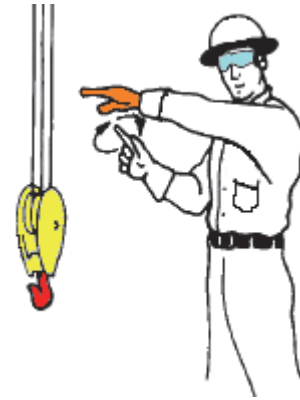
Hoist: With forearm vertical, forefinger pointing up, move hand in small horizontal circle.

Articulating Boom Crane(with hoist option) – Hoist loadline

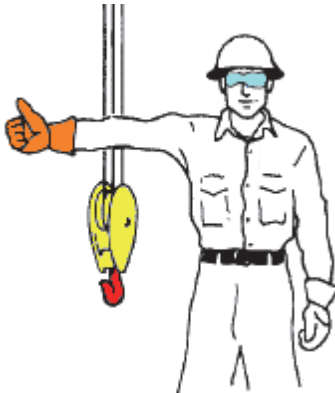


Lower: With arm extended downward, forefinger pointing down, move hand in small horizontal circles.

Articulating Boom Crane (with hoist option) – Lower loadline

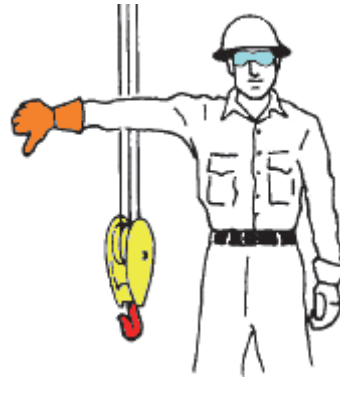


Move Slowly: Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal.



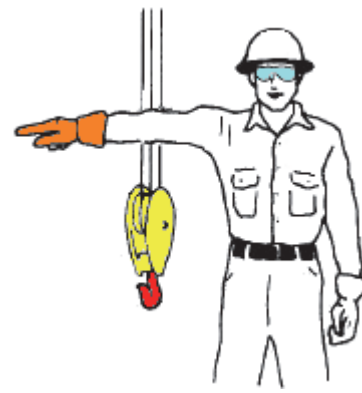
Raise Boom: Arm extended, fingers closed, thumb pointing upward.

Articulating Crane – Raise boom tip vertically

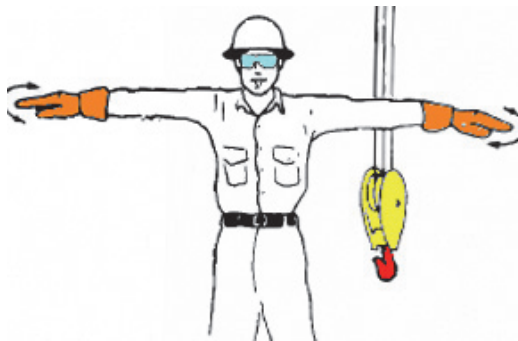


Lower Boom: Arm extended, fingers closed, thumb pointing downward.

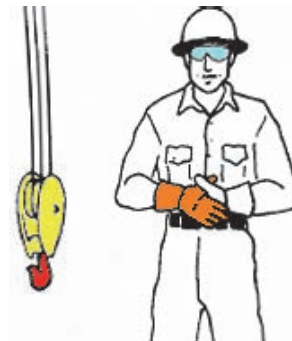
Articulating Boom Crane – Lower Boom Tip Vertically



Swing: Arm extended, point finger in direction of swing boom.

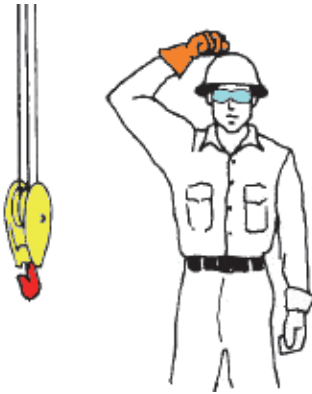


Emergency Stop: Both arms extended, pointing down, move arms rapidly up and down.

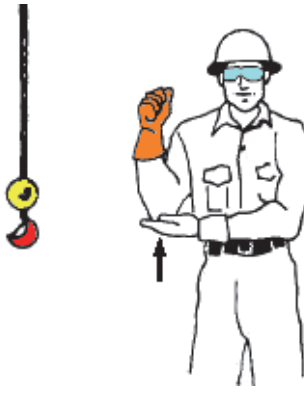


Dog Everything: Clasp hands in front of body.

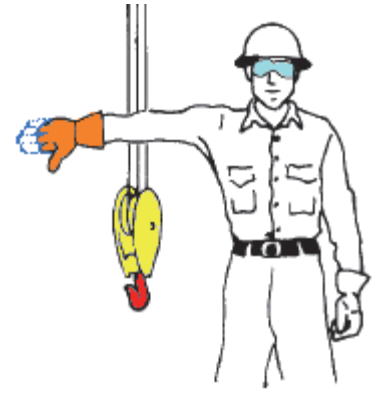
Figure 1—Standard Hand Signals for Controlling Crane Operations



Use Main Hoist: Tap fist on head, then use regular signals.

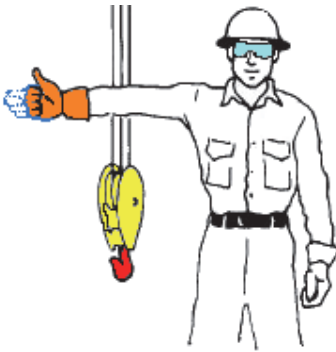


Use Whip Line: (Auxiliary Hoist) Tap elbow with one hand, and then use regular signals.



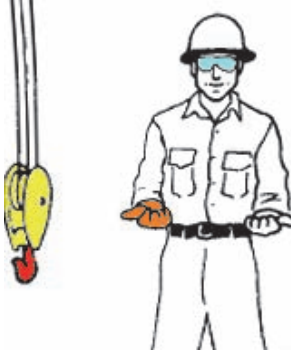
Lower the Boom and Raise the Load: With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

Articulating Boom Crane (with Hoist option) – Lower the boom tip and raise the load



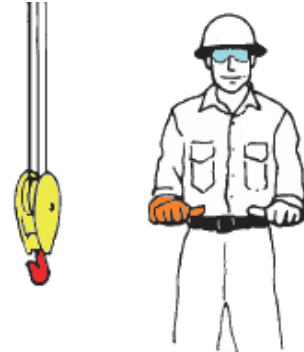
Raise the Boom and Lower the Load: With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

Articulating Boom Crane (with hoist option) – Raise the boom tip and lower the load



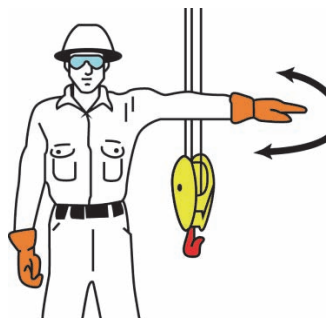
Extended Boom: (Telescoping Booms) both fists in front of body with thumbs pointing outward.

Articulating Boom Crane – Increase radius of Boom Tip



Retract Boom: (Telescoping Booms) both fists in front of body with thumbs pointing toward each other.

Articulating Boom Crane: Decrease Radius of Boom Tip



Stop: Arms extended, palm down, move arm back and forth horizontally.

Figure 1 (continued)—Standard Hand Signals for Controlling Crane Operations

4.7.2 Load Test Requirements

The following shall apply to load tests.

- a) The crane shall be operated during testing in accordance with Section 4.
- b) The crane shall be inspected in accordance with the annual inspection requirements before and after each test. Attention should be given to rigging used to attach loads. Tag lines should be used on test loads.
- c) The test weights or dynamometer should be verified for accuracy by a qualified inspector.
- d) All lifts should be planned in advance, taking into account the crane's physical location, the available space for staging and assembling the test loads, and the potentially hazardous areas to be avoided. See 7.3 for more information on planning the lift.
- e) When the test load is lifted the crane operator shall allow the control lever/s to return to the neutral position. The load test should be held for a minimum of 5 minutes.
- f) When a dynamometer is used to verify the test weight(s) the weights shall be allowed to freely rotate in order not to create a torsional stress in the dynamometer which can lead to inaccurate readings.
- g) Crane load indicators shall not be used to test cranes.
- h) Relief valves on hydraulic cranes should not be adjusted above manufacturer's recommended pressures and current limiting devices on electric cranes should not be bypassed or adjusted to increase available hoist line pull. The test may be conducted with the highest load the hoist can lift as long as it is equal to the rated load.
- i) Engine speed should not be adjusted above the manufacturer's recommended maximum rated RPM.
- j) The test load for all lifts shall be based on crane rating chart, wire rope strength, available hoist line pull, and number of parts of line. The static/onboard test load and the test radius should be calculated to load the crane as shown in Table 1.

Table 1—Static/Onboard Test Load and Radius

Static/Onboard Rated Load at a Specific Radius lb (kg)	Test Loads in Excess of Static/Onboard Rated Load at a Specific Radius
≤ 40,000 (18,144)	25 %
> 40,000 ≤ 100,000 (>18,144 ≤ 45,356)	10,000 lb (4536 kg)
> 100,000 (45,356)	10 %

- k) All cranes should be tested as they are normally rigged. Cranes should not be rigged with extra parts of line or have their hydraulic pressures, electric currents, or engine output increased. The load test should not necessarily be based on the highest load shown on the rating chart.
- l) A live weight test shall be performed for initial and temporary installations and for relocated cranes as follows:
 - load test weight/s shall be swung in all directions which the crane will be operated, avoiding obstructions (e.g. derricks, living quarters, well heads, compressors, etc.) that are present;

- test load shall be raised and lowered to demonstrate the hoist will function properly and test the static brakes;
- when the hoist is the limiting factor the hoist shall lift the safe working load as a minimum (see Figure D.2 for example).

m) Most recent Load test records should be maintained in crane records.

See Annex D for additional information on load testing.

4.8 Pull Test

A pull test may be conducted at the discretion of the crane owner or the crane owner representative.

When the crane owner or crane owner's representative elects to have a crane pull tested, a calibrated dynamometer or calibrated load cell attached to an engineered fixed point or a known suspended weight should be used and the pull test should be held for a minimum of five minutes. Upon the completion of the pull test, a qualified crane operator or qualified inspector should perform a pre-use inspection of the crane to ensure no damage occurred during the test.

5 Inspection, Testing, and Maintenance

5.1 Usage and Inspection

5.1.1 General

Inspections are intended to identify all deficiencies or items, which would affect the safe operation or reduce the lifting capability of the crane. Inspections should utilize methods and procedures appropriate for the crane type and its past and anticipated usage, as determined by the crane owner.

Restricted service may, in some cases, be continued after the identification and before correction of a deficiency. In such cases, it is the responsibility of the qualified crane operator or qualified inspector to document the deficiency, reporting it to the crane owners. Based on this information, the crane owner should define the appropriate restriction and post necessary cautionary notices, after consultation with the crane manufacturer, authorized surveyor, certifying authority or other qualified source (such as an API 2C-licensed crane manufacturer, or an engineer experienced in the design of the crane, as determined by the crane owner).

Action taken to correct a deficiency should be made as soon as practicable.

5.1.2 Crane Usage Categories

5.1.2.1 General

Inspection procedures for cranes in-service are divided into three general categories based upon their usage or duty cycle, which in turn determines different, appropriate intervals at which inspections are to be performed. The usage categories should be assigned by the users on a consistent crane-by-crane basis. The intent is to measure their duty cycle as the duration of time for which the crane is in actual use. See Annex B for further information. The three crane usage categories are described in 5.2.1.2 through 5.1.2.4. Special attention should be given to wire rope, condition, spooling and lubrication on these cranes during pre-use inspections.

5.1.2.2 Infrequent Usage Production Duty Cycle

Infrequent usage applies to those cranes that are used for 10 hours or less per month, based on the averaged use over a quarter. These cranes shall be subject to a pre-use inspection and an annual inspection. However, if the crane sits idle for three months or more the crane shall be subject to a monthly

inspection and a full function operation check. Crane usage should be reviewed on a periodic basis by the crane owner to ensure proper inspection intervals.

NOTE Special attention should be given to wire rope on these cranes during pre-use inspections.

5.1.2.3 Moderate Usage Intermittent Duty Cycle

Moderate usage applies to those cranes that are used for more than 10 hours/month but less than 50 hours/month, based on the averaged use over a quarter. These cranes shall be subject to pre-use, quarterly, and annual inspections. Crane usage should be reviewed on a periodic basis by the crane owner to ensure proper inspection intervals.

5.1.2.4 Heavy Usage

Heavy usage applies to those cranes that are used for 50 hours or more per month based on an average use over a quarter. These cranes shall be subject to pre-use, monthly, quarterly, and annual inspections. Cranes assigned this category usage need not be reviewed to determine the number of hours used each month, unless otherwise specified by the crane owner.

5.1.3 Inspection Categories

5.1.3.1 General

All cranes should receive inspections in accordance with the categories described in 5.1.3.2, 5.1.3.3, 5.1.3.4, 5.1.3.5, 5.1.3.6. These inspections are more clearly defined in Annex B. These inspection requirements apply to all cranes including those installed for temporary use. These inspection guidelines are minimum requirements. The crane owner should determine the actual scope of the inspections, with input from manufacturers and other relevant sources, as appropriate.

5.1.3.2 Initial Inspection

Initial inspections apply to cranes that are new and are being placed into service, cranes that are being permanently relocated, and temporary cranes. A qualified inspector shall perform these inspections. Every initial inspection shall include a load test performed in accordance with the procedures outlined in 4.7 and Annex D.

5.1.3.3 Pre-use Inspection

The pre-use inspection shall be performed and documented prior to the first crane use of the day, prior to or during each change in crane operator, and then as the qualified crane operator deems necessary during the day for extended operations. A qualified crane operator shall perform this inspection, and it applies to all cranes, regardless of usage category. A qualified inspector may also perform these inspections.

5.1.3.4 Monthly Inspection

The monthly inspection shall be performed once per month, for all cranes assigned a heavy usage category. A qualified crane operator shall perform this inspection. A qualified inspector may also perform these inspections.

5.1.3.5 Quarterly Inspection

The quarterly inspection shall be performed once every three months for all cranes assigned a moderate or heavy usage category. A qualified inspector shall perform this inspection.

5.1.3.6 Annual Inspection

5.1.3.6.1 The annual inspection shall be performed once every twelve months. A qualified inspector shall perform this inspection, and it applies to all cranes, regardless of usage category.

See B.3.5 for more information on annual inspections.

5.1.3.6.2 A crane that is taken out of service for more than twelve months should have an “OUT-OF-SERVICE” sign placed over the primary controls. Before the crane is placed into service, an annual inspection shall be performed.

5.1.3.6.3 Temporary cranes shall be inspected in accordance with B.3.5. After each rig-up or relocation, temporary cranes shall be load tested in accordance with the procedures in Annex D.

5.1.3.6.4 Before installation of temporary cranes, a new crane, or a refurbished replacement crane, the structure and deck of the fixed platform shall be evaluated to ensure that it can accommodate the proposed crane installation and operation. The crane may be derated in accordance with the platform’s limitation; and appropriate load rating charts shall be installed on the crane, readily visible to the crane operator.

When the structure on which the crane is mounted is the limiting factor for the crane, one or more of the following shall be in place:

- a) a durable information chart attached at the control station;
- b) an indication in the Notes section on the load chart;
- c) a written report placed in the permanent crane records.

5.1.3.6.5 Figure 2 shows a usage/inspection/inspector qualification matrix that summarizes the recommended minimum crane maintenance requirements discussed above.

5.2 Inspection and Load Test Records

5.2.1 A log of pre-use inspections should be maintained in accordance with 4.1.5.16 and A.1.3.

5.2.2 Written, dated and initialed, initial, monthly, quarterly and annual inspection reports, as well as records of repairs and modifications carried out on cranes in accordance with this document, should be kept readily available for a period of four years at an appropriate location. The person performing the inspection should be identified on the inspection record.

5.2.3 When a load test is required, written reports should be furnished to the crane owner by a qualified inspector showing load test procedures and the results. Additional guidance on load testing is provided in Annex D.

The most recent load test records should be maintained in the crane records.

		Usage Category		
		Infrequent	Moderate	Heavy
Inspection Category	Pre-use	QI or QO	QI or QO	QI or QO
	Monthly			QI or QO
	Quarterly		QI	QI
	Annual	QI	QI	QI

Inspection required
 No inspection required

Key

QI Inspection to be performed by a qualified inspector.

QO Inspection to be performed by a qualified operator.

Figure 2—Usage/Inspection/Inspector Qualification Matrix

5.3 Maintenance

5.3.1 Preventive Maintenance

A preventive maintenance program should be established by the crane owner, taking into consideration crane type, frequency of usage, history of maintenance, and manufacturer's recommendations. Written and dated maintenance records should be readily available for a period of four years.

5.3.2 Maintenance Procedure

5.3.2.1 The following precautions, where applicable, should be taken before adjustments, repairs and maintenance are started on a crane:

- a) means of starting should be rendered inoperative;
- b) appropriate out-of-service signs should be placed at the operator control station and/or on the prime mover;
- c) additional precautions can be found in Annex E.

5.3.2.2 Adjustments should be made to ensure correct functioning of components in accordance with the manufacturer's recommendations.

5.3.3 Repairs and Replacements

5.3.3.1 If unsafe conditions are disclosed by the inspection requirements as outlined in 5.1, the crane shall be taken out of service or its operation restricted to eliminate the unsafe condition.

5.3.3.2 Repairs or replacements of critical components should be made as soon as practical (see E.2).

5.3.3.3 Written reports should be maintained by the crane owner, confirming the adequacy of major repairs or alterations as implemented.

5.3.3.4 Replacement parts for critical components shall equal or exceed the original equipment manufacturer's recommendations or other qualified source (such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane, as determined by the crane owner).

5.3.3.5 Welding repairs shall not be made to critical components, such as booms and swing circle assemblies, without specific repair procedures, material traceability reports (MTRs), nondestructive examination (NDE) reports from a qualified source, and recommendations from the original crane manufacturer, or other qualified source (such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane, as determined by the crane owner). Care should be taken to ensure that arcing does not occur across any bearings.

5.3.3.6 Repair documentation of critical components shall include MTRs as applicable, welder certifications and welding procedure(s) identification number. This documentation shall be maintained in the crane files for the life of the crane.

5.3.3.7 Field welding shall not be performed on load hooks or sling hooks. Hooks should not be exposed to excessive heat.

5.4 Lubrication

The crane owner shall consider the crane or component manufacturer's recommendations as to points and frequency of lubrication, maintenance of lubricant levels, and compatibility of lubricants.

5.5 Crane Rerating

5.5.1 If a physical change is made to the crane that would enable lifting over the original load-tested weight, the manufacturer or other qualified sources, such as an API 2C-licensed crane manufacturer, authorized surveyor or an engineer experienced in the design of the crane, as determined by the crane owner, should be consulted for the appropriate action (i.e., new load chart, load test, etc.).

These changes can increase or decrease the capacity of the crane at the owner's discretion. These changes can require a new load chart to match the new configuration.

5.5.2 Cranes shall be rerated and load charts revised in accordance with the edition of API 2C in effect on the original manufacture date of the crane.

5.5.3 If the crane manufacture date is unknown, or prior to March 1, 1983, the load ratings from API 2C, 3rd edition shall apply.

5.6 Crane Derating

Temporary derating of a crane or component (winch, attachment, or appendage) due to any deficiency shall be made by the original manufacturer or other qualified source such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane as determined by the crane owner. The qualified source shall document the duration on the temporary load chart.

6 Wire Rope and Sling Inspection, Maintenance, and Replacement

6.1 General

6.1.1 The crane owner shall develop and implement a written policy for wire rope and sling inspection, lubrication, maintenance, and replacement. The crane owner's wire rope policy shall include rejection criteria and a schedule for replacement, taking into consideration crane type, facility type, usage, history of maintenance, wire rope manufacturers' recommendations, and the crane manufacturer's recommendations.

The qualified crane operator or inspector who determines whether replacement is necessary or not, shall be knowledgeable in the manufacturer's and/or owner's wire rope inspection and maintenance requirements.

6.1.2 The crane owner's written policy should also include a process to document the various activities that can be conducted on the crane's wire rope during its lifespan (e.g. who, when, dimensional measurements, type of lubrication, amount of lubrication applied, method of application, etc.). Section 6 requirements do not apply to the rigging of anti-two-block equipment (e.g. chains, shackles, etc.). These rigging components to the anti-two-block equipment shall be included as part of the periodic inspection program.

6.2 Wire Rope

6.2.1 Introduction

Wire rope is a structural component of the crane requiring periodic replacement. A loss of strength can result from wear, abuse and other forms of deterioration. The wire rope shall be carefully selected, inspected and maintained in accordance with Annex F. Initial wire rope dimensional measurements should be collected and documented in the cranes file at the time of installation and should be referred to during subsequent wire rope inspections. Rotation-resistant wire rope has special characteristics that require additional precautions.

6.2.2 Inspection

6.2.2.1 The crane owner's wire rope inspection program should be established taking into consideration crane type, facility type, frequency of usage, history of maintenance, wire rope manufacturers' recommendations, and the crane manufacturer's recommendations.

6.2.2.2 Visual inspections of wire rope should be performed by a Qualified Crane Operator during pre-use and monthly inspections. Additional wire rope inspection (see F.2) should be performed by Qualified Inspectors during quarterly and annual inspections, as the results of pre-use and monthly inspections warrant.

6.2.2.3 Inspection tools to determine the condition of the wire rope should include, but not be limited to, the following:

- steel tape measure;
- sheave groove gauges for worn sheaves used in accordance with API 9B;
- quality calipers and/or micrometers accurate to at least 0.001 in. (0.025 mm) accuracy;
- chalk.

6.2.2.4 During quarterly and annual inspections, or when ropes are changed on a crane, a number of areas affecting performance and rope life should be checked and corrective action taken as appropriate (see F.2 and F.3).

6.2.3 Rope Replacement

6.2.3.1 The various rope conditions noted upon inspection should be used to determine continued use or retirement of the rope in question.

6.2.3.2 Inspection records shall be maintained in accordance with 6.2 to determine the time interval for replacement of the rope. Records should be readily available until the specific wire rope is replaced. All observed rope deficiencies as listed in Annex F shall be recorded on these inspection records.

6.2.3.3 Wire rope unfit for use on cranes, slings or other load carrying devices shall be removed from service and identified as unfit for use.

6.2.3.4 Wire rope rejection criteria are provided in F.4.

6.2.4 Rope Maintenance

6.2.4.1 Wire rope is a machine with many parts that move and integrate with each other. Care and maintenance of this machine is as important as all other components of the crane.

6.2.4.2 Rope should be stored and handled to prevent damage and deterioration. See F.5 for recommended storage and handling procedures.

6.2.4.3 Unreeling or uncoiling of rope should be done as recommended by the rope manufacturer. See Figure F.7 for an example. When unreeling or uncoiling rope, attention should be given to avoid the introduction of kinks or twists into the rope. Rotation-resistant rope can be more susceptible to this type of damage than other rope types.

6.2.4.4 Wire rope in the boom hoist and load hoist systems should be installed as recommended by the crane and/or wire rope manufacturer. See F.6 for installation guidelines.

6.2.4.5 Refer to the manufacturer's recommendation before cutting a rope. Both sides of the rope shall be properly seized before cutting to prevent un-laying of the strands.

6.2.4.6 Care should be taken during installation to avoid contaminating, scraping or nicking the wire rope. Do not bend the rope about small pipe or crane components that might induce kinks or curling.

6.2.4.7 Wedge-type socket installation (see Figure F.8) or terminating of the wire rope should be performed or supervised by a qualified crane operator or qualified inspector.

6.2.4.8 Wire rope clips shall be drop-forged steel and shall be single saddle (U-bolt) or double saddle type clips. Malleable cast iron clips shall not be used. For spacing, number of clips, and torque values, refer to the clip manufacturer's recommendations. Wire rope clips attached with U-bolts shall have the U-bolt over the dead end of the rope and the live rope resting in the clip saddle. Clips shall be tightened evenly to the recommended torque. After the initial load is applied to the rope, the clip nuts shall be retightened to the recommended torque to compensate for any decrease in rope diameter caused by the load. Rope clip nuts should be retightened periodically to compensate for any further decrease in rope diameter during usage (see Figure F.8).

6.2.4.9 Wedge type sockets shall be properly installed, in accordance with F.7.

6.2.4.10 Rope should be maintained in a well-lubricated condition to minimize internal and external corrosion or friction. Lubricants applied in the field should be compatible with the lubricant applied by the rope manufacturer following the recommendations of the rope and/or a Crane Manufacturer. Do not apply used oil because of contamination. See F.8 for recommended methods of lubrication.

6.2.5 Crane Operation

Operation of the crane will affect rope service life. Guidance in F.9 should be followed when operating the crane.

6.2.6 Wire Rope Testing

A wire rope manufacturer's break test certificate shall be supplied to the crane owner for all wire ropes. Tests shall be performed in accordance with API 9A.

6.2.7 Pendant Lines

6.2.7.1 Each leg of a set of pendant lines shall be proof loaded by the pendant line manufacturer in accordance with recognized industry standards.

6.2.7.2 Each pendant line should be labeled showing the manufacturer and appropriate working load, proof test certification number, length, diameter, and date of proof test.

6.2.7.3 Proof test certification documentation shall be supplied to the crane owner.

6.3 Slings

6.3.1 General

Due to the numerous types of material, construction, combinations, and various types of hitches, it is not practical to list the load ratings of each individual type. The sling manufacturer should be consulted when a question arises concerning sling ratings, use, care, and/or inspection. Section F.10 lists types of common slings.

6.3.2 Sling Use and Inspection

6.3.2.1 Section F.10.2 provides guidelines on the proper use of slings. Slings shall be inspected and tested in accordance with the ASME B30.9, WRTB Wire Rope Sling User's Manual, WSTDA RS-1, WSTDA WS-1, or other applicable standards.

6.3.2.2 All slings shall be visually checked prior to use by a qualified crane operator or qualified rigger.

6.3.2.3 The frequency of documenting sling inspections should be determined by the crane owner based on the following:

- a) frequency of sling use;
- b) severity of service conditions;
- c) nature or type of lifts being made;
- d) experience based on service life of slings used in similar applications.

6.3.2.4 Minimum guidelines for sling replacement are included in F.10.4.

6.3.3 Sling Fabrication and Lifting Procedures

See F.10.3 for guidelines on sling fabrication and lifting procedures.

6.3.4 Wire Rope Sling Replacement

Deterioration that contributes to loss of the original strength should be taken into consideration and the sling retired as appropriate. Refer to the removal criteria of ASME B30.9 and F.10.4. Reasons for replacing the sling should include, but not be limited to, the conditions outlined in F.10.4. If there is any question relative to the integrity of the sling, the sling should be removed from service and properly disposed of.

6.3.5 Slings Proof Loading and Labeling

6.3.5.1 Slings of all types shall be proof loaded by the sling manufacturer in accordance with industry recommendations. See F.10.5 for further details.

6.3.5.2 All slings, regardless of grade and construction, shall be labeled showing sling manufacturer's identity and the pertinent working loads, proof test certification number, length, diameter, and date of proof test.

6.3.5.3 Slings of other than wire rope construction shall be used, inspected and tested in accordance with the sling manufacturer and industry recommendations.

7 Lift Planning

7.1 General

Prior to handling any load that is considered not routine or repetitive in nature, a written lift plan should be developed, communicated to all members of the lifting crew and followed. The complexity (e.g. verbal vs. written) and amount of detail will depend on numerous factors, including but not limited to the following:

- a) roles and responsibilities;
- b) plan the lift:
 - 1) lift categorization:
 - i. routine lifts,
 - ii. non-routine lifts:
 - simple,
 - complicated,
 - complex/critical;
 - 2) risk assessment,
 - 3) training and competent personnel,
 - 4) documentation,
 - 5) approval of lift plans,
 - 6) changes to lift plans;
- c) summary for a safe lift.

7.2 Roles and Responsibilities

7.2.1 Lift Team Responsibilities

7.2.1.1 General

The lift team should consist of all key personnel involved in the planning and execution of a lift operation. The Lift Team will typically include a Qualified Crane Operator, one or more Qualified Riggers, and the Vessel Captain if a load is being lifted from a marine vessel to a floating or fixed facility. Depending on the scope of the lift operation, the Lift Team may also include other essential personnel. Key responsibilities of the Lift Team are outlined in 7.2.1.2 through 7.2.1.4.

7.2.1.2 Lift Team Responsibilities—Before Operations

Before the operation, the Lift Team has the following responsibilities.

- a) Prepare lift plan for all lift categorization.
- b) Evaluate the lift operations to determine if additional personnel are needed to assist in loading or offloading operations.
- c) Conduct a pre-lift meeting to review scope of work and execution of plan.
- d) Review Lift Plan with all members of Lift Team.
- e) Ensure that a clear method of communication is established (e.g. radio or hand-signals).
- f) Assess site conditions to ensure that the lift operation can be conducted safely (e.g. sea state, currents, wind speed/direction, weather, size of vessel, position of cargo, etc.).
- g) Review the lift path and weight of loads to determine if specific simultaneous operations procedures are required to protect equipment from falling loads.

7.2.1.3 Lift Team Responsibilities—During Operations

During the operation, the Lift Team has the following responsibilities.

- a) Maintain constant communication between Lift Team members.
- b) Conduct another pre-lift meeting/lift plan discussion if site conditions change or if the lift operations change from the original plan, stop work authority or time out is executed.

7.2.1.4 Lift Team Responsibilities – Post Operations

After the operation, the Lift Team has the following responsibilities.

- a) Everyone on the Lift Team involved in the lift should be provided the opportunity to discuss and make improvements to the lift plan.
- b) Any learning points noted on the plan should be reviewed by the Competent Person (e.g. this can include feedback on equipment effectiveness, lifting techniques, etc.).
- c) Employees should ensure that the significant learning's and improvements identified from lifting operations are recorded and communicated to all relevant parties.

7.2.2 Person in Charge

The Person in Charge (PIC) has the overall responsibility for work activities and can be the Supervisor, Manager, Project Engineer, Offshore Installation Manager (OIM), Tool Pusher, etc. The Person in Charge recognizes, or is advised of, the need for a lifting activity and either notifies the Lifting Authority or appoints a Lifting Authority to plan the lifting operation.

7.2.3 Lifting Authority

The Lifting Authority is someone who plans and supervises lifting operations, and shall have the practical skill, theoretical knowledge, and ability to carry out risk assessments, produce and assess lift plans and conduct pre-lift meeting or toolbox talks as determined by the owner/operator. The Lifting Authority may or may not supervise the lifting operation but is the focal point of authority for the technical operation and technical aspects of the lift.

7.2.4 Lift Team

7.2.4.1 General

Each team member shall attend and participate in pre-lift meetings or toolbox talks, carry out pre-use inspections of lifting equipment and stop any operation when they are concerned about safety.

7.2.4.2 Examples of Lift Team Members

7.2.4.2.1 Rigger Responsibilities

The Qualified Rigger is an integral part of crane operations, shipping, material movement, and rigging. Qualified Riggers have certain responsibilities and duties that are critical to the safe load lifting and attaching activities in accordance with this recommended practice. The Crane Operator and Rigger(s) shall work as a team. Communication among the Lift Team is one of the most important responsibilities. All personnel who participate in rigging operations should be Qualified Riggers, in accordance with 4.1.4, and should be able to provide documentation indicating that they have successfully completed rigger training. Rigging operations should include, at minimum, attaching and/or detaching lifting equipment to loads and providing signals to crane operators. Along with the Crane Operator, the Rigger shall be a member of the Lift Team.

7.2.4.2.2 Vessel Captain Responsibilities

The material to be offloaded should be positioned on the deck of the vessel to facilitate ease of rigging during offloading operations. Safety of the vessel, crew and passengers is always the primary responsibility of the vessel's Captain. Weather, vessel's position with respect to the platform, rig, structure stability, placement of cargo is all considered part of his primary responsibility. The Captain has a legal responsibility for the safety of the vessel. For any lift operations that involve a boat or marine vessel, the vessel captain will always be a key member of the Lift Team.

7.2.5 Technical Support

Persons providing technical support for lifting operations shall be proficient in the area of expertise as determined by the owner/operator.

7.3 Planning the Lift

7.3.1 The Lift plan is intended to clearly identify the Lifting Authority planning the lift, and the lifting operation to which it relates. All designated lifting operations should have a lift plan supported by analysis of potential hazards and risks. The plan should describe in detail the systematic steps or movements required to safely relocate the load from its origin to its final resting place.

7.3.2 The lift plan (for single or multiple lifts) should be documented, and shall identify the Lift Team members. The Lifting Authority should verify the qualifications of the lift team members involved in the lift. The lift plan should include a copy of the pre-use inspection, and the most recent crane inspection should be reviewed for deficiencies.

7.3.3 The lift plan shall include information related to the risk and complexity of the lift. For frequent or routine lifts, the lift plan may be a generic plan but shall be reviewed prior to each lift, supported by an on-site risk assessment and a team briefing. Non-routine lifts may be further classified by complexity and potential hazards (e.g. simple, complicated, complex/critical), and can need significant engineering design effort.

7.3.4 Generic lift plans can be appropriate for a series of similar or routine lifts within specified limits, but shall be formally reviewed and re-issued periodically. The classification of lifting operations is designed to give the Person in Charge and the Lifting Authority additional guidance in terms of the risk assessment, planning, supervision and the qualifications of the personnel performing the lifting operation.

7.3.5 Lift plans should take into consideration, but not be limited to the following components of a safe lift:

- a) the type and number of personnel required;
- b) the specific roles and competences of personnel;
- c) how personnel will be briefed;
- d) the size/shape, weight and center of gravity of the load and lifting points;
- e) pick up and set down points and constraints such as space and stacking;
- f) rigging equipment required and lifting hardware inspection and certification checks;
- g) step-by-step instructions;
- h) communication methods to be used (e.g. hand signals, radios);
- i) where the lift will originate;
- j) final location of lift;
- k) identify if lift is onboard (static) or offboard (dynamic);
- l) condition of crane performing the lift and the most recent inspection results and corrective actions;
- m) dropped/loose object and load path survey;
- n) established emergency and rescue plans;
- o) restrictions on the lift such as weather (e.g. lighting, sea state, wind, etc.);
- p) access and egress for connecting and disconnecting the load work area;
- q) simultaneous, conflicting or nearby operations or work/activities;
- r) whether heavy lift control or permit to work (PTW) are applicable;
- s) load integrity check (padeyes, frames, rigging, etc.);
- t) load charts are correct and configured to the crane;

- u) an assessment of whether tag lines should be used, their hazards and limitations;
- v) stop work authority.

7.4 Lift Categorization

To ensure that suitable controls are applied, lifting operations should be categorized according to the level of risk and complexity. As an aid to identifying risks and suitable controls, lifting operations should be categorized to reflect increasing risk and increasing level of control required. The Lifting Authority should determine the applicable categorizations for each lift. See Annex G for example categorization schemes for routine and non-routine lifts.

7.5 Risk Assessment

7.5.1 Every lifting operation should be risk assessed by the Lifting Authority before the work begins. The Lifting Authority should ensure that appropriate controls are in place for those hazards identified in the written assessment such that the risks are managed as an integral part of the lift plan. A suitable documented risk assessment such that risks are managed as an integral part of the lift plan. A suitable documented risk assessment may already exist for “routine” lifts (generic). If so, the existing risk assessment shall be reviewed for its applicability. If any significant changes are required to the existing risk assessment, for example there are additional risks not accounted for, a new risk assessment should be developed.

7.5.2 The following are components of a risk assessment.

- a) Complete a job safety analysis (JSA) or a job safety environment analysis (JSEA) to identify hazards and reduce risks.
- b) Limits and visual inspections.
- c) Safe working load (SWL) of crane or working load of rigging is never exceeded.
- d) Lifts that exceed an established percentage of the crane SWL require permit to work (PTW) controls for heavy lift authorization.
- e) Lifts that involve blind spots require that a stand-alone Signaller is assigned to oversee the safety on the lift and give hand signals. This person should not be involved with the rigging/handling of the load being moved.
- f) Tag line(s), shall be free of knots, of proper lengths, and should be attached to all lifts, if appropriate and deemed necessary.
- g) Persons rigging, slinging/un-slinging loads should remain in a position of safety and have a designated escape route.
- h) Personnel not involved in the lifting operation or the JSA or JSEA should stay clear of the lift area in a position of safety.
- i) Personnel shall not stand or walk under suspended loads or allow a load to be swung over their head.
- j) Riggers spotting loads should avoid placing hands on the load and stand clear until tag lines are accessible.
- k) Only spot loads on level and stable surfaces and on the decks that are rated to support the weight.
- l) Communication methods between the Crane Operator, Captain, and Rigger of an alongside vessel.

- m) All lifting equipment and hardware should be certified, of adequate SWL, and visually inspected for condition prior to being used for overhead lifting.
- n) Only Qualified Riggers that have successfully completed rigger training according to this RP should perform rigger functions.
- o) Lifting palletized material, certified pallet forks or device specifically designed for lifting pallets should be used.
- p) Assess the center of gravity.
- q) Criteria and limits for safe operation of cranes are addressed in the equipment manufacturer's manual.
- r) When it is required to lift, suspend, or transfer personnel in an approved/certified work basket or personnel transfer device, identify what controls are required (e.g. JSA and PTW).
- s) If any doubt exists about the lift plan or uncertainty about the procedure going forward, a "Stop Work Authority" or "Time Out" should be called and the person in charge contacted if safety cannot be resolved within the work group.
- t) When a Qualified Crane Operator leaves the crane controls, the crane shall be shut down, all controls left in neutral position, brakes locked, and master clutches disengaged. The swing lock, where applicable, shall be engaged at all times when the crane is unattended.
- u) Cranes should not be left unattended while a load is suspended.
- v) Load charts, boom angle or radius indicator, and emergency stops should be available and all limit switches operational and tested.

7.6 Personnel Transfer

7.6.1 The crane operator, while transferring personnel between vessels or from a vessel to a platform, shall raise the personnel carrier only high enough off the deck to clear all obstructions: swing the personnel carrier over the water; raise or lower it in such a manner as to minimize swinging; position it slightly above the landing area; and gently lower it to the deck.

7.6.2 A loaded personnel carrier shall not be raised or lowered directly over a vessel. If the crane cannot swing the loaded personnel carrier clear of the vessel beneath, the vessel, where practical, shall be moved out from under the personnel carrier.

7.6.3 Personnel carriers shall be of a design and in a condition suitable for the intended purpose, and maintained and inspected in accordance with the manufacturer's specifications.

7.6.4 See Annex C for additional information on personnel transfer.

7.7 Personnel Qualifications

Owner/operators should identify the standards required for critical roles and the process for establishing and verifying the qualifications of those involved in planning and executing lifting operations. The system should allow the PIC to easily confirm personnel qualification. To facilitate this, training records should be readily available, and if practical, on the person. Only qualified personnel should be involved in lifting operations.

7.8 Documentation of a Lift Plan

The following should be elements of a lift plan:

- written lift plan;

- safety checklist;
- drawings;
- risk assessment;
- JSA;
- toolbox talk;
- permit to work;

7.9 Approval of Lift Plans

All lifts plans should be reviewed and approved by the Lifting Authority. The rigor of review should be determined by the category of lift, which can require an engineer specialist.

7.10 Changes to lift Plans

Any changes to plan should be approved as if it were a new plan.

7.11 Summary Questions for a Safe Lift

The following questions should be asked of the appropriate personnel to ensure a safe lift.

- a) Is there a new or existing lift plan which is adequate for the lifting operation?
- b) Has a risk assessment been undertaken and the risks managed through the control measures within the lift plan?
- c) Is the equipment selected fit for purpose and identified in the lift plan?
- d) Do the personnel selected to undertake this lifting operation have the correct level of experience or competence?
- e) Have the steps of the lift plan been communicated and understood by all involved?
- f) What could go wrong? (Has this information been put into the lift plan and task risk assessment?)
- g) Have all potentially affected parties been informed of the lifting activities (including third parties)?

8 Personnel Training Qualifications

8.1 Qualified Rigger

8.1.1 The employer shall verify and document that the Qualified Rigger is responsible for the safe operation of using slings and rigging hardware and are aware of their responsibilities of this RP. To ensure the safe use of slings and rigging hardware it is necessary that the Qualified Rigger have the training, knowledge about slings and rigging hardware, has demonstrated a satisfactory skill level, and has the experience to be considered qualified in accordance with this RP.

8.1.2 The person shall have successfully completed a rigger-training program in accordance with Annex H.

8.1.3 The employer shall ensure that rigger qualifications are maintained, at a minimum every four years, through requalification.

8.1.4 The employer should verify that the employee has no history of a disabling medical condition, which can be sufficient reason for disqualification.

8.2 Qualified Crane Operator

8.2.1 The employer shall verify and document that the Qualified Crane Operator is responsible for the safe operation of the crane and is aware of their responsibilities as defined in Annex H. To ensure the safe operation of cranes it is necessary that the Qualified Crane Operator have training, knowledge and has demonstrated a satisfactory skill level. Only qualified Crane Operators shall operate any crane.

8.2.2 Crane Operator shall meet the requirement of a Qualified Crane Operator as defined in H.3.

8.2.3 The employer shall ensure that crane operator qualifications are maintained, at a minimum every four years, through requalification.

8.2.4 The Crane Operator shall meet the rigger requirements in 8.1.1 and shall meet the following physical qualifications:

- a) have vision of at least 20/30 Snellen in one eye and 20/50 in the other with or without correction, and have depth perception as demonstrated by record of a recognized test administered by an authorized medical person;
- b) be able to distinguish red, green, and yellow, regardless of position of colors, if color differentiation is required for crane operation;
- c) have hearing, with or without hearing aid, adequate for the specific operation.

8.3 Qualified Crane Inspector

8.3.1 It is the responsibility of the inspector's employer to verify and document that the Qualified Crane Inspector is responsible for the integrity of the applicable cranes and is aware of their responsibilities as contained in Annex H.

8.3.2 A person so designated by the employer who by reason of appropriate experience and training, has successfully completed classroom-type training on crane maintenance and troubleshooting; on hoist troubleshooting and overhaul; and on the structural aspects of offshore cranes, which gives knowledge of structurally critical components and critical inspection areas. These minimum training requirements are outlined in H.4. Additionally, individuals recognized by regulatory authorities ("Authorized Surveyors" or "certifying authorities") may conduct inspections of cranes pursuant to this edition, provided they meet the requirements of H.3. With successful completion of this minimum training supplemented with requalification at a minimum of every four (4) years, the inspector is considered qualified to perform the Initial, pre-use, monthly, quarterly, and annual inspections. The scope of these inspections is outlined in 5.1.3.

8.3.3 It is not a requirement for a Qualified Inspector to also be a Qualified Crane Operator. However, a Qualified Inspector is not a Qualified Crane Operator unless they have also completed the requirements of a Qualified Crane Operator (see 8.2), including the physical outlined in 8.2.4 and H.4.

9 Temporary Crane Installation

9.1 Planning the Installation

9.1.1 A qualified person, such as an API 2C-licensed crane manufacturer, an authorized surveyor or an engineer experienced in the design of the crane shall be used to plan the installation of a temporary crane, as determined by the owner. The crane owner shall ensure that calculations conform to API 2C and are recorded and documented. If a temporary crane manufacture date is unknown, or does not have an API monogram, a design review shall be conducted by the crane owner in accordance with API 2C, third edition, as a minimum.

9.1.2 The qualified person shall ensure the adequate review of the following:

- a) platform design and condition;
- b) selected temporary crane;
- c) planned crane placement on the platform;
- d) crane base beams and sub-base beams, and tie down design, meet the safe working loads for the crane being installed;
- e) critical components, as defined in API 2C.

9.1.3 The tie down design may be welded or clamped design. Should any of these critical components limit the load of the crane, this shall be reflected in the crane's load chart designed specifically for this proposed location in accordance with API 2C latest edition. The load chart shall be applicable through the full rotation of the crane.

9.1.4 If any one lift of the temporary crane package is equal to or greater than 80 % of the rated capacity of the platform crane at the anticipated radius, an annual inspection with pull test shall be performed within 30 days prior to the lift.

9.2 Installing the Temporary Cranes

The platform beams and the temporary crane beams shall be inspected for laminations to ensure the integrity of the tie down welds. Welding and tie down procedures shall be designed and approved by a qualified person. All welding procedures for joining of structural load bearing or load transfer members and the performance of welders employing these procedures shall be qualified in accordance with a recognized standard such as AWS D1.1.

9.3 Testing and Inspecting the Installation

Load tests shall be performed by a qualified inspector in accordance with this standard (see 4.7 and Annex D). An Annual Inspection shall be performed before and after the load test. The tie down welds shall be inspected by nondestructive testing by a qualified person before and after load testing. Examples of this type of testing are

- ultrasonic testing,
- magnetic particle,
- dye penetrant, or
- radiographic examination.

9.4 Usage

9.4.1 Temporary cranes are frequently used for construction, maintenance, and/or for installing equipment that the platform crane may be incapable of achieving within its operating limits.

9.4.2 These temporary cranes are transported and installed on marine facilities and placed into service once the rig up and testing are completed.

9.4.3 Since they are not the permanent crane, their fitness for purpose are more specifically identified in the tasks they are mobilized to address.

9.4.4 The load ratings should meet the criteria as described in the edition of API 2C in effect on the original manufacture date of the temporary crane.

9.4.5 User standards or specific operating requirements can help ensure that a suitable crane is selected for the specific job(s).

9.5 Crane Design

9.5.1 The provider of the temporary crane should submit, if requested, any documentation or design parameters that the crane was designed and manufactured to.

9.5.2 The crane pedestal, substructure, base beams and all crane tie-down connections should be designed in accordance with API 2A-WSD. The load capacity of these components should be included in rating the load limits of the crane.

9.5.3 The provider should submit substructure, base beam, substructure-to-base beam connections, and base beam tie-down design in writing for the subject crane setup and certify that such design is performed by a qualified person and that such design is specific to the setup of the proposed crane at the proposed platform.

9.5.4 The design submittal should include, but not be limited to, the following:

- a) drawing or sketch of substructure, base beams, substructure-base beam connection and base, beam tie-down detail;
- b) specification of materials;
- c) welding and/or bolt torque procedures;
- d) maximum pedestal reactions;
- e) maximum moment, corresponding thrust, boom length, radius static, rate load, load factor;
- f) maximum thrust, corresponding moment, boom length, radius, static, rated load, load factor;
- g) maximum reaction at tie-down points should be provided;
- h) weights of the crane components;
- i) outside-to-outside dimensions of the crane components;
- j) substructure and base beam drawings (plan, elevations, and sections) showing all dimensions, stiffener locations, and thicknesses.

9.5.5 The substructure, base beam, and tie-down details should be reviewed by a qualified engineer.

9.5.6 Stresses and loads transferred to offshore platform by the crane should be analyzed by the customer. Platform modifications, not including tie-down details, necessary to support the transferred stresses and loads should be analyzed by the facility owner. The analysis, modification, design, and drawings shall be in accordance with API 2A-WSD.

9.6 Crane Equipment

9.6.1 All cranes operating on offshore structures shall have anti-two-blocks devices on main and auxiliary lines.

9.6.2 The crane shall be equipped with boom high angle limiting devices if applicable.

9.6.3 The crane shall have a load indicator.

9.6.4 The temporary crane provider shall supply emergency lowering equipment when handling personnel.

9.6.5 The temporary crane provider shall supply the test certificates for the boom, main, and auxiliary hoist cable, including pendent lines, in accordance with 6.2.

9.6.6 The temporary crane provider should furnish slings that are certified in accordance with 6.3.5 for temporary crane component pre-rigging components.

9.6.7 The crane should be equipped with emergency slew and swing capability.

NOTE A placard with procedures for sufficient operation and necessary tools to accomplish the tasks can satisfy this requirement.

9.6.8 Access shall be provided to the boom for inspections on boom tip and two-block system.

NOTE Access to location points, (e.g. heliport, flare boom, etc.) or boom walkway can be temporary.

9.7 Load Test Requirements

9.7.1 General

9.7.1.1 Temporary Crane Provider shall perform load tests of the temporary cranes in accordance with 4.7 and Annex D of this standard. Temporary cranes shall be subject to the appropriate inspections and load testing after each rig-up or relocation of cranes in accordance with 4.7 and Annex D.

9.7.1.2 When performing a dynamometer load test, the temporary crane provider should furnish a properly calibrated dynamometer with appropriate dial range for the specific load testing requirements. In addition, it is suggested that the temporary crane provider submit a calibration certificate furnished by a third party for the subject dynamometer prior to beginning offshore work.

9.7.2 Function Test of Temporary Crane

Minimum should include rated load to water level and back up, boom up and down through radius, slew/swing with rated load in the quadrants of the lift to be performed as determined by crane customer.

9.8 Preventative Maintenance

9.8.1 The temporary crane provider shall inspect, maintain, repair, and document maintenance and repairs made to crane in accordance with 5.1.3, Annex D, and relevant manufacturer recommendations.

9.8.2 The temporary crane provider's preventative maintenance and repair program shall be performed by qualified personnel in accordance with 5.3.

9.8.3 The temporary crane provider is responsible for all pre-use, monthly, quarterly, and annual inspections of the crane except in a bare rental.

9.8.4 Upon installation of a temporary on crane on an offshore structure, the contractor shall perform an initial inspection and document in accordance with 5.3. A pre-load and post-load test inspection form should be submitted verifying that the inspection was completed.

9.8.5 Quarterly crane inspections shall be performed and documented by a qualified crane inspector designated by the temporary crane provider.

9.8.6 Pre-use and monthly crane inspections shall be performed and documented by a qualified crane operator designated by the temporary crane provider.

9.8.7 Documentation of all inspections should be submitted to the customer representative in accordance with 5.2.2 and 5.2.3, unless waived by the customer.

9.8.8 The temporary crane documentation shall be kept by the crane owner for a period of four (4) years, and accessible upon request.

9.8.9 The temporary crane documentation may be copies of originals.

9.8.10 The temporary crane bare rental customers are responsible for pre-use inspections, monthly, quarterly, and annual inspections, maintenance, operations, and documentation of work of temporary crane.

9.9 Work History

The temporary crane provider should be prepared to submit a work history report of the proposed crane for the last ten (10) jobs or for all jobs in the last twelve (12) months (whichever is shorter). The subject report should include, but not be limited to, the following minimum job specific information:

- a) company, contact name, and phone number of reference;
- b) location and duration of job;
- c) crane configuration, including boom length, sub-base and/or base beam arrangements, etc.;
- d) report of any crane modifications, repairs and/or maintenance performed (i.e. pendant lines);
- e) if applicable, number of times that base beam, ball ring and boom bolts have been torqued;
- f) bare rentals of temporary crane records as provided by users.

9.10 Rental Checklist

The temporary crane provider should submit the following information to the customer:

- a) layout of crane on platform drawings;
- b) crane sub-base beam drawings;
- c) crane base beam drawings;
- d) sub-base to base beam connections;
- e) base beam to platform tie-down design.

These drawings should be reviewed by a qualified person.

9.11 Tie-down Weld Design

The weld design may be indicated on the tie-down drawings. Weld type, size, and location should be indicated. These drawings should be reviewed by a qualified person.

9.12 Torque Procedure

A torque procedure should be submitted if the crane pedestal is attached to the structure via bolts. At a minimum, the procedure shall include bolt, nut, washer grade, size, coating, and torque sequence. Torque should be indicated.

9.13 Weld Procedure

A weld procedure should be submitted if the crane pedestal is attached to the structure via welding. A typical AWS format is sufficient.

9.14 Load Test

Whenever a temporary crane is installed, a load test shall be performed in accordance with Annex D.

9.15 Load Test Procedure

9.15.1 Pre-load test inspection is performed by a qualified inspector on temporary crane.

9.15.2 Perform pre-NDE and post-NDE on temporary crane tie down welds.

9.15.3 Perform load test on temporary crane. The test load should be performed using the Load Test Method with a live load. The initial load test should be lifted and moved in all the quadrants of operation, when the facility configuration allows.

9.15.4 The load test report should include, but not be limited to, the following information.

- a) Auxiliary line, select appropriate load for components being tested:
 - actual test load;
 - actual test radius;
 - indicated load;
 - hydraulic hoist pressure.
- b) Main hoist line, Select appropriate load for components being tested.
 - actual test load;
 - actual test radius;
 - indicated load;
 - hydraulic hoist pressure.
- c) Check radius or boom angle indicator at four (4) values including maximum and minimum.

9.16 Inspection of Temporary Cranes after Installation

Inspection of temporary cranes after installation should include

- a) pre-use inspections,
- b) monthly inspections,
- c) quarterly inspections, and
- d) annual inspections.

Usage on temporary cranes should be considered as heavy usage category.

Annex A

(informative)

Crane Operation

A.1 Operational Considerations

A.1.1 Hands-on proficiency is the last segment of crane operator qualification training. It should be held on a crane similar to the type of crane to be operated by the Qualified Crane Operator, in order to allow them to demonstrate their ability.

A.1.2 During periods of bad weather, such as lightning or high winds, or where the crane operator's ability to see the signal person is impaired by darkness, fog, rain, etc., crane operations should be restricted, at the crane operator's discretion.

A.1.3 A log should be used for pre-use inspection reporting, and may also be used for documenting crane usage. The crane cab, a weather tight enclosure on the crane, or inside the nearest building are examples of appropriate locations for storage of logs.

A.1.4 The hook load may or may not include the weight of the hook block and wire rope. This can be determined from the crane's load rating chart. Examples of ways to determine load weight are:

- weight indicators,
- scales, and
- shore-based weighing.

A.1.5 Sling use guidelines are provided in the following.

- a) Slings, their fittings, and fasteners should be inspected prior to use and retired in accordance with 6.2.
- b) Suitable protection should be provided between the sling and sharp surfaces of the load to be lifted.
- c) Proper storage should be provided for slings while not in use. Special considerations should be given in high heat areas where elevated corrosion and loss of lubrication can contribute to reduced service life.
- d) Slings should never be choked in the splice.
- e) Sharp bends or knots should not be permitted in wire rope slings.
- f) Loads should not be lifted with one leg of a multi-leg sling until the unused legs are secured.

A.2 Moving the Load

A.2.1 The load should be moved in accordance with Section 7 and the following.

- a) The qualified crane operator and the designated signal person directing the lift, if used, should determine that:
 - 1) the load is secured and properly balanced in the appropriate sling or lifting device before it is lifted;
and

- 2) the lift and swing paths are clear of obstructions and personnel.
- b) Before starting to lift, the following conditions shall be verified:
 - 1) the correct slings have been selected for the weight to be lifted;
 - 2) the load is free to be lifted;
 - 3) multiple part lines are not twisted around each other in such a manner that all of the lines will not separate upon application of lift;
 - 4) the hook is brought over the load in such a manner as to minimize swinging;
 - 5) if there is a slack rope condition, the rope is properly seated on the drum and in the sheaves.
- c) During lifting, care shall be taken that:
 - 1) acceleration or deceleration of the moving load is accomplished in a smooth manner;
 - 2) the crane operator should be aware of the effect of the velocity and weight of the load when lowering at high speeds to minimize shock loading;
 - 3) load, boom, or other parts of the machine do not contact any obstruction.

The crane operator should engage the controls smoothly to avoid excessive stress on crane machinery.

When rotating the crane, sudden starts and stops should be avoided. Rotational speed should be such that the load does not swing out beyond the radius at which it can be controlled.

Annex B

(informative)

Usage, Inspection, Testing, and Maintenance

B.1 Usage and Inspection

The following are considerations that should be given to the type of crane usage, manufacturer's recommendations, and any other pertinent criteria. The crane owner should develop a preventive maintenance program in accordance with 5.3.

B.2 Crane Usage

B.2.1.1 Crane Usage Categories

Crane usage categories have been developed for the crane owner to maintain and inspect their equipment based on a duty cycle versus a strict time limit. In order to categorize a crane in the infrequent or moderate usage category, a certain amount of usage documentation is required of the crane owner. This documentation is different from and in addition to the pre-use log. The crane owner has the option of not documenting crane usage, in which case the crane should default to the heavy usage category.

B.2.1.2 Determining Crane Usage

The duty cycle or usage on a crane may be determined by keeping a log of actual crane use. The type of log used is at the discretion of the crane owner. Keeping track of engine run time could also be used, but this would overestimate the actual crane use time. Other types of usage recording devices, such as drum counters, hour meters, etc. could be used. It should be the crane owner's responsibility to keep track and document the duty cycle of each crane.

B.3 Crane Inspection

B.3.1 General

A quarterly inspection should be performed in the event a crane's duty cycle increases from infrequent usage to a higher usage category. However, the annual inspection should not exceed twelve months from the last time it was performed.

The following sections provide information on suggested work scopes for each of the inspection categories listed.

B.3.2 Pre-use Inspection

Pre-use inspections (performed by a qualified crane operator or qualified inspector) should include, but are not limited to, the following actions.

- a) Perform a walk-around visual examination of the crane boom and support structure to verify that no visible damage exists.
- b) Check all fluid levels of prime mover to include the following, where applicable:
 - engine oil;
 - radiator coolant;

- hydraulic reservoir;
 - diesel fuel reservoir;
 - auxiliary hydraulic reservoir.
- c) Verify control mechanisms including brakes and clutches for proper operation.
- d) Visually check for lubricant oil leakage on hoist(s) and all gear boxes. In hoists where a sight glass is provided, also check the fluid level.
- e) Visually check for leakage or damage to the air and non-mechanical systems.
- f) Check the following devices, for proper operation where applicable:
- boom hoist pawl;
 - helicopter warning light;
 - crane hook latch;
 - boom hoist limit;
 - anti-two-block device operation;
 - safe load indicators (if installed).
- g) Verify the correct load-rating chart for the configuration in use is visible to the crane operator at the primary control station.
- h) Visually check wire rope for evident deterioration and damage, or improper reeving.
- i) Visually check for loose, missing, or corroded bolts, pins, keepers, or cotter pins.
- j) Visually check rigging gear to be used, such as slings, sling hooks, and shackles.
- k) Lubricate components and correct deficiencies as required based on the results of these inspections.

B.3.3 Monthly Inspection

Monthly Inspections (performed by a qualified crane operator or qualified inspector) shall include all the elements of a pre-use inspection in B.3.2 and should include, but are not limited to, the following actions.

- a) Further check all control mechanisms for proper function, and contamination by foreign matter.
- b) Check appropriate electrical apparatus for proper function.
- c) Verify the boom hoist limit and anti-two-block devices are functioning properly. Care should be exercised to prevent damage to crane components.
- d) Lubricate components and correct deficiencies as required based on the results of these inspections. Document these results per 5.2.2.

B.3.4 Quarterly Inspection

Quarterly Inspections (performed by a qualified inspector) shall include all the elements of a pre-use inspection (see B.3.2) and a monthly inspection (see B.3.3) and should include, but are not limited to the following actions.

- a) Boom should be inspected for bent chord members, missing or broken lacing, and cracked welds on critical members. Boom section end connections should be inspected for cracked welds, deformation, and corrosion.
- b) Check boom angle/radius indicators over full range for accuracy.
- c) Sheaves should be inspected for wear, cracks, and rope path alignment and bearing condition.
- d) Check power plants for proper performance compliance with safety requirements.
- e) Check belts and chains for proper adjustment.
- f) Visually check crane hooks for deformation, and discard if deformations exceed those manufacturer's recommendations.
- g) Inspect wire rope in accordance with 6.1.
- h) Check lubricant level in all hoists and slew drives, including those not fitted with sight glasses.
- i) Lubricate components and correct deficiencies as required based on the results of these inspections. Document these results in accordance with 5.2.2. Oil sample analysis, as suggested by the hoist manufacturer, is intended primarily to evaluate its mechanical integrity. Oil sample analysis need not necessarily mean a laboratory analysis. It can be effectively achieved by qualitative tests performed in the field by a qualified inspector or crane operator (such as cheesecloth, smell, and texture tests).

B.3.5 Annual Inspection

B.3.5.1 General

Annual inspections (performed by a qualified inspector) shall include all the elements of a pre-use (see B.3.2), monthly (see B.3.3), and quarterly inspections (see B.3.4), as well as inspections of any other critical crane components and weight indicator systems to verify their accuracy, where applicable.

B.3.5.2 Inspection of Critical Crane Components

B.3.5.2.1 General

The annual inspection of critical components appropriate for an individual machine will differ, depending on the crane type and design of the individual components. A basic guideline for inspection of critical crane components should consider but not be limited to the following.

B.3.5.2.2 Hoist Assemblies

Annual Inspection and maintenance of the hoist should be determined by the crane owner as a function of the hoist type, past and anticipated duty cycle, and condition. The quality of the hoist lubricant is considered a primary indicator of the mechanical integrity of the hoist. Brakes should be tested by stalling the drive. Consult the crane manufacturer or other qualified source for the best applicable procedures for testing the hoist and swing parking brakes.

B.3.5.2.3 Foundation

Weldments in the crane's pedestal and supporting deck structure should be visually examined for fracture, deformation, and corrosion. Special attention should be paid to areas of rust and cracked paint.

If foundation issues are identified, the appropriate industry standards (e.g. API RP 2X, BSI 1771, etc.) should be referenced by the crane owner to fully evaluate the damage.

B.3.5.2.4 Swing Circle Assembly

B.3.5.2.4.1 General

The swing circle assembly is the connecting component between the crane revolving upper structure and the pedestal. Consequently, regular inspections are paramount to ensure a long and safe operational life.

There are three main types of swing circle assemblies typically used on pedestal-mounted cranes:

- hook and roller assemblies;
- king posts;
- ball/roller bearings.

The inspection procedure for each varies significantly and should be tailored, not only to fit the type of swing circle assembly, but also for the physical and operational environment of each particular crane and platform.

Regardless of the type of swing circle assembly, the objective of any inspection is to determine and monitor wear, fatigue, corrosion, and the overall operational condition. The crane and swing circle assembly manufacturers are the best sources for information in developing the inspection program. The following are suggested inspection guidelines for each type of swing circle assembly.

B.3.5.2.4.2 Hook and Roller Assemblies

B.3.5.2.4.2.1 Ring Gear

The following apply to inspection of ring gear.

- a) Center pin and bushing condition should be verified and monitored for wear. Center pin wear is generally due to improperly or unevenly adjusted hook rollers.
- b) Proper lubrication of center pin bushing should be verified.
- c) Obvious wear between ring gear teeth and swing pinion gear would indicate center pin wear and improperly adjusted hook rollers.
- d) Excessive lateral wallowing, wobbling, or loud popping noise of machine base or frame indicates center pin bushing wear.

B.3.5.2.4.2.2 Hook Rollers

The following apply to inspection of hook rollers.

- a) Hook rollers to turntable clearance should not exceed manufacturer specifications.
- b) Hook rollers should be evenly adjusted to minimize uneven stress and wear on Center Pin and Center Pin Bushing.

- c) Hook roller path should be smooth, flat, and have no ridges or dents that would cause uneven load distribution.
- d) Hook rollers should be concentric with no flat spots.
- e) Bearings should be well lubricated and should roll smoothly with no noticeable popping or grinding noise.

B.3.5.2.4.2.3 Hook Roller Brackets, Bracket Pads, and Bolts

The following apply to inspection of hook roller brackets, bracket pads, and bolts.

- a) Machine should be tilted fully in both directions noting any deflection between the hook roller bracket and the machined surface of the main frame pad where the hook roller bracket mounts. Consult manufacturer for tolerances.

NOTE Forged castings that comprises hook roller brackets very seldom bend or distort; i.e., the main frame generally yields, thus causing obvious deflection or gap.

- b) Hook roller bracket bolts should be checked for proper bolt torque, excess stretching, excess rust pitting, improper size, etc.

B.3.5.2.4.3 King Post

Bearing areas of the crane should be inspected to ensure that there is no significant wear or damage to either the rotating or stationary load bearing members, which left uncorrected, might result in a loss of structural integrity of the mounting system. The King Post crane inspection procedure will depend on the design of the crane being inspected and should be done in accordance with the manufacturer's recommendations. The inspection should include, but not limited to, the following.

- a) Upper thrust bearing.
- b) Upper radial bearing.
- c) Lower thrust bearings or radial bearings.
- d) King pin wear and condition.
- e) Lower king post radial bearings. The radial bearings condition is critical as it protects the king post from the lower thrust rollers or radial bearings. On cranes not equipped with wear bearings or wear material, the wear zone on the king post shall be carefully monitored to ensure the structural integrity of the king post.
- f) King post-to-platform structural connection.

B.3.5.2.4.4 Ball/Roller Bearing

B.3.5.2.4.4.1 General

This type of swing circle assembly is either bolted and/or welded to the pedestal and rotating crane turntable.

The three major inspections that should be performed are for:

- bearing wear,
- crane/bearing connection integrity, and

- operating characteristics.

B.3.5.2.4.4.2 Bearing Wear

The wear in the bearing shall be monitored to determine its expected service life. The wear measurement may be performed in a number of ways. Some of which are as follows.

- a) Wear assessment by grease sample analysis—wear may be monitored by periodic grease sample analysis as describe in this section. Grease samples should be collected every twelve months as a minimum and the results of the analysis recorded; this period should be shortened if obvious metal or contaminants are present.
- b) Annual Ball Ring Grease Sampling Analysis Method.
 - 1) Preparation
 - Clean the raceway to minimize contamination of the sample.
 - Position the crane boom at the minimum radius to allow a full 360° rotation.
 - Use grease that is recommended by the crane manufacturer.
 - 2) Collection of Sample
 - Pump grease while slowly rotating the crane 360°.
 - A sufficient bead of grease should be observed all the way around the lip seal.
 - Select eight points equally spaced to obtain a sufficient sample.
 - Collect the sample in a clean container, such as a clear plastic bag, sample jar, etc.
 - Clean off excess grease after taking the sample.
 - 3) Evaluation of Sample
 - Take a small portion of the sample and spread it out on a light colored material such as a white cotton cloth, coffee filter, etc.
 - Dilute the grease sample with a solvent to expose any contaminates.
 - Inspect the sample looking for metal particles, sand, nylon, rust, water, etc.

NOTE Special attention should be given to metal particle size, shape, and quantity.

 - The crane manufacturer, appropriate supervisory personnel, or experienced engineer should be consulted if the sample is questionable and further evaluation is required.
- c) Tilt Method — In order to perform this procedure, it shall be possible to fully tilt the bearing forward and rearward using the counterweight of the crane, jacks, boom luffing cylinder, etc. The objective is to measure the total internal bearing raceway to rolling element clearance with no substantial moment on the bearing that could cause elastic deformation.

It is strongly recommended the tilt procedure be performed at a minimum of four locations every 90° around the circumference of the bearing.

This procedure involves positioning a dial indicator between the rotating and nonrotating bearing races. The crane boom is positioned to fully tilt the bearing forward using a light hook load if necessary. The dial indicator is either positioned under the boom or under the rear of the crane in line with the boom centerline and zeroed. The boom is then raised to its highest position to fully tilt the bearing rearward. The bearing clearance is then measured on the dial indicator (see Figure B.1). The bearing should again be tilted forward to its original position to verify the accuracy of the measurement by the dial indicator again reading zero.

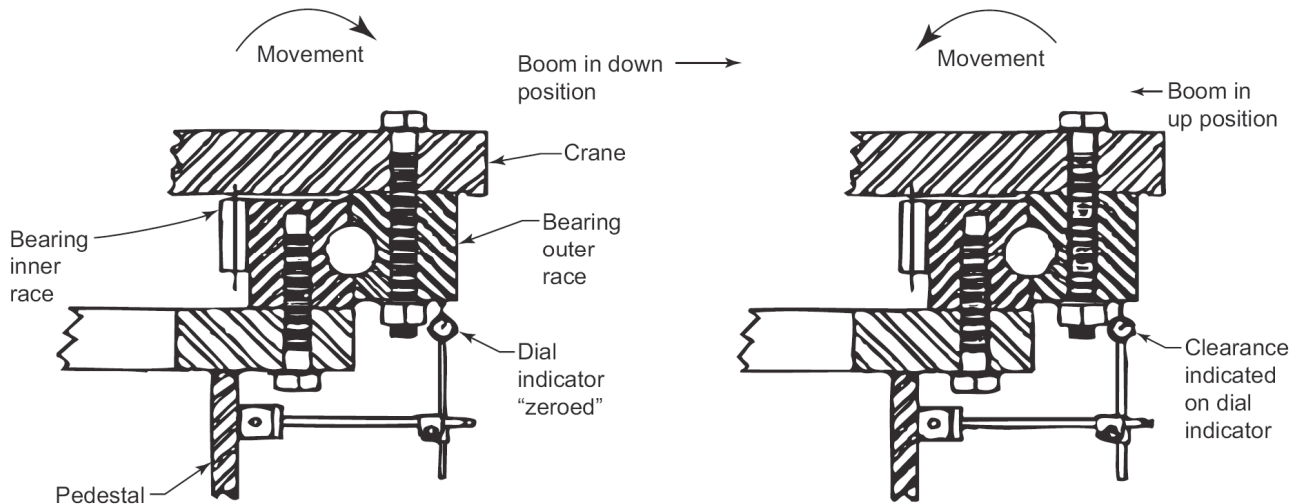


Figure B.1—Tilt Method

CAUTION This tilt procedure can only be used if the crane has sufficient counterweight to fully tilt rearward when the boom is raised to its highest position. If the crane/bearing is not tilted fully, highly inaccurate and misleading clearance measurements will result.

For cranes with insufficient counterweight, jacks may be used to fully tilt the bearing rearward or on box boom cranes, the luffing cylinder may be used to lightly power down against an adequate support to tilt the bearing rearward.

- d) **Depression Measurement Method** — This system involves the monitoring of bearing wear by periodically measuring the distance between two machined surfaces on the front or rear of the crane with the bearing fully tilted forward with no excessive moment load. In order for the procedure to be accurate, the measurements shall be taken between the exact same surfaces at the exact same point each time with the boom at the same position with the same moment load.

The first measurement shall be performed when the bearing is new and the crane is first put into service to obtain a base value for subsequent repeat measurement comparisons. Without having this base value, the depression measurement method cannot be used to determine the total wear in the bearing as the bearing is never tilted rearward (see Figure B.2).

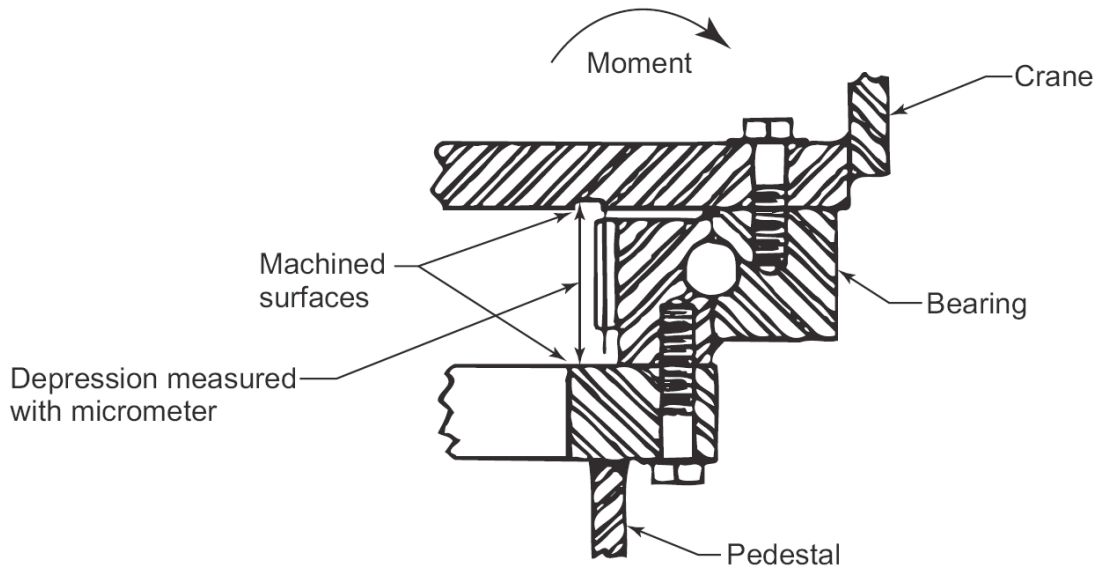


Figure B.2—Depression Measurement Method

- e) Rotation Method — When the Tilt Method cannot be used due to insufficient crane counterweight and when no base value reading was ever taken for use with the Depression Measurement Method, a third method shall be used. One possible third method is the Rotation Method.

The Rotation Method is based on the fact that a bearing may be fully tilted forward in the direction of the boom and the tilt will follow the rotation of the crane. A dial indicator, with a magnetic base, may be fixed to the crane or pedestal with the needle of the indicator positioned on a clean, rust free, machined horizontal surface of the bearing or crane. The dial indicator is positioned in the front or rear of the crane in line with the boom. The boom shall be positioned such that the bearing is fully tilted forward with no excessive moment load.

After the indicator is zeroed, the crane is slowly rotated 360° with the dial indicator reading recorded every 45° of crane rotation. The dial indicator should return to zero when the crane is rotated 360° back to its original position (see Figure B.3).

The dial indicator should be repositioned every 90° in order to perform four individual tests.

This method may not be as precise as the tilt and depression measurement methods as the machined surface of the bearing opposite where it contacts the crane and pedestal flange may not be machined perfectly true to the rolling element raceway diameter.

However, the rotation method does produce reasonably accurate results when performed on a periodic, consistent basis and may be the only method that can be used.

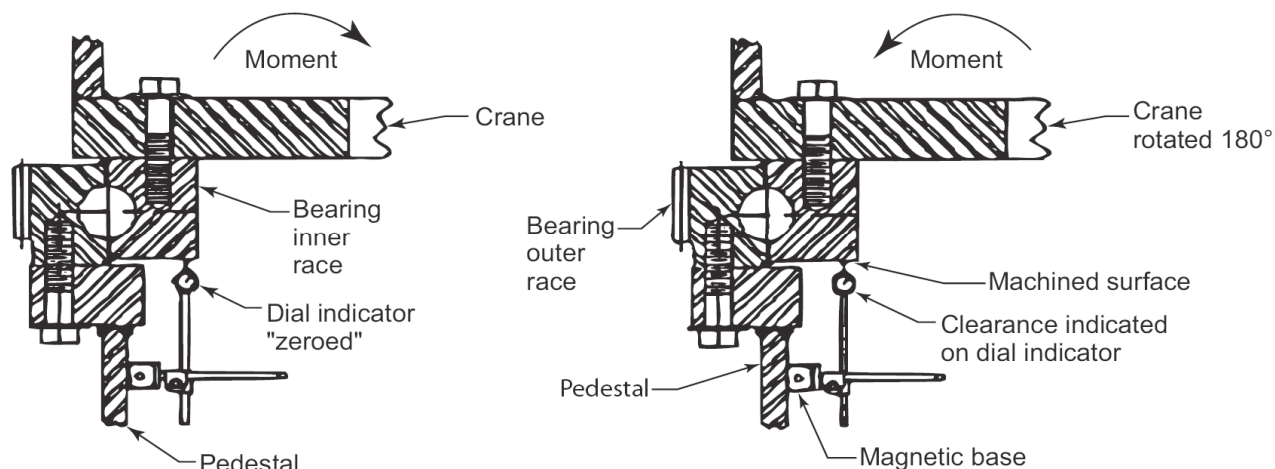


Figure B.3—Rotation Method

B.3.5.2.4.4.3 Crane/Bearing Connection Integrity

The crane/bearing may be connected using bolts, welding or combinations of the two. The integrity of this connection is crucial to the life of the swing circle assembly. The crane and/or swing circle assembly manufacturer should be contacted for guidance when developing the inspection procedures, as each crane is unique.

Bolts shall be correctly preloaded to function properly and the crane manufacturer may be the only source for proper torque/preload procedures and values. General purpose bolt torque charts may not be applicable due to the various bolt materials, plating, surface finishes, joint designs, etc. found in use. A loose or incorrectly preloaded mounting bolt is one of the major causes of swing circle assembly failure.

B.3.5.2.4.4.4 Operating Characteristics

The operating characteristics of a bearing are another factor to be considered in an inspection.

The crane should be rotated 360° in each direction at slow, intermediate, and full speed and the smoothness of rotation monitored. Any irregular, jerky, bumpy, etc. motions should be recorded and further inspection can be necessary.

B.3.5.2.5 Testing Anti-two-blocking Systems

B.3.5.2.5.1 General

A means shall be provided to protect hoist ropes, structural components and machinery from damage which can occur when two sheave groups (e.g. load block and boom head) come into contact as the hoist cables are drawn in. A control override device or proximity warning device may be used. Stalling of the hoist drum is acceptable where damage or loss of control would not result.

NOTE Two-block systems are installed on cranes to assist the crane operators in the avoidance of damage to the crane and cargo. These devices are not failsafe and should not be totally depended on to protect the crane and cargo. Ultimately the qualified operator is responsible for the safe operation of the crane and care of the cargo that is to be handled.

B.3.5.2.5.2 Anti-two-block Testing Guidelines

The location of the hoist/s is important in order to determine the manner in which you test the two-blocking systems.

If the hoist/s are mounted in or on the boom the two-blocking system only needs to stop the upward motion of the main/auxiliary hoists or sound a warning device such as a horn or bell when the load block or overhaul ball comes in contact with the two-blocking valve, hanging weight or boom point.

If the hoist/s are mounted on the upper structure of the crane and the boom moves independent the two-blocking system shall stop the upward motion of the main/auxiliary hoist the downward motion of the boom hoist or sound a warning device when the load block or overhaul ball comes in contact with the two-blocking valve or hanging weight.

B.3.5.2.5.3 Types of Two-blocking Systems and How they Should be Tested

B.3.5.2.5.3.1 Proximity Warning Device

This could be a horn or bell that would sound off when the block/s of the crane comes into contact with a hanging weight that is attached to an air control valve or electric switch mounted on the boom tip. When the weight is lifted the control valve or electric switch should shift sending a signal down the boom to the horn or bell.

When testing, the crane operator should raise the block/s up until each strike their respective weights, the warning device should be capable of being heard over the sound of the engine at full speed and any other noise that can affect the crane operator's hearing.

CAUTION This device is not designed to stop the hoist/s from coming into contact with the boom point. The crane operator shall shift the control lever back to neutral.

B.3.5.2.5.3.2 Stalling of the Hoist Drum

This type of two-blocking system is used on some cranes where the hoist/s are mounted in or on the boom. It is easy to recognize, there is generally a wedge device hanging from the main pin in the boom point. When the blocks are drawn into the boom point the hydraulic relief valve(s) in the hydraulic circuit relieves the pressure from the system to stop the main/auxiliary hoist(s) from moving in the upward direction.

When testing, the crane operator should raise the block/s slowly until each strikes the boom point, then bring the engine to full speed and continue to pull slowly on the control lever until the full system pressure is reached.

CAUTION It is not advisable to get a running start to pull the block/s into the boom point at full speed during the two-blocking test. If the crane is accidentally two-blocked during normal operations at full speed the crane should be inspected before further operations

B.3.5.2.5.3.3 Controlled Override Device

This type of two-blocking system could be an air, electric or hydraulic system that when engaged stops the hoist from pulling before the block/s run into the boom point. An override device is allowed. The override can be used to bypass the hoist up mode to raise the block a little more or lower the block to get out of the two-block mode.

The crane operator should check to make sure the override device is not engaged. Most override valves are spring loaded to automatically remove the valve from the override position. Then raise the block(s) slowly until each strikes the hanging weight or hanging valve. The hoist being tested should stop. Raise the engine to full speed while holding the hoist control in the full up position. The hoist should not move or at worst case creep up very slow. Engage the override device and lower the block(s) a sufficient distance to ensure the override device is not engaged. Engage the control lever for the hoist to be tested in the up position. When

the block strikes the hanging weight or hanging valve the hoist should stop completely within 12 in. to 18 in. (30.5 cm to 45.7 cm) or at worst creep up slowly.

If the hoists are mounted on the upper structure and the boom is independent, the two-blocking system shall be tested to make sure the boom down function will stop if the two-blocking hanging valves or hanging weights are engaged. Raise the boom to approximately 45 degrees. Lower the block(s) a few inches below the two-blocking hanging valves or hanging weights. Lower the boom slowly if an auxiliary hoist is on the crane the overhaul ball should strike the hanging two-block device first, the boom should stop going down immediately. Engage the override and lower the overhaul ball down sufficient distance to ensure the anti-two-block device is not engaged. Attempt the same test on the main block, the same results should be obtained.

CAUTION If the override valve is engaged the two-blocking system is bypassed. If conducting the test at full speed, be prepared to shift the control lever back to neutral if the speed does not drastically change when the block(s) strike the hanging weight or hanging valve.

B.3.5.2.5.3.4 No Override Two-blocking Systems

This system was designed to eliminate the need for an over-ride device. If the crane operator engages any part of the two-blocking or high angle safety system, the operator only needs to reverse the control lever to get out of the two-block safety mode.

This test can be performed as described in B.3.5.2.5.3.1 without the need to check the override valve or to engage the override to get out of the two-block safety mode. A qualified crane operator or qualified inspector should operate the crane while testing safety devices.

Annex C

(informative)

Crane-assisted Personnel Transfer

C.1 Purpose

The purpose of this annex is to provide guidance for crane assisted personnel transfer operations. This appendix recognizes that there are multiple parties (facility, vessel, employer of personnel) involved in transfers and stresses the importance of complete communication and understanding of the process by all parties.

C.2 General Information

C.2.1 The transfer of any person should only be undertaken with their agreement. No one should be transferred by personnel transfer device against his or her wishes.

C.2.2 “Free-fall” lowering shall not be permitted when personnel are transported.

C.2.3 The number and/or weight of personnel transferred per trip in a personnel transfer device should not exceed either the manufacturer’s crane personnel handling rating or the transfer device rating.

C.2.4 A job safety analysis (JSA) should be conducted for personnel transfer via a personnel transfer device. All personnel participating in the transfer, including the passengers to be transferred, shall participate in the personnel transfer JSA process.

C.2.5 No personal luggage or cargo should be permitted inside the transfer device unless the transfer device is designed for this purpose i.e. transfer device has designated marked areas for light luggage. Should there be any doubt about what is “light” a cargo basket should be used to transfer the luggage.

C.2.6 Personnel transfer devices should not be used for cargo (material) transfer. Heavy luggage, sharp items, and cargo should be transferred in a cargo basket separately from the personnel. Luggage should not be transferred in the center of the net-style transfer device. This practice can cause the debarkation process to be slowed, the rider be delayed in getting to a safe area and increase the risk of a back injury due to the awkwardness of leaning over to get bags. These reasons become especially important in rougher seas.

C.2.7 Personnel going offshore the first time should receive personnel transfer training that is based on the type of personnel transfer device that can be used. Before any attempt is made to lift personnel with a transfer device, clear instructions should be given to all persons involved.

C.2.8 All personnel riding a personnel transfer device shall wear an approved work vest or PFD. When transfers are conducted at night, the PFD/work vest light should be operable during the transfer.

C.2.9 Personnel transfer devices should not be used in weather, wind, or sea conditions that either the vessel captain/master or MODU/facility crane operator considers unsafe. Acceptable operating envelopes will vary depending on the following:

- size of vessel;
- if the vessel is equipped with dynamic positioning;
- landing space on the vessel is limited;

- wind speed/direction;
- transferee experience;
- transfer device;
- wave conditions;
- crane operator experience;
- other variables.

If the operating envelope is in question the vessel captain/master and crane operator should communicate and make a joint decision whether or not to go ahead with the transfer.

C.2.10 Radios are the preferred method of communication between the crane operator and facility deck or vessel personnel; everyone who is involved in the transfer operation should be equipped with a portable or fixed radio. Whenever possible, vessel and facility deck personnel and crane operators should communicate with radio headsets with integrated microphones that fit on or under required PPE.

C.2.11 A designated signalman (banksman) should be assigned to the personnel transfer operation and provide clear instructions to the crane operator via radio or hand signals (see Figure 1).

C.2.12 The Crane Operator should have a clear line of sight to the personnel transfer device at all times during the transfer. If obstructions block the Crane Operator's view, it can be necessary to move cargo or reposition the boat so that the Crane Operator's view is not obstructed. If this is not possible, a risk assessment which is approved by both the OIM and vessel master should be conducted before proceeding with the operation.

C.2.13 A safe designated primary landing zone should be determined by the qualified person. Personnel transfer devices should not be landed on the boat or facility deck unless there is a clear area for the personnel transfer device to be landed. Personnel transfer devices should not be landed on top of cargo.

C.2.14 Crane operator, facility deck and vessel personnel shall recognize API crane hand signals. In the event that a radio is not available, or radio communications are lost, prior to the lift, the crane operator and vessel personnel should verify with each other that they are familiar with and recognize the hand signals described in Figure 1.

C.2.15 Inspection of the personnel transfer device and rigging should be conducted prior to use on each work shift by a qualified person in accordance with company policies/procedures developed in consideration of manufacturer's inspection procedures and this document. The inspection procedures should include but are not limited to the following:

- a) visually inspect safety load line, swages and associated hardware when attaching to crane hook;
- b) inspect crane hook positive locking device for proper function and physical condition;
- c) inspect emergency fall containment line and attachment shackle, if installed;
- d) ensure snag resistant tag line is properly attached;
- e) ensure that no non-original equipment manufacturer's modifications have been made to the personnel transfer device.

C.2.16 Additional more in-depth inspections of personnel transfer devices should also be conducted following company policies/procedures developed in consideration of manufacturer's inspection procedures and applicable regulations.

C.2.17 Personnel transfer devices should be attached to the crane hook assembly in accordance with the manufacturer's instructions. In addition, the transfer device should have the following.

- a) A snag resistant tag line should be attached to either the center deck lashing point or the outside bottom platform ring in such a manner that the potential for tag line damage is minimized when the transfer device is resting on a surface. The tag line should be attached with a minimum $\frac{5}{8}$ in. (15.9 mm) bolt type anchor shackle. Personnel transfer device tag lines should be identified by a high visibility color or reflective external coating.

C.3 Facility Personnel Transfer Procedures

C.3.1 Each facility that transfers personnel using personnel transfer devices should have documented transfer procedures. These should include but are not limited to the following:

- a) a pre-use inspection should be performed on the personnel transfer device(s) prior to conducting personnel transfer operations;
- b) when not in use, the personnel transfer device should be stored in accordance with the manufacturer's recommendations;
- c) crane hooks used for personnel transfers shall have a positive locking latch;
- d) cranes assigned to personnel lifting duties shall be suitable for this purpose in accordance with API 2C;
- e) only qualified crane operators in accordance with 8.2 or regulatory requirements should be assigned to personnel transfer duties utilizing a crane;
- f) only personnel transfer devices specifically designed for personnel transfer shall be used;
- g) personnel transfer devices shall not be used as a work platform;
- h) a semi-rigid, snag resistant tag line of a minimum length of 10 ft (3.05 m) should be affixed to all personnel transfer devices;
- i) when conditions are less than favorable (limited deck space on the vessel, weather, wind, or sea conditions) the facility crane operator shall confer with the vessel captain to determine if the operating envelope is acceptable.

C.3.2 Facility personnel who are in charge of personnel transfers should inform employees about the type of transfer procedures used to gain access to the offshore destination. It should be determined whether any persons are feeling ill, suffer from vertigo, or have any anxiety regarding transfer procedures.

C.3.3 The crane operator should observe the vessel and facility to ensure that there is a clear area on the vessel deck and/or facility deck to safely land the personnel transfer device.

C.3.4 The crane operator can refuse to lift any person who does not comply with the operator's or the operator designee's instructions.

C.4 Vessel Personnel Transfer Procedures

C.4.1 The vessel captain/master is in total command of the vessel. However each vessel crewmember has the authority and responsibility to stop any unsafe operation on the vessel (stop work authority).

C.4.2 The captain/master of the vessel is responsible for safe positioning of the vessel during lifting operations and should consult with the crane operator prior to a lift for details related to positioning. During crane operations, the vessel should move as little as possible and not follow the movement of the load.

C.4.3 Prior to boarding the vessel, personnel should be informed of the type of transfer procedures used to gain access to the offshore destination. It should be determined whether any persons are feeling ill, suffer from vertigo, or have any anxiety regarding transfer procedures.

C.4.4 The vessel captain/master or designee in charge of a personnel transfer from a vessel should determine whether any persons are feeling ill, suffering from seasickness, or vertigo, or have any anxiety regarding the transfer and make appropriate accommodations to safely transfer the person.

C.4.5 Passengers should remain in the designated passenger area until given the clearance to exit. Before any attempt is made to lift personnel with a personnel transfer device, clear instructions should be given to all persons involved.

C.4.6 All personnel should wear a securely donned and approved PFD (personal flotation device) or work vest (and immersion suit or other PPE where required) during the transfer.

C.4.7 The vessel captain/master or designee should determine whether or not there are any first-time riders. It should be determined whether or not first-time riders have received instructions on how to ride the personnel transfer device. If first-time riders have not received training, they should be given at a minimum training as laid out in C.5.1.

C.4.8 Personnel waiting to board the personnel transfer device should stay in the vessel's designated safe area until informed that it is safe to approach the transfer device.

C.4.9 The vessel captain/master can refuse boarding privileges to anyone appearing under the influence of alcohol or drugs. This person should then be referred to the company officials for further actions.

C.4.10 The deck of the vessel should have clearance where the crane operator can safely place and retrieve the personnel transfer device in the designated landing area.

C.4.11 Vessel personnel should verify the crane operator has an unobstructed view of the personnel transfer device landing area and signal person on deck.

C.5 Personnel Transfer Device Operations

C.5.1 General

C.5.1.1 Personnel transfer devices can be flexible or fixed/rigid wall design with a passenger area and designed for the transport of personnel by an offshore crane to and from a vessel. The passenger area may be designed for either seated or standing personnel transport.

C.5.1.2 Personnel to be transferred by a personnel transfer device for the first time should be trained in accordance with the manufacturer's instructions. This training should include orientation on the safe use of personnel transfer devices to include the following:

- a) safe loading and unloading procedures;
- b) crane actions, movements and signals;
- c) body positions, pinch points, and personal stability;
- d) personnel luggage loading procedures and limitations;
- e) personnel protective equipment requirements;

C.5.1.3 During the JSA, instructions to riders should include but not be limited to the following.

- a) If you are ill, suffering from seasickness, or suffer from vertigo, be sure to inform the deck personnel who are assisting with the transfer operation.
- b) Horseplay or pranks of any kind during personnel transfers are unsafe and are prohibited.
- c) Stay in the vessel's designated safe area until informed that it is safe to approach the personnel transfer device.
- d) Do not jump from the personnel transfer device.
- e) Do not attempt to carry anything in your hands when boarding or riding a personnel transfer device.
- f) On net type transfer devices, passenger forearms should be interlocked on the inside of the sidewall netting.
- g) Watch for the personnel transfer device landing, stand back and do not approach the personnel transfer device until ordered so by the crewmember in charge.
- h) If being transferred in the standing position, be prepared for a possible hard landing with knees bent.
- i) Place luggage in a separate cargo basket (exception—a personnel transfer device equipped with a designated cargo area and small/light baggage only).
- j) Always use proper manual lifting techniques for luggage.
- k) Only the designated signal person should be permitted to communicate with the crane operator.

C.5.2 Personnel Transfer Device Procedures

C.5.2.1 The following applies when transferring personnel by a net type personnel transfer device.

- a) Individuals should be instructed to stand on the outer rim, evenly spaced, and adjacent to a sidewall opening in the netting, facing inward.
- b) Passenger forearms should be interlocked on inside of sidewall netting.
- c) In preparation for lifting off the deck, personnel should have one foot firmly placed on the basket rim and the other foot on the deck of the boat (facility) for stability.
- d) As the crane operator begins to hoist the net type personnel transfer device, passengers step off the deck and place both feet firmly on the outer rim.
- e) As the personnel transfer device nears the deck, personnel should bend their knees slightly to absorb any landing shock and be prepared to step off.
- f) Nothing is carried in the hands when boarding or riding the basket. Backpacks shall not be worn while riding in the basket or when carry equipment or heavy packs.

C.5.2.2 The following applies when transferring personnel by a rigid personnel transfer device.

- a) For rigid personnel transfer devices where passengers sit:
 - individuals should be instructed to sit on the seats, evenly spaced/even weight distribution and fasten any installed safety harness or safety straps;

- in preparation for lifting off the deck, personnel should sit firmly back into the seat;
- as the personnel transfer device nears the deck, personnel should remain seated until directed to unfasten any safety harness and safely but quickly step out of the transfer device.

b) For rigid personnel transfer devices where passengers stand:

- individuals should use the same procedures as a rope personnel basket but with the following changes;
- man positioning lanyards should be provided and used according to company and manufacturer's recommendations;
- riders should stand just inside the outer rigging and grasp the inner rigging in the same manner as they hold the outside vertical lines on a net basket.

NOTE Rigid personnel transfer devices are normally designed for carrying light luggage (see C.2.5).

Annex D

(normative)

Load Testing

D.1 The load applied to the crane during the test should be carefully chosen by the designated qualified inspector. Since the test loads are based on the crane rating chart, the qualified inspector shall be familiar with the applicable load-rating chart. Figure D.1 is a graph of capacity vs. radius for a typical crane. The rating for the crane is always limited by the lowest point of all the curves as shown in Figure D.1. The load-rating chart should show the approved load rating at operating radii not exceeding 5 ft. (2 m) increments and corresponding boom angles/radius feet down to horizontal for the specified boom length and jib length where applicable. Note the shaded area for the typical crane rigged with two-part line and the transition points A and B. To the left of point A, the rated load is limited by the available hoist line pull. Between points A and B, the rated load is limited by the over turning-moment (OTM); and to the right of point B, the rated load is limited by the boom suspension system. This graph has been greatly simplified for this illustration and the qualified inspector should be aware that curves for the boom, gantry, swing bearing, etc., have been omitted for clarity. Since the crane's hoists will be used to impose the overload on the crane, the qualified inspector should choose a test load that is within the capacity of the hoist(s) as normally rigged. The crane should not be rigged with extra parts of line to lift a greater test load at a closer radius. If the crane is hoist-limited, the test load may be imposed on the crane with a lesser load at a greater radius.

D.2 Using Figure D.1 as an example, the rated load for a four-part line at 20 ft (6.1 m) has the same OTM as a two-part line at 40 ft (12.2 m). To the right of point A, a two-part line is capable of overloading the crane while the auxiliary line cannot overload the crane at any radius. The qualified inspector should be aware that line pull on many non-mechanical and electric hoists may be self-limiting. The load test requires self-limiting hoists lift at least 100 % of the rated load.

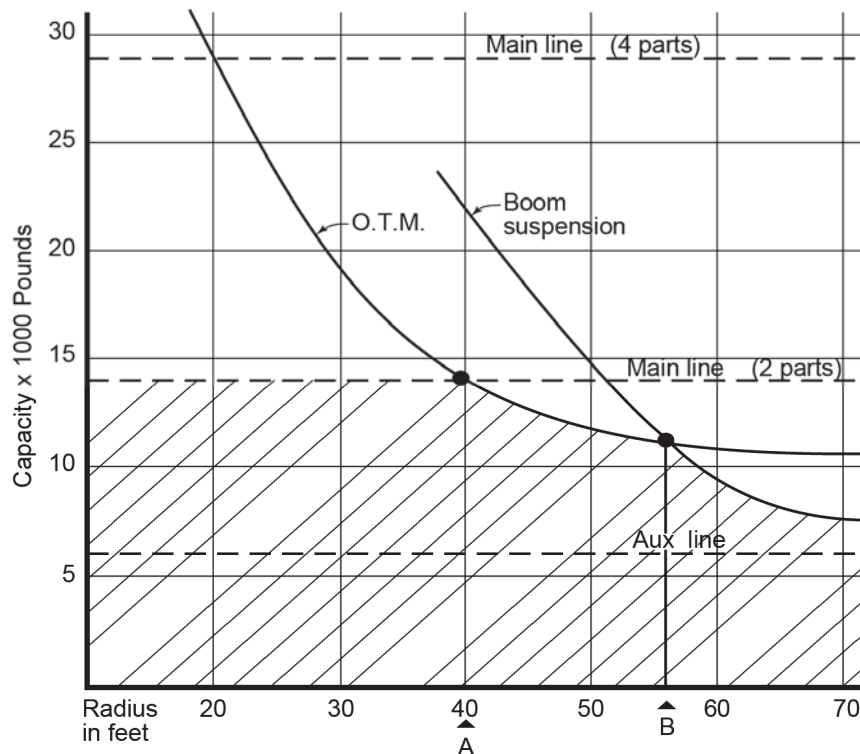


Figure D.1—Capacity vs. Radius for a Typical Crane

D.3 The qualified inspector should also take into consideration the maximum and minimum boom angles that are usually employed in anticipated material transfers. Consideration should be given to the maximum parts of line that the crane would reasonably be expected to use. The test load for all lifts shall be based on crane rating chart, wire rope strength, available hoist line pull, and number of parts of line. The static/onboard test load and the test radius should be calculated to load the crane as shown in Table 1.

D.4 Figure D.2 is an example of a typical load chart posted at operator control station.

D.5 Example of load test for fixed bottom-supported structure (in U.S. customary units).

NOTE This example may not be applicable to other type facilities or equipment.

- a) Four-part capacity > 62 degrees = not to exceed 27,432 lb due to hoist limitations;
- b) Four-part capacity in mid-range 40 to 50 degrees (R = radius):
 - 1) 44 degrees/60 ft R = 17,540 lb. $\times$ 1.25 = 21,925 lb to be applied for load test,
 - 2) 49 degrees/55 ft R = 19,680 lb. $\times$ 1.25 = 24,600 lb to be applied for the load test,

Crane Model Number: _____			
Crane Serial Number: _____			
Radius ft (m)	Boom Angle Degrees	Static/Onboard Main Hoist Capacity, 4-part lb (kg)	Static/Onboard Auxiliary Hoist Capacity, 1-part lb (kg)
20 (6.1)	77	27,432 (12,443)	6000 (2722)
25 (7.6)	73	27,432 (12,443)	6000 (2722)
30 (9.1)	70	27,432 (12,443)	6000 (2722)
35 (10.7)	66	27,432 (12,443)	6000 (2722)
40 (12.2)	62	27,432 (12,443)	6000 (2722)
45 (13.7)	58	25,330 (11,490)	6000 (2722)
50 (15.2)	53	22,250 (10,092)	6000 (2722)
55 (16.8)	49	19,680 (8927)	6000 (2722)
60 (18.3)	44	17,540 (7956)	6000 (2722)
65 (19.8)	38	15,720 (7130)	6000 (2722)
70 (21.3)	32	14,160 (6423)	6000 (2722)
75 (22.9)	25	12,810 (5811)	6000 (2722)
80 (24.4)	15	11,660 (5289)	6000 (2722)
NOTE 1 Main hoist capacities are based on four-part reeving of $\frac{5}{8}$ in. (15.9 mm) diameter wire rope (minimum breaking strength = 45,400 lb [20,593 kg]).			
NOTE 2 Auxiliary hoist capacities are based on one-part reeving of $\frac{5}{8}$ in. (15.9 mm) diameter wire rope (minimum breaking strength = 45,400 lb [20,593 kg]).			
NOTE 3 Sheave efficiency is included.			
NOTE 4 All ratings in accordance with the original code of construction.			

Figure D.2—Example of a Typical Load Chart

3) 53 degrees/50 ft $R = 22,250 \text{ lb.} \times 1.25 = 27,812 \text{ lb.}$

NOTE This capacity exceeds the hoist capacity. If this angle/radius is chosen for the load test the load test shall not exceed 27,432 lb.

c) Four-part capacity < 25 degrees = capacity $\times 1.25$;

d) One-part capacity during load test not to exceed 6000 lb.

D.6 Load test procedures should contain the following information at a minimum:

- date;
- crane owner;
- platform or vessel name;
- crane manufacturer;
- crane model;
- crane serial number;
- boom length, main
- boom length, auxiliary;
- parts of line, main hoist/auxiliary hoist;
- crane owner's representative;
- qualified inspector;

NOTE The crane owner's representative and the qualified inspector may be the same individual.

- inspector's company/agency;

D.7 In the case of cranes that do not conform to API 2C, third edition or later, the crane manufacturer, or other qualified source (such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane, as determined by the crane owner) should be consulted, as required, to determine test loads based on the crane's normal rigging arrangement.

D.8 The test load should be applied by one of the following methods.

- a) Suspended Weight Method—select a suitable test load, assemble the load, lift the load and boom out to the desired radius. With the load suspended, set the load hoist and boom hoist brakes and check for drum rotation. The initial load test should be lifted and moved in all the quadrants of operation, when the facility configuration allows.
- b) Dynamometer Method—determine the dynamometer tie-down locations. Measure and record the radius value. Align the boom point with the tie-down and attach the dynamometer. Verify that the load hoist line is vertical, pull with the load hoist until the desired test load is indicated on the dynamometer. Set the load hoist brake and check for drum rotation.

D.9 The load test report should include, but not be limited to, the following information.

- a) Auxiliary Line, select appropriate load for component(s) being tested:

- actual test load;
 - actual test radius;
 - indicated load;
 - hydraulic hoist pressure.
- b) Main hoist line, select appropriate load for component(s) being tested:
- actual test load;
 - actual test radius;
 - indicated load;
 - hydraulic hoist pressure.
- c) Check radius or boom angle indicator at three (3) values including maximum and minimum.
- Measured actual radius and indicated radius:
- Minimum;
 - Intermediate;
 - maximum.
- d) Measured actual boom angle and indicated boom angle:
- Minimum;
 - Intermediate;
 - maximum.
- e) Function the following and record test results:
- main hoist anti-two-block;
 - auxiliary hoist anti-two-block;
 - high boom angle limit;
 - low boom angle limit (if applicable);
 - prime mover shutdown;
 - emergency shutdown;
 - rotate crane.
- f) Record relief valve pressure setting on the following hydraulic functions:
- hoist circuits;
 - boom circuits;
 - swing circuits.

Annex E

(informative)

Crane Maintenance

E.1 Maintenance Procedure

E.1.1 A hazard review of the work scope (e.g. a JSA, LOTO, risk assessment, etc.) and the following processes, where applicable, should be conducted before adjustments, repairs and maintenance are started on a crane:

- a) boom shall be lowered to the deck or boom rest or otherwise secured against dropping and swinging;
- b) blocks shall be lowered to the deck or otherwise secured against dropping and swinging;
- c) all controls shall be in the off or neutral position.

E.1.2 Adjustments can include, but are not limited to, the following:

- a) all operating mechanisms and control systems;
- b) limit devices;
- c) swing circle assembly;
- d) prime mover;
- e) non-mechanical system; appropriate out-of-service signs should be placed at the control station and/or prime mover by a qualified crane operator or inspector.

After adjustments, repairs, and maintenance have been completed, the crane shall not be put in-service until all guards have been reinstalled, LOTO removed, limit devices reactivated, and maintenance equipment removed. Corrective action taken shall be documented, and outstanding deficiencies shall be documented and reported to the PIC or the crane owner.

E.2 Repairs and Replacements

Booms being assembled or disassembled on the deck, with or without support of the boom harness, shall be securely blocked or supported to prevent dropping of the boom and/or boom sections.

No welding repairs shall be made to critical components, such as booms and swing circle assemblies, without specific repair procedures and recommendations from the original crane manufacturer, or other qualified source (such as an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in the design of the crane, as determined by the crane owner).

Annex F

(normative)

Wire Rope and Sling Inspection, Maintenance, and Replacement

F.1 Wire Rope Components

Wire rope, also called rope, consists of three basic components:

- the core;
- the individual wires that form the strands; and
- the multi-wire strands that are helically laid around the core (see Figure F.1). See API 9A for further information.

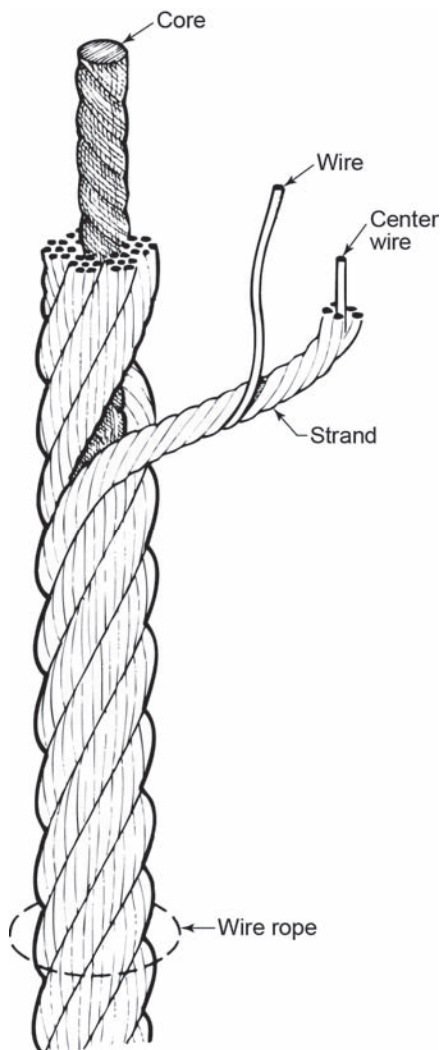


Figure F.1—Three Basic Components of Wire Rope

A rope lay or lay length is the distance measured parallel to the axis of the rope in which a strand makes one complete helical revolution about the core (see Figure F.2).

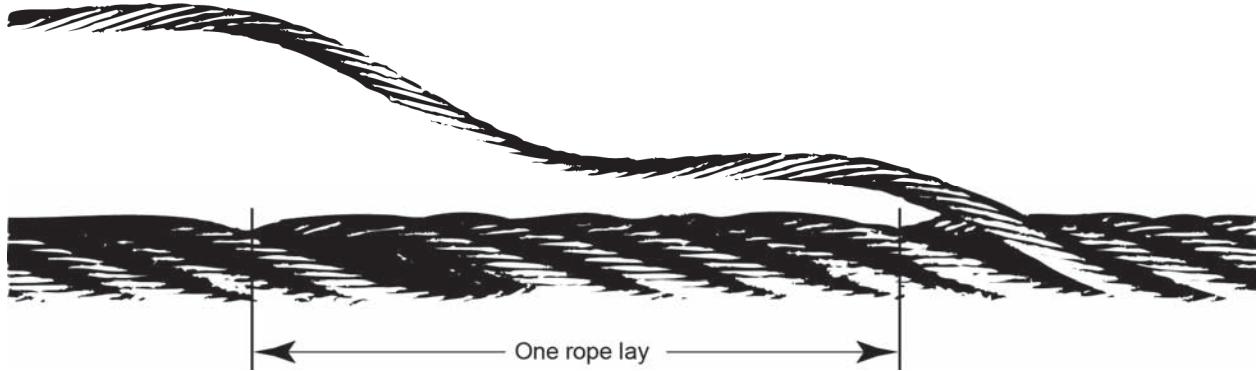


Figure F.2—Showing Distance of One Rope Lay

F.2 Wire Rope Inspection

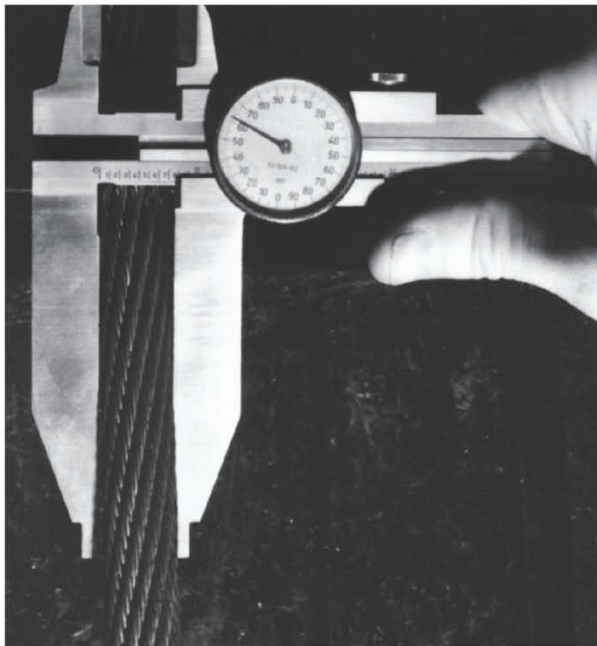
Wire rope inspection items should include, but not be limited to, the following.

- a) Reduction of rope diameter below the nominal diameter, or initial wire rope dimensional measurements, due to wear of outside wires, loss of core support or internal or external corrosion. Core failure in rotation-resistant rope can be difficult to observe. Typical methods to check core failure are as follows:
 - diameter measurement; diameter is reduced with core deterioration (see Figure F.3);
 - length of lay measurement; core failure results in an increase in the lay length (see Figure F.4).
- b) The number of broken outside wires and the concentration of the broken wires. Attention should be given to valley breaks where the breaks are at the strand to contact points (see Figure F.5).
- c) Worn outside wires.
- d) Corroded or broken wires at the end connections. Corroded, cracked, bent, worn, or improperly applied end connections.
- e) Kinking, crushing, cutting, or unstranding.
- f) Improper spooling on hoist drum such as:
 - strand crushing,
 - core protrusion,
 - abrasion,
 - excessive strand gaps,
 - loose and uneven spooling,
 - high stranding.

- g) Heavy wear and/or broken wires occur in rope sections in contact with certain components of the crane. Care shall be exercised in inspecting the rope at these points. Inspection shall include, but not be limited to, the following areas.
- Equalizer sheaves or saddles, also referred to as fixed guides, or other sheaves.
 - End connections including socket or end attachments to running ropes, boom pendants and other standing ropes.
 - Sections of the rope where the rope is continually running over sheaves within the various hoist systems. This inspection is of particular importance where boom angle and load block changes are frequent and limited to short distances.
 - Crossover and flange points of the rope on the hoist drums.

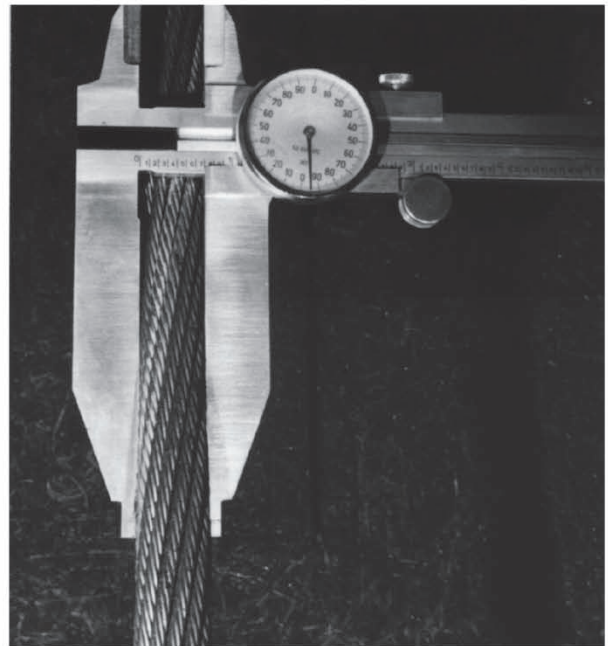
Measurement—Diameter
(Can be detected by inspection and measurement)

Core and not Broken



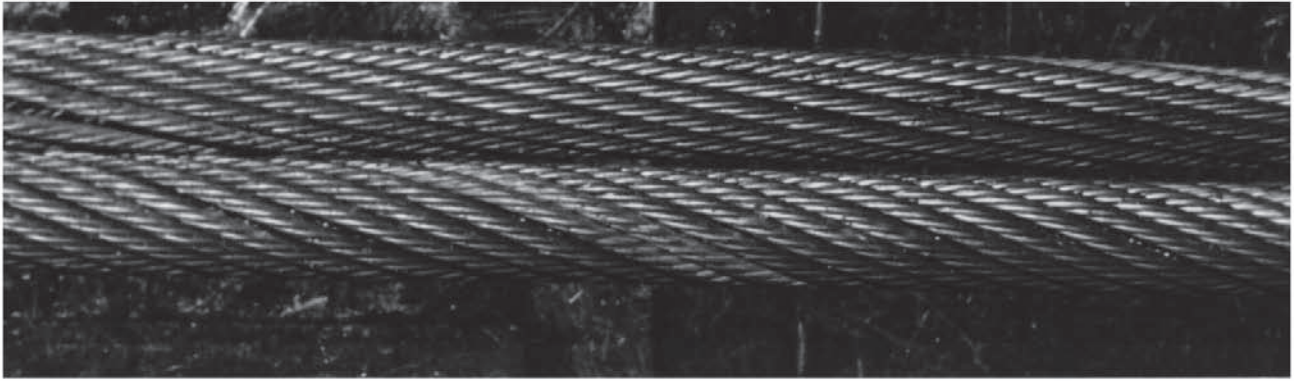
NOTE The measurement of a $\frac{3}{4}$ in. (19 mm) rotation-resistant rope under 10,000 lb (4536 kg) load away from the break measures 0.762 in. (19.4 mm).

Core Broken



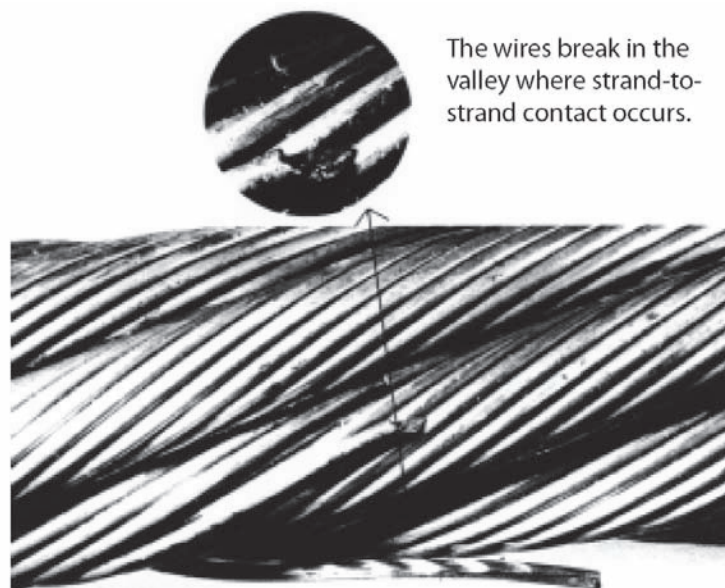
NOTE The measurement of a $\frac{3}{4}$ in. (19 mm) rotation-resistant rope under 10,000 lb (4536 kg) load away from the break measures 0.695 in. (17.7 mm).

Figure F.3—Measurement—Diameter



NOTE The top wire rope has the core failure and shows a definite increase in lay length.

Figure F.4—Core Failures in Rotation-Resistant Wire Rope



Check for internal damage after discovering broken wires between strands.

Figure F.5—Valley Breaks

F.3 Sheave Inspection

Sheave inspection should include, but not be limited to, the following:

- a) check with a groove gauge for wear and for corrugation (the rope imprint in the groove surface);
- b) check for broken or chipped flanges;
- c) check for cracks in the hub;
- d) check for freedom of rotation without drag;

- e) check for bearing wear, with consideration given to bearing type;
- f) check rope path for cracks, chips or other deterioration.

F.4 Wire Rope Rejection Criteria

F.4.1 The following criteria are based on using the wire rope under maximum load conditions. While the wire rope should be replaced if any of the conditions are found, limited usage can continue until the wire rope is replaced. This determination shall be made by a qualified crane operator or a qualified inspector.

F.4.2 When broken wires appear, the inspections should be at more frequent intervals as additional broken wires can be anticipated in a short period of time. Valley breaks are more detrimental than surface broken wires.

The following are rejection criteria for wire rope.

- a) Running ropes used in the boom hoist:
 - Six randomly distributed broken wires within one lay length;
 - Three broken wires in one strand within one lay length.
- b) Running ropes of rotation-resistant construction used in the main or auxiliary hoist:
 - Four randomly distributed broken wires within 30 rope diameters;
 - Two broken wires in one strand within six rope diameters.
- c) Standing ropes such as boom pendants:
 - Three broken wires within one lay length;
 - Two broken wires at the end connection.
- d) One valley break can indicate internal rope damage requiring close inspection of this section of the rope (see Figure F.5). When one or more valley breaks are found in one lay length the rope should be retired.
- e) The rope construction has been distorted by kinking, crushing, or other distortional damage.
- f) There is evidence of heat damage from any source (i.e. engine exhaust, flare towers, stress corrosion cracking, etc.). Heat can be generated by passing a rope over a frozen or non-turning sheave, contact with structural members of the crane, improperly grounded welding leads or lightning strikes.
- g) Reductions for the rope diameter, from initial wire rope dimensional measurements, in a nonworking area (an area away from the sheaves) compared to the lowest diameter of rope measured in three working areas (areas where the rope regularly goes over a sheave) of more than the following is observed:
 - $\frac{3}{64}$ in. (0.047 in.) (1.2 mm) for diameters up to and including $\frac{3}{4}$ in. (19.1 mm);
 - $\frac{1}{16}$ in. (0.062 in.) (1.6 mm) for diameters of $\frac{7}{8}$ in. to $1\frac{1}{8}$ in. (22.2 mm to 28.6 mm);
 - $\frac{3}{32}$ in. (0.093 in.) (0.8 mm) for diameter of $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. (31.8 mm to 38.1 mm);
 - For rope diameters greater than $1\frac{1}{2}$ in., a 5 % diameter loss from baseline measurement.

See Figure F.6 for the proper method of measuring rope diameters.

- h) Increase in the length of an individual rope lay is observed. This increase in lay length and accompanying reduction in diameter can be caused by failure of the core. This can occur more readily in ropes or rotation-resistant construction (see Figure F.4).
- i) Corrosion that causes pitting to the surface of individual wires is cause for rope replacement.

F.4.3 Wire rope replacement should be selected by using the following criteria.

- a) Boom hoist rope replaced with rope of the same diameter, length, construction, grade, (either galvanized or bright with the same minimum break load) as originally furnished or as recommended by the Crane Manufacturer or other qualified sources (see item d). Rotation resistant rope should not be used to replace boom hoist ropes.
- b) Pendants or standing ropes replaced with rope of the same diameter, length, construction, grade, (either galvanized or bright with the same minimum break load) as originally furnished or as recommended by the crane or rope manufacturer. End connections should be the same as originally furnished or as recommended by the Crane Manufacturer or other qualified sources (see item d).
- c) Load hoist ropes replaced with rope of the same diameter, length, construction, grade (either galvanized or bright with the same minimum break load) as originally furnished or as recommended by the Crane Manufacturer or other qualified sources (see item d).
- d) When the replacement rope is other than the type and grade that was originally furnished, all load rating charts should be reviewed and altered as appropriate by the original crane manufacturer, an API 2C-licensed crane manufacturer, authorized surveyor, or an engineer experienced in crane wire rope applications as determined by the crane owner.

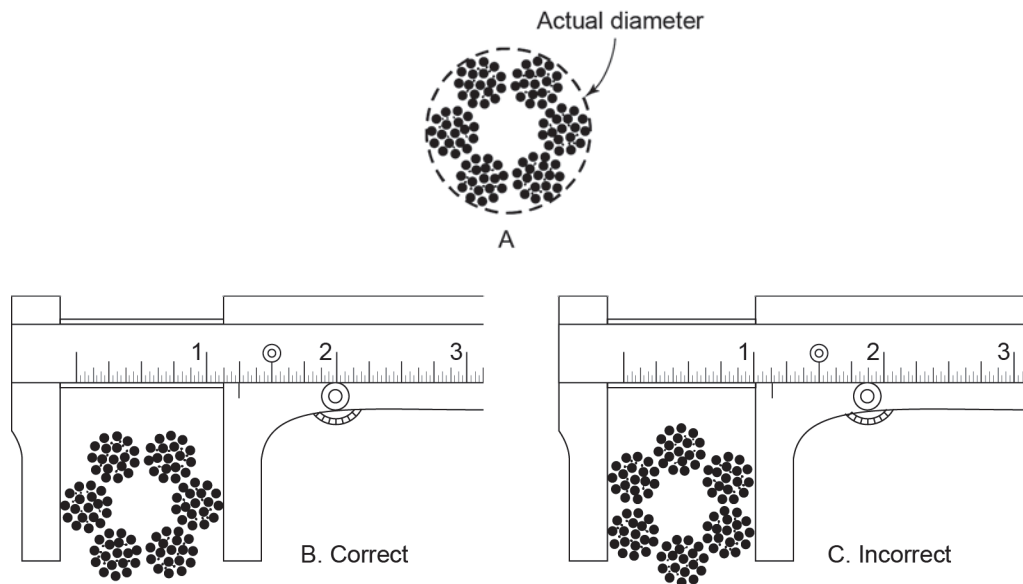


Figure F.6—Right and Wrong Way to Measure Wire Rope Diameter

F.5 Recommended Storage and Handling Procedures

F.5.1 Stored rope shall be covered in a well-ventilated area and away from excessive heat.

F.5.2 Where covered storage is not available, the rope and reel shall be covered with waterproof material. For long periods of storage, apply a lubricant coating to the outside layer of rope on the reel.

F.5.3 On a crane that is to be out of service for long periods of time, apply the proper lubricant to all wire rope.

F.5.4 Care shall be taken during shipping and handling of the reel and rope to prevent damage to the rope. The loose end of the rope on the reel shall be secured properly to the reel. Do not drive a nail through the center of the wire rope.

F.5.5 More frequent inspections can be required in high heat areas where elevated corrosion and loss of lubrication can contribute to reduced shelf life.

F.6 Installation Guidelines

F.6.1 To avoid introduction of twist into the rope while reeving, the rope should be removed from the same side of the reel as it will be operated on the drum, top-to-top or bottom-to-bottom (see Figure F.7).

F.6.2 When transferring rope from a storage reel to a drum, the rope should travel from the top of the reel to the top of the drum; or from the bottom of the reel to the bottom of the drum. This will avoid a reverse bend in the rope as it is being installed. Installing a rope so that a reverse bend is put into it causes the rope to become “twisty”, difficult to handle spool smoothly on the drum. This is especially true for large diameter wire ropes. A braking action should be applied to the reel at all times (use a block or timber against the reel flange) to get a good smooth wrap on the drum or use a spooling device to hold a load or tension on the spool of wire rope to prevent the wire from getting loose.

F.6.3 Spool rope in accordance with the wire rope manufacturer’s recommendations to properly seat the rope on the drum under tension. Particular care shall be taken in spooling the first layer.

F.6.4 Care shall be taken to ensure that the boom, main and auxiliary hoist systems are reeved for the specific crane configuration in use.

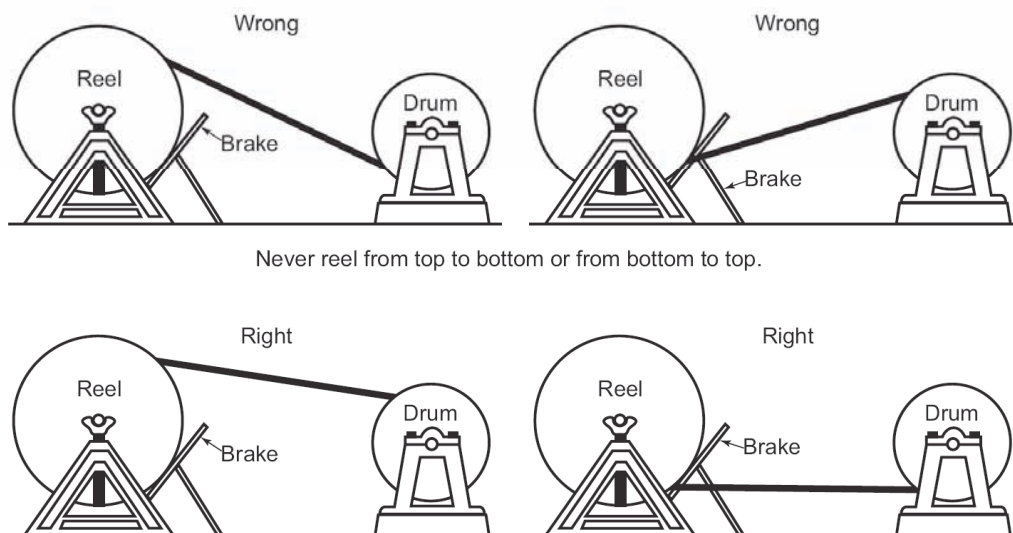
F.6.5 When reeving through the sheave system, avoid kinks or looping which could damage the rope.

F.6.6 Certain wire rope manufacturers recommend that welded wire rope ends be left intact, while others recommend that all welded ends be properly cut off. Consult with the crane or wire rope manufacturer on recommended procedures. High performance wire rope, particularly compacted rotation-resistant wire rope, can have special manufacturer recommendations for end preparation which should be followed.

F.6.7 Swivels shall not be used at the dead end of multi-part hoist systems with rotation-resistant rope, unless recommended by the crane and wire rope manufacturer.

F.6.8 Swivels shall be installed at the dead end of single part systems following the recommendation of the crane and/or wire rope manufacturer. The swivel is typically an integral part of the overhaul ball and may be of a top or bottom swivel design.

F.6.9 New rope shall be installed and broken-in in accordance with the manufacturer’s recommendations. Initial wire rope dimensional measurements should be collected and documented in the cranes inspection records at the time of installation and should be referred to during subsequent wire rope inspections.



NOTE Reel from top-to-top or from bottom-to-bottom.

Figure F.7—Transferring Rope from Reel to Drum

F.7 Wedge-type Socket Installation Guidelines

The manufacturer's installation guidelines should be consulted and followed. The following should be considered for wedge-type socket installation.

- a) Verify that the socket and wedge are the correct size for the rope in use. Sockets may be adaptable to two sizes of rope but the wedge is for one size of rope only. The rope size is cast or stamped in both the socket and wedge. Check the socket eye and pin for roundness and wear. A pin keeper shall always be used with the pin.
- b) Check socket and wedge for rough edges or burrs; remove before use (see Figure F.8 and F.6.5).
- c) Remove the wedge from the socket, insert the rope into the socket, form a large loop, insert the rope back into the socket.

CAUTION Confirm that the live end of the rope is on the straight side of the socket and the dead end on the tapered side of the socket.

- d) Secure the socket, place the wedge in the socket, and take a pull on the live side rope. Pull the wedge and rope into position in the socket. There should be a sufficient length of the dead end side rope out of the socket to permit completion of one of the accepted restraining methods (see Figure F.8).
- e) When first put into service, apply an increasing load to ensure that the wedge is properly seated. Do this gradually and avoid shock loads.

F.8 Recommended Methods of Lubrication

The following are methods of lubrication:

- pouring of lubricant onto rope as it passes over a sheave(while capturing the excess);
- swab the rope when not in motion with lubricant soaked rags;
- brush or spray with lubricant;
- pressure lubrication.

F.9 Wire Rope Operational Considerations

To protect and preserve the wire rope, the following should be observed when operating a crane.

- a) Do not allow the rope to become slack and loose on the drum. When the boom is at rest with no load on the hook, maintain a slight tension in the boom hoist system.
- b) When hoisting or lowering an empty hook block or overhaul ball, reduce drum speed where applicable before the brake is applied to prevent loosening of the rope on the drum.
- c) When a rope is found to be loose on the drum, re-spool the rope under tension as soon as practical while performing a visual inspection of the rope. During all inspections other than the pre-use inspection, re-spool the drum under tension where required and practical.

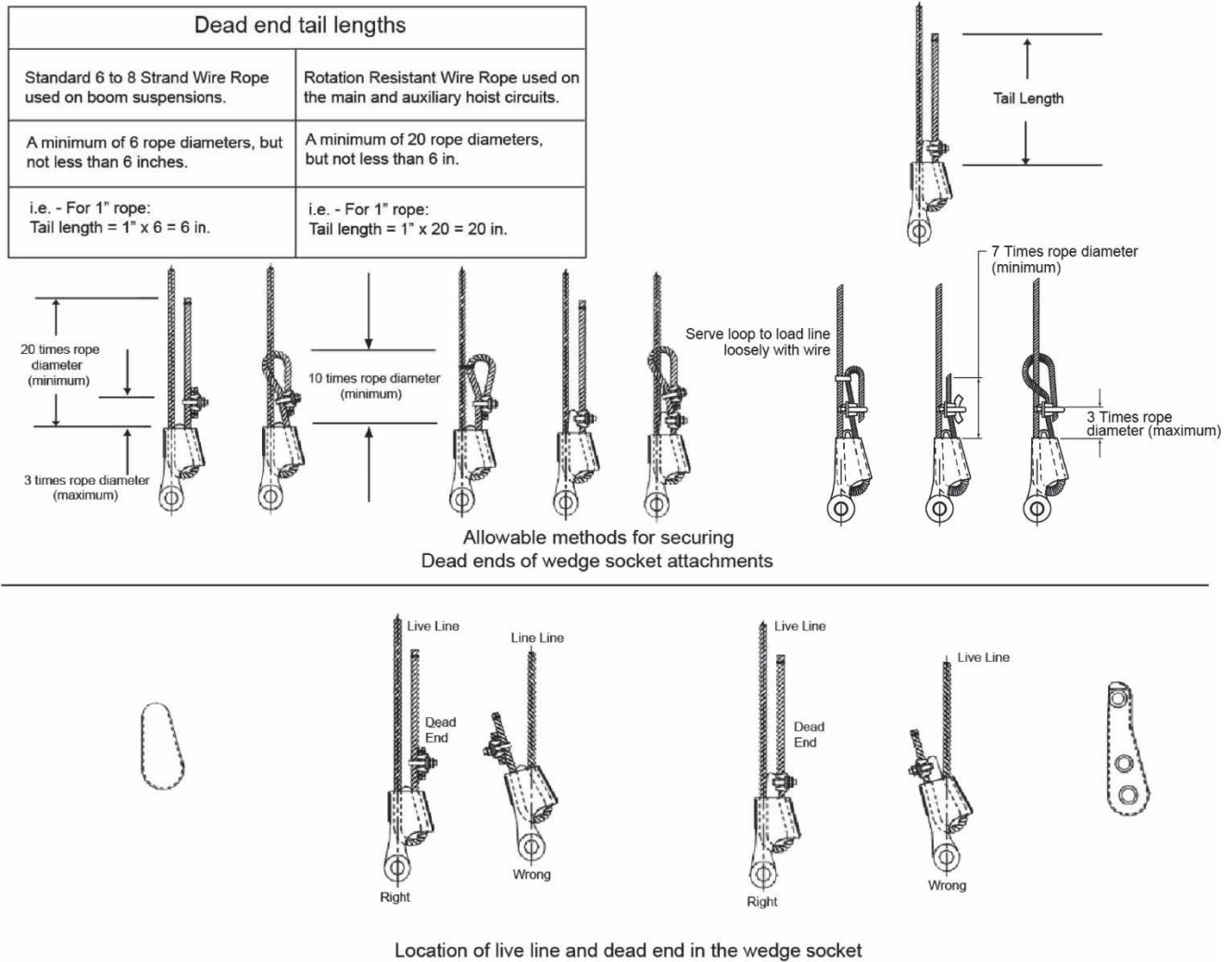


Figure F.8—Method of Installing Wedge-socket Attachment

F.10 Slings

F.10.1 Types of Slings

The types of slings typically used, but are not limited to, the following:

- wire rope slings;
- synthetic webbing slings;
- alloy steel chain slings;
- synthetic round slings.

F.10.2 Use of Slings

The following shall apply when using slings.

- a) Suitable protection shall be provided between the sling and all sharp surfaces of the load to be lifted.
- b) Proper storage shall be provided for slings while not in use.
- c) Slings shall never be choked in the splice.
- d) Sharp bends or knots shall not be permitted in wire rope slings.
- e) Loads shall not be lifted with one leg of a multi-leg bridle sling until the unused legs are secured.
- f) Any angle other than vertical at which a sling is rigged increases the loading on the sling.
- g) Whenever a sling is found to be deficient, the eyes should be cut, or other end attachments or fittings removed to prevent further use, and the sling body discarded.
- h) A sling eye should never be used over a hook or pin with a body diameter larger than the natural width of the eye. Never force an eye on a hook. The eye shall be used on a hook or pin with at least the diameter of the rope.
- i) A sling shall be visually inspected before use to determine if it is capable of safely making the intended lift.
- j) Rated loads of a sling are different for each of the three basic methods of rigging (vertical, choker, basket, etc.) and the rated loads of a sling are different for each of the methods of rigging based upon the angle of hitch, on construction of the wire rope, web material and width, etc. These rated loads are available from the manufacturer. These rated loads should be indicated on the heavy-duty tags attached to each type of sling at the time it is fabricated.

F.10.3 Guidelines for Fabrication and Lifting Procedures

F.10.3.1 Wire rope slings should generally not be field fabricated. If circumstances require field fabrication proper equipment should be available and qualified inspectors should supervise or perform this function using accepted standard practices. Zinc or resin poured sockets shall be fabricated in accordance with API 9B.

F.10.3.2 No single-leg hitch shall be used on slings with a load that cannot be controlled. Always rig the sling and load so as not to allow the load or lifting device to rotate and unlay the sling rope. Rotation or twisting of the load can cause excessive stress on the attachment connection and reduce the sling's capacity or pull out.

F.10.3.3 Slings used in choker configurations should have a rated capacity of 70 % of vertical load limit of a single leg sling if the choke angle is 120° or greater (see Figure F.9).

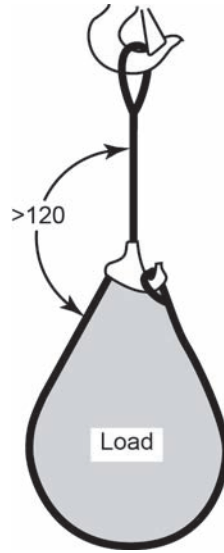


Figure F.9—Choker Configuration

F.10.3.4 For bridle slings and basket hitches where both legs are not vertical, Equation F.1 may be used for computation of the sling arrangement rated capacity (see Figure F.10).

$$C = C_{SL} \times N_L \times \cos A \quad (F.1)$$

where

C is the rated capacity;

C_{SL} is the single-leg capacity;

N_L is the number of legs;

A is the sling angle.

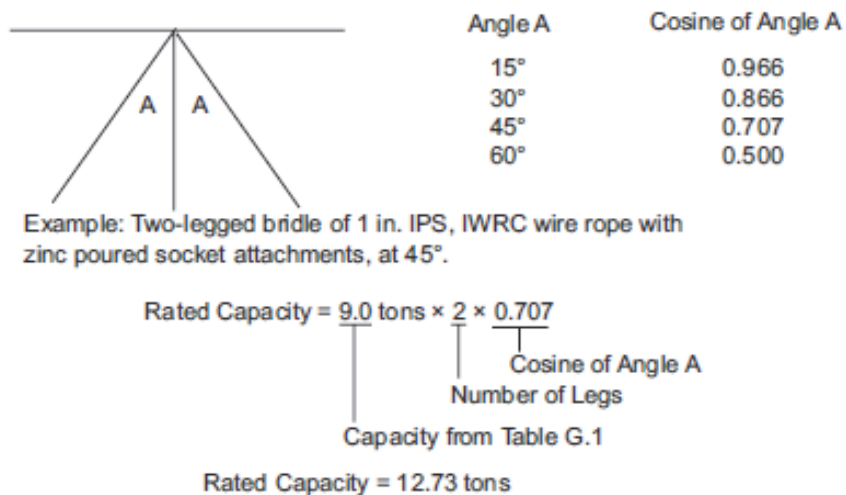


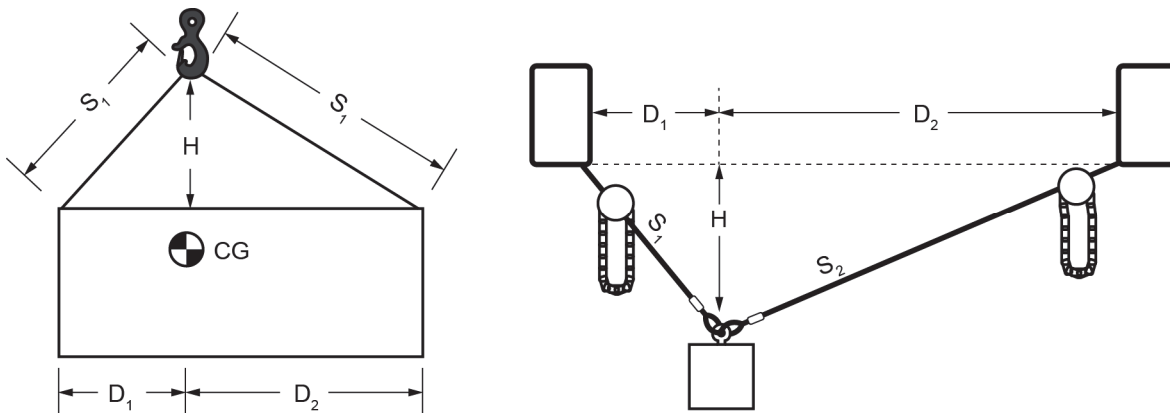
Figure F.10—Rated Sling Capacity Calculation Example (Included Angle)

F.10.3.5 As an alternative to the calculations in F.10.3.4, Equation F.2 may be used for calculating the rated sling capacity (see Figure F.11).

$$T = L \times D \times \frac{S}{H} \times (D_1 + D_2) \quad (\text{F.2})$$

where

- T is the sling tension;
- L is the load weight;
- D is the distance from the center of gravity to the sling attachment point;
- S is the length of the sling leg;
- H is the sling height.



$$\text{Tension 1} = L \times D_2 \times S_1 / H (D_1 + D_2)$$

$$\text{Tension 2} = L \times D_1 \times S_2 / H (D_1 + D_2)$$

NOTE Horizontal sling angles of less than 30° are not recommended (see ASME B30.9).

Figure F.11—Rated Sling Capacity Calculation Example (Horizontal Angle)

F.10.3.6 Slings shall not be made using wire rope clips.

F.10.4 Sling Replacement

Sling retirement/replacement criteria are as follows:

- a) In single part slings constructed of 6 × 19 class and 6 × 37 class wire rope in single-part slings, ten (10) randomly distributed broken wires in one lay length or five (5) broken wires in one strand in one lay length. For other constructions, refer to the WRTB *Wire Rope Sling User's Manual* and/or ASME B30.9.
- b) For cable laid, cable-laid grommets and multi-part slings, use the following:
 - sling body allowable broken wires per lay per braid cable laid;
 - less than 8-part braid;
 - twenty (20) 8-part braid or more;

- forty (40) for other constructions, refer to the WRTB *Wire Rope Sling User's Manual* and/or ASME B30.9.
- c) Severe localized abrasion or scraping.
- d) Kinking, crushing, or any other damage resulting in distortion of the rope strand, wires, core configuration, eyes, and splices.
- e) Evidence of heat damage or exposure to severe heat.
- f) Cracked, deformed, or worn end attachments.
- g) Hooks that have been opened more than 15 % of their normal throat opening or twisted more than 10° from the plane of the unbent hook.
- h) Severe corrosion of the rope or end attachments.
- i) Reduction in diameter of the rope not to exceed nominal diameter of the rope when new.
- j) Increase in diameter of the rope not to exceed nominal diameter of the rope when new due to internal core corrosion.

F.10.5 Proof Load of Slings

F.10.5.1 The proof load for single-leg slings with mechanical or poured attachments shall be twice the vertical rated capacity. Slings with hand-tucked splice attachments shall be proofed loaded to the vertical rated capacity.

F.10.5.2 The proof load for multiple-leg bridle slings shall be applied to each of the individual legs.

Annex G (informative)

Lift Categories

G.1 General

This annex describes some typical categories of lifting operations according to their level of risk and complexity. Owner/operators may have their own terminology to categorize these types of operations. Regardless, lifting operations should be categorized to reflect increasing risk and increasing level of control required.

G.2 Routine Lifts

The following may be classified as routine crane operations:

- a) within the normal operating parameters of the crane;
- b) lifting over non-sensitive areas;
- c) suitable environmental conditions;
- d) familiar, competent qualified crane operators;
- e) load has known and evaluated weight, shape, and center of gravity;
- f) standard rigging arrangements;
- g) repetitive lifting operations using the same equipment;
- h) single function or series of functions repeated manually or automatically;
- i) order of function repeated.

A generic risk assessment and lift plan may be used for routine lifts. However, classifying a lifting operation as “routine” does not automatically make it a “safe” lifting operation. Most incidents associated with lifting occur during routine operations. The risk assessments and lifts plans should be reviewed during a pre-lift meeting for continued applicability. If any change in conditions occurs, the risk assessment should be reevaluated.

G.3 Non-routine Lifts

G.3.1 General

Non-routine lifting operations can be sub-divided into the following three categories to reflect increasing risk:

- a) simple;
- b) complicated;
- c) complex/critical.

G.3.2 Simple Lifts

The following are classified as simple lifting operations:

- a) equipment specifically installed by a crane operator;
- b) load has known and evaluated weight;
- c) center of gravity below the lifting point;
- d) use of a certified lifting point directly above the load;
- e) ample headroom;
- f) not sensitive, difficult or in restricted areas;
- g) use of one crane;
- h) unlikely to be affected by changing environmental conditions;
- i) experienced and competent crane operator;
- j) standard rigging arrangements;
- k) suitable working area available;
- l) relevant permits.

G.3.3 Complicated Lifts

The following are classified as complicated lifting operations:

- a) continuation of a lifting operation with different equipment (due to malfunction, inadequacy, or unsuitability);
- b) use of two crane (tandem lift);
- c) within sensitive, difficult, or in restricted areas;
- d) lifts from one offshore vessel to another;
- e) load has an offset center of gravity;
- f) the load is fragile;
- g) the load has a large surface area which may act as sail;
- h) load has to be rotated or overturned;
- i) the signalman is out of site with the Crane Operator during the lift;

G.3.4 Complex/Critical Lifts

A critical lift plan consist of as many drawings, specifications, and procedures as necessary to accurately assess all important load factors and site factors relating to a critical lift. The following are included as a guide, but should not be interpreted as being all-inclusive in the analysis and preparation of a critical lift.

- a) Continuation of a lifting operation with different people (shift changeover).
- b) Lifting of personnel.

- c) Over or in sensitive areas.
- d) Transferring the load from one crane to another.
- e) Environmental conditions likely to affect equipment performance.
- f) Operator under training.
- g) Load with unknown, difficult to estimate weight, and/or center of gravity.
- h) Load is special and/or of high value or critical.
- i) Non-standard rigging arrangements.
- j) Load lowered into or lifted from a confined space.
- k) Lift operations involves divers.
- l) Plan view drawing of lifting operation.

Sound engineering and planning is still the responsibility of technical support.

Annex H (normative)

Training

H.1 General

Training shall include contents of this document with each of the following recommended specific training:

- a) Qualified Rigger training;
- b) Qualified Crane Operator training;
- c) Qualified Inspector training.

H.2 Qualified Rigger Training

H.2.1 General

H.2.1.1 An important part of crane safety is proper training of rigger personnel. Training should incorporate familiarization in lifting loads with slings, rigging hardware, and safety issues associated with JSA's/JSEA's and lift plans.

H.2.1.3 Training should include classroom-type, hands-on training, and examination. Instructor should provide students with a written description of the exercises on a form dated and to be signed by instructor and student.

H.2.1.4 Hands-on training should include proper inspection, use, selection, and maintenance of rigging gear (slings, rigging hardware).

H.2.1.5 The training program shall include a written exam.

H.2.1.6 The student/employer shall provide proof of compliance with the physical requirements in 8.1.4.

H.2.2 Rigger Training Outline

H.2.2.1 Course content shall discuss lift planning in accordance with Section 7 and Annex H.

H.2.2.2 Course content shall include the following topics related to each piece of rigging hardware.

- a) Rigging hardware:
 - 1) blocks;
 - type of blocks
 - block application
 - block inspection/rejection criteria
 - 2) sheaves;
 - type of sheaves

- sheave application
- sheave inspection/rejection criteria
- 3) hooks/latches;
 - type of hooks
 - type of latches
 - hooks application
 - hook inspection/rejection criteria
- 4) rings, links, swivels;
 - type of rings, links, swivels
 - ring, link, swivel application
 - ring, link, swivel inspection/rejection criteria
- 5) shackles;
 - type of shackles
 - shackle application
 - shackle inspection/rejection criteria
- 6) turnbuckles;
 - type of turnbuckles
 - turnbuckle application
 - turnbuckle inspection/rejection criteria
- 7) spreader and equalizer beams;
 - type of spreader and equalizer beams
 - spreader and equalizer beams application
 - spreader and equalizer beams inspection/rejection criteria
- 8) cable clips;
 - type of cable clips
 - cable clip application/rejection criteria
 - cable clip inspection
- 9) pad eyes;
 - type of pad eyes

- pad eye application/rejection criteria
 - pad eye inspection
 - 10) eyebolts;
 - type of eyebolts
 - eyebolt application
 - eyebolt inspection/rejection criteria
 - 11) Any other attachment points.
- b) Identify rigging hardware through actual parts, models, or other suitable representation to help students learn to recognize the rigging hardware.
 - c) Describe the application of each piece of rigging hardware.
 - d) Describe inspection points, how to inspect, and criteria for removal of each piece of rigging hardware.
 - e) Describe and explain safe and unsafe conditions for usage.
 - f) Describe the purpose and proper use of different types/variations of basic rigging hardware under discussion.
 - g) Describe rigging hardware weight capacity rating where applicable.
 - h) Describe how to properly maintain hardware.
 - i) Describe safe and proper storage techniques/practices for each piece of rigging hardware.

H.2.2.4 Course content shall discuss and the appropriate section objectives shall include the following topics related to slings.

- a) Slings:
 - 1) type of slings and material
 - wire rope
 - synthetic
 - chain
 - two-, three-, and four-leg bridle;
 - 2) sling application (configuration and function);
 - 3) sling inspection/rejection criteria;
 - 4) sling handling and storage;
 - 5) sling angle and load tension;
 - 6) D/d ratio;

- 7) cargo nets and other basket types (e.g. bulk bags/flexible fabric).
- b) Describe configurations to include different types of hitches (vertical, choker, basket).
- c) Describe function, applications, and safety precautions of hitches (vertical, choker, basket).
- d) Describe when to use and how to use.
- e) Describe the effect of the sling load at different sling angles.
- f) Describe safe and proper storage techniques/practices for all rigging hardware.

H.2.2.5 Course content shall discuss and the appropriate section objectives shall include the following topics related to procedures and precautions:

- a) Procedures and precautions:
 - 1) load control/taglines;
 - 2) unbinding loads;
 - 3) personnel transfer/pre-lift considerations;
 - 4) sling handling and storage;
 - 5) determining load weights and center of gravity of load;
 - 6) softeners (e.g. wear pads);
 - 7) attaching unused slings;
 - 8) improving sling efficiency;
 - 9) turning loads;
 - 10) securing loads;
 - 11) placement of loads.
- b) Describe the procedures and inspection for each type of personnel transfer equipment.

H.2.2.6 Course content shall discuss and the appropriate section objectives shall include the following topics related to rigging basics:

- pinch points/body positions;
- personal protective equipment (PPE);
- signals/radio communications.

H.2.3 Practical Exercises

H.2.3.1 General

The examiner shall mentor or coach until completed to insure acceptable understanding and responsibility.

Training shall document and ensure that practical exercises include the following.

- a) A crane should be used during these exercises.
- b) Actual hardware typically used on the job.
- c) Minimum of one hands-on exercise for each student on each appropriate topic item as follows:
 - rigging hardware;
 - slings;
 - procedures and precaution;
 - rigging basics.

Follow the rigging equipment manufacturer's recommendations on inspection, maintenance, installation, and identification.

- d) The minimum practical exercises are as follows:
 - pre-lift rigging inspection;
 - rigging hitches;
 - hand signals.

H.2.3.2 Task 1—Pre-lift Rigging Hardware and Sling Inspection Practical Exercise

H.2.3.2.1 The objective of the pre-lift rigging inspection is to test student's ability to understand and perform inspection of rigging hardware to be used:

- a) wire rope slings;
- b) synthetic sling;
- c) shackle;
- d) hook and latch;
- e) load block.

NOTE See Figure H.1 for an example Pre-Lift Rigging Hardware and Sling Inspection Form.

H.2.3.2.2 At the examiner's indication to start, the student will perform a visual inspection identifying the criteria for removal for each of the following.

- a) Visually check the wire rope sling for the following:
 - 1) wear,
 - 2) abrasion,
 - 3) broken wires,
 - 4) corrosion,

- 5) kinks,
- 6) dog legs,
- 7) eye deformation,
- 8) end fitting condition,
- 9) identification tag.

b) Visually check the synthetic sling for the following:

- 1) wear,
- 2) broken stitches,
- 3) heat damage,
- 4) chemical damage,
- 5) holes,
- 6) tears,
- 7) cuts,
- 8) snags,
- 9) ultra-violet (sun) damage,
- 10) eye fitting condition,
- 11) identification label.

c) Visually check shackle for the following:

- 1) wear on bow,
- 2) wear on pin,
- 3) pin flush w/shackle,
- 4) throat opening,
- 5) cracks and nicks,
- 6) any modifications,
- 7) missing parts,
- 8) markings.

d) Visually check hook and latch for the following:

- 1) excessive wear,
- 2) cracks or sharp nicks,

-
- 3) latch (positive locking for personnel transfer),
 - 4) throat opening,
 - 5) bent tip,
 - 6) any modification,
 - 7) parts missing,
 - 8) markings.
- e) Visually check block for the following:
- 1) wear of pins,
 - 2) trunnion,
 - 3) swivel clearance,
 - 4) sheave condition,
 - 5) identification label,
 - 6) side plate fasteners are tight.
- H.2.3.2.3** At the examiner indication, that the task is concluded.
- H.2.3.2.4** The examiner shall review the test results of the practical and insure the student has an acceptable understanding.
- H.2.3.2.5** The examiner and student shall sign the practical exercise form. The student signing on the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

TASK 1

Pre-Lift Rigging Hardware and Sling Inspection

Circle One: **Pass** **Fail**

Name: _____

Date: _____

Print

The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

Wire Rope Sling:

1. Wear and abrasion/broken wires:	Pass	Fail
2. Corrosion:	Pass	Fail
3. Kinks/dog legs:	Pass	Fail
4. Eye deformation and condition of end fitting:	Pass	Fail
5. Identification Tag:	Pass	Fail

Synthetic Sling:

1. Wear and broken stitches:	Pass	Fail
2. Heat damage and chemical damage:	Pass	Fail
3. Holes or tears and cuts or snags:	Pass	Fail
4. Condition of end fitting:	Pass	Fail
5. Identification label:	Pass	Fail

Shackle:

1. Wear on bow and wear on pin:	Pass	Fail
2. Throat opening:	Pass	Fail
3. Cracks and nicks:	Pass	Fail
4. Any modifications or missing parts:	Pass	Fail
5. Markings:	Pass	Fail

Hook:

1. Excessive wear/any cracks or sharp nicks:	Pass	Fail
2. Latch:	Pass	Fail
3. Throat opening and bent tip:	Pass	Fail
4. Any modification or parts missing:	Pass	Fail
5. Markings:	Pass	Fail

Load Block:

1. Wear of pins:	Pass	Fail
2. Side plate/fasteners tight:	Pass	Fail
3. Sheave alignment and condition:	Pass	Fail
4. Swivel clearance:	Pass	Fail
5. Identification label:	Pass	Fail

Comments: _____

Examiner Signature _____

Student Signature _____

Figure H.1—Pre-lift Rigging Hardware and Sling Testing Form

H.2.3.3 Task 2—Rigging Hitches Practical Exercise

H.2.3.3.1 The objective of the Rigging Hitches is to test your ability to understand and perform the basic hitches to be used:

- vertical hitch;
- choker hitch;
- basket hitch;
- two and/or four part bridle sling. (e.g. $\geq 60^\circ$).

NOTE See Figure H.2 for a typical Rigging Hitch Form.

H.2.3.3.2 At the examiner's indication to start, the student will perform a visual inspection of all rigging slings and hardware and perform the four described hitches. Select those items that meet the "Remove from Service" criteria and set them off to the side and obtain a replacement. All components to complete the basic hitches will be on site.

H.2.3.3.3 At the examiner's indication to start, the student will perform the basic hitches and perform and/or explain the process describe below.

- a) Configure vertical hitch: (attach vertical sling to load with rigging gear given).
- 1) Perform a visual inspection on all rigging hardware and slings on location.
 - 2) Those items that meet the "Remove from Service" criteria and remove from location and obtain a replacement.
 - 3) If lift plan and JSA is completed.
 - 4) Correct personal protective equipment (PPE).
 - 5) Observe pinch points and body positioning.
 - 6) Know the Person In Charge (PIC).
 - 7) Have a escape route/emergency plan.
 - 8) Verify the weight of the load.
 - 9) Attach tag line.
 - 10) Observe conditions of the load.
 - 11) Verify sling capacity.
 - 12) The vertical hitch was assembled correctly.
 - 13) Verify if the load is safe or not safe to lift.
 - 14) The sling is attached properly to the hook.
 - 15) Verify if load is balance (center of gravity).
 - 16) Assembled rigging is disassembled and stowed properly.
 - 17) Utilize Stop Work Authority.

- b) Configure choker hitch (attach choker sling to load with rigging gear given).
- 1) Perform a visual inspection on all rigging hardware and slings on location.
 - 2) Those items that meet the "Remove from Service" criteria and remove from location and obtain a replacement.
 - 3) If lift plan and JSA is completed.
 - 4) Correct personal protective equipment (PPE).
 - 5) Observe pinch points and body positioning.
 - 6) Know the Person In Charge (PIC).
 - 7) Have an escape route/emergency plan.
 - 8) Verify the weight of the load.
 - 9) Attach tag line.
 - 10) Observe conditions of the load.
 - 11) Verify sling capacity.
 - 12) The Choker hitch was assemble correctly.
 - 13) Verify if the load is safe or not safe to lift.
 - 14) The sling is attached properly to the hook.
 - 15) Verify if load is balance (center of gravity).
 - 16) The assembled rigging is disassembled and stowed properly.
 - 17) Utilize stop work authority.
- c) Basket hitch (attach basket hitch to load with rigging gear given).
- 1) Perform a visual inspection on all rigging hardware and slings on location.
 - 2) Those items that meet the "Remove from Service" criteria and remove from location and obtain a replacement.
 - 3) If lift plan and JSA is completed.
 - 4) Correct personal protective equipment (PPE).
 - 5) Observe pinch points and body positioning.
 - 6) Know the Person In Charge (PIC).
 - 7) Have an escape route/emergency plan.
 - 8) Verify the weight of the load.
 - 9) Attach tag line.
 - 10) Observe conditions of the load.
 - 11) Verify sling capacity.
 - 12) The basket hitch was assemble correctly.
 - 13) Verify safe or not safe to lift.

- 14) The sling is attached properly to the hook.
 - 15) Verify if load is balance (center of gravity).
 - 16) The assembled rigging is disassembled and stowed properly.
 - 17) Utilize stop work authority
- d) Configure two and/or four part bridle $\geq 60^\circ$.
- 1) Perform a visual inspection on all rigging hardware and slings on location.
 - 2) Those items that meet the "Remove from Service" criteria and remove from location and obtain a replacement.
 - 3) If lift plan and JSA is completed.
 - 4) Correct personal protective equipment (PPE).
 - 5) Observe pinch points and body positioning.
 - 6) Know the Person In Charge (PIC).
 - 7) Have an escape route/emergency plan.
 - 8) Verify the weight of the load.
 - 9) Attach tag line.
 - 10) Observe conditions of the load.
 - 11) Verify sling capacity.
 - 12) The two and/or four part bridle was assembled $\geq 60^\circ$ correctly.
 - 13) Verify approximate load tension.
 - 14) Verify safe or not safe to lift.
 - 15) The sling is attached properly to the hook.
 - 16) Verify if load is balance (center of gravity).
 - 17) The assembled rigging is disassembled and stowed properly.
 - 18) Utilize stop work authority.

H.2.3.3.4 When the student has completed rigging assignment, the student will announce that they are "DONE". The examiner will evaluate the completed rigging setup.

H.2.3.3.5 Then the examiner will indicate that the task is concluded. The student will disassemble the rigging assembly before continuing on to the next rigging assignment and properly stow the rigging hardware in the designated location.

H.2.3.3.6 The examiner will review the test results of the practical and ensure the student has acceptable understanding.

H.2.3.3.7 The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

Figure H.2—Rigging Hitches Testing Form

Basket Hitch:		
1. Perform a visual inspection on all rigging slings and hardware:	Pass	Fail
2. Verify those items that meet the "Remove from Service" criteria were set off to the side and obtain a replacement:	Pass	Fail
3. Verify if Lift Plan and JSA are completed:	Pass	Fail
4. Verify person protective equipment (PPE)	Pass	Fail
5. Verify pinch points and body positioning	Pass	Fail
6. Verify Person In Charge (PIC):	Pass	Fail
7. Verify escape route/emergency plan:	Pass	Fail
8. Verify the weight of the load:	Pass	Fail
9. Verify tag lines:	Pass	Fail
10. Verify condition of the load:	Pass	Fail
11. Verify sling capacity:	Pass	Fail
12. Verify Basket hitch was assembled	Pass	Fail
13. Verify safe or not safe to lift:	Pass	Fail
14. Attached to hook properly:	Pass	Fail
15. Verify if load is balance (center of gravity):	Pass	Fail
16. Verify assembled rigging is disassemble and stowed properly:	Pass	Fail
17. Stop work authority	Pass	Fail
Two and/or Four Part Bridle Sling ($\geq 60^\circ$):		
1. Perform a visual inspection on all rigging slings and hardware:	Pass	Fail
2. Verify those items that meet the "Remove from Service" criteria were set off to the side and obtain a replacement:	Pass	Fail
3. Verify if lift plan and JSA are completed:	Pass	Fail
4. Verify personal protective equipment (PPE)	Pass	Fail
5. Verify pinch points and body positioning	Pass	Fail
6. Verify Person In Charge (PIC):	Pass	Fail
7. Verify escape route/emergency plan:	Pass	Fail
8. Verify the weight of the load:	Pass	Fail
9. Verify tag lines:	Pass	Fail
10. Verify condition of the load:	Pass	Fail
11. Verify sling capacity:	Pass	Fail
12. Verify Two and/or Four Part bridle was assembled $\geq 60^\circ$	Pass	Fail
13. Verify approximate load tension	Pass	Fail
14. Verify safe or not safe to lift:	Pass	Fail
15. Attached to hook properly:	Pass	Fail
16. Verify if load is balance:	Pass	Fail
17. Verify assembled rigging is disassemble and stowed properly:	Pass	Fail
18. Stop work authority	Pass	Fail
Comments:		
Examiner Signature		Student Signature

Figure H.2 (continued)—Rigging Hitches Testing Form

H.2.3.4 Task 3—Hand Signals: (optional radio)

H.2.3.4.1 The objective of the hand signal task is to test the student's ability to understand and perform the basic hand signals in this RP. The examiner should try to use the appropriate hand signal to the crane configuration (e.g. telescoping, knuckle boom crane, etc.).

NOTE See Figure H.3 for typical Hand Signal Form.

The testing of hand signal proficiency shall include the following.

- a) The designated signal person shall have the opportunity at the start of this task, to discuss any special hand signals.
- b) Verify hand signal chart is posted.
- c) At the examiner's indication to start.
- d) The student will be asked to respond and/or describe verbally five or more of the standard hand signals in this document.
- e) The examiner may give the signal request in any sequence. Then the student will perform the signal for the following (for addition signals, see 4.3.2):
 - hoist up,
 - lower,
 - dog everything,
 - emergency stop,
 - raise boom,
 - lower boom,
 - swing as directed (e.g. left or right direction),
 - raise slowly.

H.2.3.4.2 At the examiners indication the task is concluded. The examiner will review the test results of the practical and insure the student has acceptable understanding.

H.2.3.4.3 The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

H.2.3.4.4 Upon completion of the qualified rigger training the Qualified Rigger will be issued a certificate and card with the minimum information shown in Figure H.3 and Figure H.4.

TASK 3 Hand Signals		
Circle One: Pass Fail		
Name: _____		Date: _____
Print		
The examiner and student will sign off on the practical exercise. The student signing off on practical exercise validates he/she has acceptable understanding and knows his/her responsibilities.		
1. Signal #1 (Hand Signal Given): _____	Pass	Fail
2. Signal #2 (Hand Signal Given): _____	Pass	Fail
3. Signal #3 (Hand Signal Given): _____	Pass	Fail
4. Signal #4 (Hand Signal Given): _____	Pass	Fail
5. Signal #5 (Hand Signal Given): _____	Pass	Fail
6. Signal #6 (Hand Signal Given): _____	Pass	Fail
7. Signal #7 (Hand Signal Given): _____	Pass	Fail
8. Signal #8 (Hand Signal Given): _____	Pass	Fail
9. Signal #9 (Hand Signal Given): _____	Pass	Fail
10. Signal #10 (Hand Signal Given): _____	Pass	Fail
11. Verify Hand Signal Chart is posted.....	Pass	Fail
Comments: _____ _____ _____		
_____ Examiner Signature	_____ Student Signature	

Figure H.3—Hand Signal Testing Form

COMPANY LOGO	(Company Name Here)		
	(Company Address Here)		
	(Company Phone/Fax Number Here)		
	Qualified Rigger		
(First Name Here)	(Last Name)	(Last four ID #)	
The individual named above, has satisfactorily demonstrated necessary skills through written, practical, oral evaluation and has successfully completed the course of instruction as prescribed for (Course Title Here) in accordance with latest edition of the API RP2D.			
Expires: _____ / _____ / _____ Date		Instructor/Examiner: _____ Name	

Figure H.4—Qualified Rigger Card Example

H.3 Crane Operator Training

H.3.1 General

H.3.1.1 The student shall present a valid rigger certification to the instructor.

H.3.1.2 Crane Operator shall be qualified to safely operate the crane(s) on which they have been trained in accordance with H.3.2.

H.3.1.3 By completing the training in H.3.2, the Crane Operator shall also be qualified to perform the crane inspections, with the exception of the initial, quarterly, and annual inspections.

H.3.2 Qualified Crane Operator Training

H.3.2.1 One important part of crane safety is proper training of crane operator. Training should incorporate familiarization in lifting loads with slings, rigging hardware and safety issues associated with JSAs and lift plans.

H.3.2.3 Crane Operators shall qualify for either two of the following crane types and/or sub-types.

a) Operation of non-mechanical:

- hydraulic,
- electric.

b) Operation of mechanical (friction).

H.3.2.3 Hands-on proficiency is the last segment of crane operator qualification training. It should be held on a crane similar to the type of crane to be operated by the Qualified Crane Operator, in order to allow them to demonstrate their ability.

H.3.2.4 The following are requirements for crane operator training.

a) Classroom-type sessions with written and hands-on examinations on the type of crane to be operated by the Qualified Crane Operator.

- 1) Such classroom-type sessions and examinations shall cover all major crane components; the operational and maintenance procedures appropriate for the type and capacity of crane to be operated; and all major issues and guidelines addressed in this document.
- 2) Training shall also cover lubricating points; adjustments; principles of crane operation, especially boom operating procedures; safety devices and anti-two-block system; the proper use and care of all running cables and pendants; and the proper reading and understanding of crane lifting capacity and reeving charts, boom and indicator charts and hand signal charts.

b) The Qualified Crane Operator shall demonstrate by written examination an appropriate understanding of the provisions of this document.

c) If a mechanical or non-mechanical crane is to be operated, the necessary experience and training:

- 1) shall be focused on each type of crane classification; and
- 2) shall be more intense on mechanical than for non-mechanical, due to the greater skills required to safely operate mechanical cranes.

H.3.2.4 The Qualified Crane Operator shall have attended hands-on training on the proper inspection, use and maintenance of rigging gear (slings, shackles, hooks, nylon slings, etc.) and be trained in all rigger requirements.

H.3.2.5 The training program shall include a written exam.

H.3.2.6 The Qualified Crane Operator shall demonstrate hands-on proficiency in the safe operation of the types of cranes they are to operate.

H.3.2.7 The student/employer shall provide proof of compliance with the physical requirements in 8.2.4.

H.3.3 Crane Operator Training Outline

H.3.3.1 Course content shall discuss the appropriate section objectives and shall include the following topics:

- lift plan,
- JSA/JSEA.

H.3.3.2 Course content shall discuss and the appropriate section objectives shall include the following topics related to a Qualified Crane Operator.

a) Types of cranes used offshore:

- 1) mechanical cranes,
- 2) non-mechanical cranes.

b) Crane components and lifting capacities.

- 1) Components of a stationary mounted crane. Identify and describe the standard components on each type of crane.
- 2) Basic crane terminology and their definitions.
- 3) Boom angle and load radius and how load weight directly affects the lifting capacity of any crane as well as how to use the various tools available (boom angle indicator, load rating charts) to evaluate and perform a safe lift.
- 4) Basic lifting principles are affected by different variables including boom angle, length, and radius as well as load weight, as such, the items below should be discussed in the training:
 - lever principles;
 - lifting principles;
 - types of lifts;
 - static/onboard;
 - shock loading;
 - dynamic/offboard loading.

5) Reading a load rating chart as specified in the following:

- correct and configured to crane;
- weight that can be lifted at a specified boom length and boom angle;
- working radius;
- parts of line;
- crane is de-rated;
- exceeding the loads and/or conditions stated on load rating chart;
- the weight of the hook block, auxiliary ball, slings etc. also be considered part of the load;
- comparison of load weights relative to boom angle and length of boom.

Load charts are placed on a crane for safety. The Qualified Crane Operator should:

- study and know how to read the chart and use it for every lift;
- identify the different procedures for static/on-board, dynamic/off board lifting; and
- consider the sea state, wind and other operating conditions.

6) Number of parts of line and relationship to rated load.

7) Limitations of the size and type of wire rope used in boom hoist lines, pendants, and load hoist line.

8) Lifting capacity of the main and auxiliary hook.

9) Lifting capacity of load and boom hoist drums (speed vs. line pull).

c) Wire rope construction and use.

1) Mechanics of wire rope.

2) Classes, designation, and characteristics of wire rope:

- lay length;
- right regular lay;
- left regular lay;
- rotation resistant.

3) Handling and installation precautions of wire rope.

4) Guidelines for replacement of wire rope and wedge socket installation.

5) Rope maintenance (lubrication).

6) Recommended storage and handling procedures.

7) Wire rope inspection/replacement criteria.

d) Mounting features of the revolving superstructure:

- 1) hook rollers,
- 2) ball ring,
- 3) king post,
- 4) others.

e) Boom structure:

- 1) types of boom construction (lattice, box, etc.),
- 2) wire rope rollers/guides,
- 3) boom bolts,
- 4) pins and pin connections.

f) Limit devices:

- 1) boom-hoist limit,
- 2) load hoist limits,
- 3) boom stops,
- 4) all locking devices,
- 5) anti-two-block devices.

g) Additional items:

- 1) sheaves,
- 2) hand signals,
- 3) control identification,
- 4) engine emergency shutdown (ESD).

H.3.4 Practical Exercises

H.3.4.1 General

The training provider shall document, ensure that hand-on exercises and demonstrations include the following:

- a) pre-use inspection;
- b) lift plan for the three unique types of lifts;
- c) swing crane and control load;
- d) performance of at least three unique types of lifts:
 - 1) static (onboard),

- 2) dynamic (offboard),
- 3) blind;
- e) one or more depth perception exercises;
- f) interpretation of load chart during lifting exercises;
- g) hand signals;
- h) the minimum practical exercises:
 - 1) pre-use inspection,
 - 2) hand signals,
 - 3) lift procedures:
 - Lift #1 onboard (static),
 - Lift #2 offboard (dynamic),
 - Lift #3 blind.

H.3.4.2 Task 1—Pre-use Inspection Practical Exercise

H.3.4.2.1 The objective of Task 1 is to test the student's ability to understand the minimum API 2D requirements.

- a) The task shall be completed in order to pass. Any student not performing this portion of test will constitute a failure of the task. The examiner will proceed to coach the student on the correction needed and retest the student until completion is attained.
- b) The student has the opportunity at the start of this task to discuss any special instructions.
- c) Check entry and exit for personnel on crane before starting task and finishing task. (Perform a walk around to verify personnel are not around crane before starting and shutting down the crane and verify entry/exit gate is secured.)
- d) The examiner will provide the student with a pre-use inspection form to fill out.
- e) At the examiner's indication to stop, hand the pre-use inspection to examiner.
- f) The examiner will review the test results of the task to see if completed.
- g) The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

NOTE See Figures H.5 and H.6 for an example Pre-use Inspection Testing Form and a Pre-use Inspection Checklist respectively.

TASK 1 Pre-use (Daily) Inspection	
Circle One: Pass Fail	
Name: _____ Print	Date: _____
The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.	
Has student participated and completed pre-use inspection. Pass Fail	
Comments: _____ _____ _____ _____ _____ _____ _____ _____ _____	
_____ Examiner Signature	_____ Student Signature

Figure H.5—Pre-use Daily Inspection Testing Form

Pre-use Inspection Form Reference Maintenance Section			
Pre-use Checklist Crane Manufacturer: _____ Crane Model: _____ Crane S/N: _____	Date: _____ Time: _____ Platform/Rig Name: _____ Crane Operator Signature: _____ (print) _____ Crane Operator Signature: _____ _____		
	Ok	Fault	Comments
1) Check engine oil and hydraulic oil levels			
2) Check coolant/ fuel level			
3) Check fan/and any belts			
4) Check for fuel, oil, coolant, hydraulic, and air leaks			
5) Start and stop engine prior to use			
6) Check for hoist lubricant oil leakage			
7) Visually examine hoist boom and support structure for damage (walk-around)			
8) Check operation of anti-two-block			
9) Check boom hoist pawl			
10) Check control mechanisms including brakes and clutches for proper operation			
11) Check for loose, missing, or corroded bolts, pins, keeper, or cotter pins			
12) Examine condition of wire rope for evident deterioration and damage, or improper reeving			
13) Visually check rigging gear to be used such as slings, sling hooks and shackles			
14) Check hoist hook latch			
15) Check condition and operation of weight indicator			
16) Confirm that correct and configure load chart is posted			
17) Check aircraft warning light (if installed)			
18) Ensure lock pin in hook for personnel lift			
19) Check for leakage or damage to the air and non-mechanical systems			
20) Check entry and exit for personnel and gate is secured			

Figure H.6—Pre-use Inspection Checklist

H.3.4.3 Task 2—Hand Signals (optional radio): Address Radio Protocol for both Rigger and Operator

H.3.4.3.1 The objective of the hand signal is to test your ability to understand and perform the basic hand signals in accordance with 4.3.2. The examiner should try to use the appropriate hand signal to the crane configuration (ex. telescoping crane).

NOTE See Figure H.7 for an example Hand Signal Testing Form.

H.3.4.3.2 The test shall include the following.

- a) The designated signal person will have the opportunity at the start of this task, to discuss any special hand signals.
- b) Verify hand signal chart is posted.
- c) At the examiner's indication to start, the student will be asked or respond and describe verbally to give five or more of the standard hand signals in this RP.
- d) The examiner may give the signals in any sequence. The student will then perform the signal.
- e) Hoist up.
- f) Lower.
- g) Dog everything.
- h) Emergency stop.
- i) Raise boom.
- j) Lower boom.
- k) Swing as directed (e.g. left or right direction).
- l) Raise slowly.
- m) At the examiner's indication that the task is concluded.
- n) The examiner will review the hand signal test results.
- o) The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

TASK 2 Hand Signals		
Circle One: Pass Fail		
Name: _____ Print	Date: _____	
The examiner and student will sign the practical exercise form. The student signing the practical exercise validates form he/she has acceptable understanding and knows his/her responsibilities.		
1. Signal #1 (Hand Signal Given): _____	Pass	Fail
2. Signal #2 (Hand Signal Given): _____	Pass	Fail
3. Signal #3 (Hand Signal Given): _____	Pass	Fail
4. Signal #4 (Hand Signal Given): _____	Pass	Fail
5. Signal #5 (Hand Signal Given): _____	Pass	Fail
6. Signal #6 (Hand Signal Given): _____	Pass	Fail
7. Signal #7 (Hand Signal Given): _____	Pass	Fail
8. Signal #8 (Hand Signal Given): _____	Pass	Fail
9. Signal #9 (Hand Signal Given): _____	Pass	Fail
10. Signal #10 (Hand Signal Given): _____	Pass	Fail
11. Hand Signal Chart is Posted: _____	Pass	Fail
12. Pulled the correct lever(s): _____	Pass	Fail
Comments: _____ _____ _____ _____ _____		
_____ Examiner Signature	_____ Student Signature	

Figure H.7—Hand Signal Testing Form

H.3.4.4 Task 3—Lift Procedures

H.3.4.4.1 The objective of this practical exercise is to test the students' ability to understand and perform lift procedures, swing crane and control load, depth perception, interpretation of load chart during lifting exercises.

H.3.4.4.2 The task shall be completed in order to pass the lift procedure practical exercise. Any failed portion of this test will constitute a failure of the task. The examiner will proceed to coach the student on the correction needed and retest you until completion is attained.

H.3.4.4.3 The Crane Operator has the opportunity at the start of this task, to discuss any further explanation.

NOTE See Figure H.8 through Figure H.10 for examples of lift procedures forms.

H.3.4.4.4 The student shall perform the following lift procedures.

a) Lift #1 Onboard (static).

- 1) At the examiner's indication, bring the load block over the load used for test and center the load block at the start position.
- 2) The load will be attached to the crane hook by designated rigger.
- 3) At the examiner's indication to start:
 - i. verify the weight of the load used for test,
 - ii. check load chart to verify crane capacity,
 - iii. determine if it's safe or not safe to lift, and
 - iv. verify tag line on load.
- 4) At the start position. The student will move the load used for test to the second designated spot performing the procedures listed.
 - i. The student will lift the load used for test slowly (approximately 6 in. to 12 in.) off deck.
 - ii. Stop and check winch brake.
 - iii. The student will make sure the path is clear:
 - of all obstacle—when test weight reaches an obstacle, lift load high enough to clear the obstacle, swing over the obstacle and lower the load to a safe height; and
 - of all personnel—never move test weight over personnel.
 - iv. Watching for overturning moment (overload).
 - v. The student will make sure the load is under control.
 - vi. Watching for dragging the load on the deck (sideloading).
 - vii. Watching for load contacting any part of the course.
 - viii. Checking depth perception to see if load in place at position #2.

- ix. Once the test weight reaches position #2, place it there so that the load used for test is under control.
- x. The student will then slowly lower the test weight on to the deck.
- xi. The examiner will give you a stop signal once the test weight is in #2 position.
- xii. Remain at the controls until the examiner gives a clear indication that the lift #1 Onboard (static) is finished.
- xiii. The examiner will review the test results of the Lift #1.
- xiv. The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has an acceptable understanding and knows his/ her responsibilities.

b) Lift #2 Offboard (Dynamic) where practical and/or simulated.

- 1) At the examiner's indication, bring the load block over the load used for test and center the load block at the start position.
- 2) The load will be attached to the crane hook by designated rigger.
- 3) At the examiner's indication to start:
 - i. verify the weight of the load;
 - ii. check load chart to verify crane capacity;
 - iii. determine if it's safe or not safe to lift;
 - iv. verify tag line on load.
- 4) At the start position. The student will move the test weight to the third designated spot performing the procedures listed.
 - i. The student will lift test weight slowly off deck.
 - ii. Stop and check winch brake once you clear the boat (if applicable).
 - iii. The student will make sure the path is clear:
 - of all obstacle—when test weight reaches an obstacle, lift load high enough to clear the obstacle, swing over the obstacle, and lower the load to a safe height; and
 - of all personnel—never move test weight over personnel.
 - iv. Watching for overturning moment (overload).
 - v. The student will make sure the load is under control.
 - vi. Watching for dragging the load on the deck (sideloading).
 - vii. Watching for load contacting any part of the course.
 - viii. Checking depth perception to see if load in place at position #3.

- ix. Once the test weight reaches position #3, place it there so that the test weight is under control.
- x. The student will then slowly lower the test weight on to the deck.
- xi. The examiner will give you a stop signal once the test weight is in #3 position.
- xii. Remain at the controls until the examiner gives a clear indication that the Lift #2 offboard/dynamic is finished.
- xiii. The examiner will review the test results of the Lift #2.
- xiv. The examiner and student will sign on the practical exam form.

c) Lift #3 Blind.

- 1) The student has the opportunity to discuss any special hand signals needed to perform blind lift with examiner and Signalman. Radio communication can also be used as an option (if available).
- 2) Watching the designated signalman hands signals bring the load block over the load used for test *t* at position #3 and center the block.
- 3) The load will be attached to the crane hook by designated rigger.
- 4) Watching designated signalman hand signals indication to start:
 - i. verify the weight of the load;
 - ii. check load chart to verify crane capacity;
 - iii. determine if it's safe or not safe to lift;
 - iv. verify tag line on load.
- 5) At the #3 position. You will move the test weight to position #4 designated spot performing the procedures listed.
 - i. Watching the designated signalman you lift test weight slowly (about 6 in. to 12 in.) off deck.
 - ii. Stop and check winch brake.
 - iii. The designated signalman will direct you to position #4 by watching the following.
 - When test weight reaches an obstacle—the signalman will direct you to lift the load high enough to clear the obstacle, swing over the obstacle and lower the load to a safe height.
 - Crane Operator will be watching for overturning moment (overload).
 - iv. Watching for overturning moment (overload).
 - v. Once the test weight reaches position #4, place it there by watching the signalman hand signals so that the test weight is under control.
 - vi. You will then slowly lower the test weight on to the deck by watching the signalman.
 - vii. The signalman will give you a stop signal once the test weight is in Position #4.

- viii. Remain at the controls until the examiner gives a clear indication that the lift #3 Blind is finished.
- ix. The examiner will review the test results of the Lift #3.
- x. The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

H.3.4.4.5 Upon completion of the qualified crane operator training, the Qualified Crane Operator will be qualified in one of the following:

- a) mechanical (friction);
- b) non-mechanical;
 - hydraulic,
 - electric.

H.3.4.4.6 Upon completion of the qualified crane operator training, the Qualified Operator will be issued a certificate and card with the minimum following information required on the card and certificate (see Figure H.11).

TASK 3 Lift Procedures Lift #1 Onboard (Static)		
Circle One: Pass Fail		
Name: _____		Date: _____
Print		
The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.		
1. Student participated in the (group) pre use Inspection:	Pass	Fail
2. Lift Plan on hand:	Pass	Fail
3. Verify the Entry/Exit (before starting):	Pass	Fail
4. Verify the weight of the load:	Pass	Fail
5. Check interpretation of load chart:	Pass	Fail
6. Determine if the load is safe or not safe to lift:	Pass	Fail
7. Centering the ball or load block over the load:	Pass	Fail
8. Verify tag line on load:	Pass	Fail
9. Testing the winch brakes:	Pass	Fail
10. Clearing all obstacles:	Pass	Fail
11. Lifting load over personnel:	Pass	Fail
12. Watch for overturning moment (overload):	Pass	Fail
13. Watch for two-blocking:	Pass	Fail
14. Control of the load:	Pass	Fail
15. Dragging the load (sideloading):	Pass	Fail
16. Load contacting any part of the course:	Pass	Fail
17. Check depth perception to see if place at position #2:	Pass	Fail
Comments: _____ _____ _____		
_____ Student Signature	_____ Examiner Signature	

Figure H.8—On-board (Static) Lift Procedures Testing Form

Circle One: Pass Fail

The examiner and student will sign the practical exercise form. The student signing the practical exercise form validates he/she has acceptable understanding and knows his/her responsibilities.

- | | | |
|--|------|------|
| 1. Student participated in the (group) pre use Inspection. | Pass | Fail |
| 2. Lift Plan on hand | Pass | Fail |
| 3. Verify the Entry/Exit (before starting): | Pass | Fail |
| 4. Verify the weight of the load: | Pass | Fail |
| 5. Check interpretation of load chart: | Pass | Fail |
| 6. Determine if the load is safe or not safe to lift: | Pass | Fail |
| 7. Centering the ball or load block over the load: | Pass | Fail |
| 8. Verify tag line on load: | Pass | Fail |
| 9. Testing the winch brakes: | Pass | Fail |
| 10. Clearing all obstacles: | Pass | Fail |
| 11. Lifting load over personnel: | Pass | Fail |
| 12. Watch for overturning moment (overload): | Pass | Fail |
| 13. Watch for two-blocking | Pass | Fail |
| 14. Control of the load: | Pass | Fail |
| 15. Dragging the load (sideloading): | Pass | Fail |
| 16. Load contacting any part of the course: | Pass | Fail |
| 17. Check depth perception to see if place at position #3. | Pass | Fail |

Comments: _____

Examiner Signature _____

Figure H.9—Off-board (Dynamic) Lift Procedures Testing Form

Front Side (Crane Operator)

COMPANY LOGO	(Company Name Here)		
	(Company Address Here)		
	(Company Phone/Fax Number Here)		
	Qualified Crane Operator		
(First Name Here)		(Last Name)	(Last four ID #)
The individual named above, has satisfactorily demonstrated necessary skills through written, practical, oral evaluation and has successfully completed the course of instruction as prescribed for (Course Title Here) in accordance with latest edition of the API RP2D.			
Expires: _____ / _____ / _____ Date		Instructor/Examiner: _____ Name	

Back Side (Crane Operator)

CRANE OWNER'S NOTES:	It is advised that all crane owners give due consideration to the following when requiring the use of a Qualified <i>Crane Operator</i> .		
1.	The crane owner shall be responsible for Qualified <i>Crane Operator</i> Qualifications requirements to be met in accordance with API RP2D latest edition.		
Check Box			
☐	No history of a disabling medical condition, which can be sufficient reason for disqualification.		
☐	Any corrective lenses required.		
Crane Type Qualified to Operate			
Mechanical	☐ Friction		
Non-Mechanical	☐ Hydraulic		
	☐ Electrical		
Tracking No: _____			

Figure H.11—Blind Lift Procedures Example Certificate

H.4 Crane Inspector Training

H.4.1 General

Crane inspector training is a critical part of the prevention of crane accidents due to component failure. Training shall reference a formalized, written training program. An outline of the major items that should be included in this training program is listed. In addition to the recommended training elements for Qualified Crane Operators the inspector training program shall be tailored to the particular cranes or crane types for which the inspector is to be qualified.

H.4.2 Qualified Crane Inspector Training

H.4.2.1 Important part of crane safety is proper training of inspectors. Training shall incorporate familiarization on crane maintenance, troubleshooting, inspecting, JSAs/JSEAs, and lift plan.

H.4.2.2 Qualified Crane Inspectors shall be trained as follows on the type of cranes they will inspect.

a) Maintenance and troubleshooting of non-mechanical functions to include:

- hydraulic,
- electric.

b) Maintenance and troubleshooting of mechanical functions (friction).

H.4.2.3 The following shall be included as requirements for inspector training.

- a) Classroom-type sessions with written and hands-on examinations on the type of crane to be maintain, troubleshoot, and inspected by the Qualified Crane Inspector.
 - 1) Such classroom-type sessions and examinations shall cover all major crane components; the operational and maintenance procedures appropriate for the type and capacity of crane to be operated; and all major issues and guidelines addressed in this document.
 - 2) Training shall also cover hoist overhaul and troubleshooting, structural aspects of offshore canes; knowledge of structural critical components inspection area's and additionally applicable recognized regulatory compliance requirements.
- b) The Qualified Inspector shall demonstrate by written examination an appropriate understanding of the requirements of this RP.
- c) If a mechanical or non-mechanical crane is to be maintained, troubleshoot, or inspected, the necessary experience and training shall be focused on each type of crane classification.

H.4.2.4 With this minimum training, the Qualified Crane Inspector should be qualified to maintain, troubleshoot, and perform inspections on the crane(s) on which they have been trained.

H.4.3 Crane Inspector Training Outline

H.4.3.1 Course content shall discuss and the appropriate section objectives shall include the following objectives related to API 2C (as applicable) for offshore pedestal mounted cranes as appropriate for the type of crane used. The following should be reviewed:

- a) critical components;
- b) API 2C definitions;

- c) crane rated loads;
- d) crane ratings;
- e) allowable stresses;
- f) design authentication and testing;
- g) critical rigging components;
- h) boom hoist, load hoist, and telescoping boom hoist;
- i) swing mechanism;
- j) power plant;
- k) controls;
- l) cabs and enclosures;
- m) miscellaneous requirements and equipment;
- n) welding of critically stressed components;
- o) nondestructive examination of critical components;

H.4.3.2 Course content shall include the entire body of information contained within API 2D, API 2C, and the appropriate section objectives shall include the following objectives related to API 2D for offshore pedestal mounted cranes as appropriate for the type of crane used.

H.4.3.3 Course content shall familiarize students with typical problems encounter in crane maintenance, troubleshooting and inspection for offshore pedestal mounted cranes as appropriate for the type of crane used and knowledge of the following.

- a) Mechanical and non-mechanical cranes (general):
 - 1) load charts/information charts (correct and configure to crane);
 - 2) importance of following manufacturer's recommendations;
 - 3) safety factors involved;
 - 4) hoists;
 - 5) structural aspects of offshore cranes;
 - 6) structurally critical components;
 - 7) critical inspection areas;
 - 8) recognized applicable regulatory compliance;
 - 9) basic knowledge of NDE such as (dye penetrant procedures);
 - 10) what records are to be reviewed and maintained;
 - 11) how to review completed repair records and status of any open repairs;

-
- 12) knowledge and demonstration of measurement tools;
 - 13) safety systems;
 - 14) prime mover;
 - 15) boom inspection and repair;
 - 16) emergency load lowering procedures (as applicable).
- b) Non-mechanical (specific basic hydraulic):
- 1) physical world of hydraulic;
 - 2) hydraulic terminology;
 - 3) transmission of force and energy;
 - 4) simple hydraulic system;
 - 5) basic hydraulic symbols;
 - 6) hydraulic fluid;
 - 7) operation at the suction side of pump;
 - 8) actuators;
 - 9) luffing cylinders;
 - 10) control of hydraulic energy;
 - 11) check valves, accumulators;
 - 12) flow control values;
 - 13) directional control values;
 - 14) pressure control values;
 - 15) pilot operated pressure control valve;
 - 16) different types of pumps;
 - 17) hydraulic motors;
 - 18) reservoirs, coolers, and filters;
 - 19) hydraulic symbols and schematic drawings;
 - 20) knowledge of hoses;
 - 21) hoists;
 - 22) Emergency load lowering procedures (as applicable).

- c) Non-mechanical (specific basic electric):
 - 1) electrical symbols and schematic drawings;
 - 2) basic electrical terminology;
 - 3) all applicable motors, controls, and panels;
 - 4) swing limit switch;
 - 5) emergency load lowering procedures (as applicable).
- d) Mechanical (specific basic friction):
 - 1) mechanical terminology;
 - 2) swing lock and brake;
 - 3) vertical and horizontal swing shaft and bevel gear boxes;
 - 4) applicable hook roller assemblies
 - 5) upper and lower reduction gear cases ;
 - 6) all hoist planetary brakes and clutches;
 - 7) clutch assemblies;
 - 8) all applicable drum brakes;
 - 9) boom hoist pawl;
 - 10) boom hoist brake;
 - 11) chain case and pump;
 - 12) applicable operational function controls and systems;
 - 13) bearing – gear – shaft and housing inspection;
 - 14) emergency load lowering procedures (as applicable).

H.4.4 Practical Exercises and Simulations

H.4.4.1 General

H.4.4.1.1 A pedestal crane shall be used for practical exercises and testing.

H.4.4.1.2 Practical exercises shall include the instructions on the proper usage of measuring and testing tools, as specified in relevant recommended practices

H.4.4.1.3 Practical exercises shall include identification of stress, corrosion, and inspection practices.

H.4.4.1.4 The training provider shall maintain a documented requirement for all the hands-on exercises conducted in each course.

H.4.4.1.5 The hands on exercises shall include a requirement for covering any failed portions of the hand-on examination immediately after exam completion.

H.4.4.2 Practical Evaluation

H.4.4.2.1 The training provider shall maintain a documented procedure requiring a practical examination with all exercises in crane maintenance, troubleshooting and inspection centered on critical components for offshore pedestal mounted cranes as appropriate for the type of crane used.

a) Mechanical and non-mechanical cranes (basic general):

- 1) types of swing assemblies typically used on pedestal-mounted cranes;
- 2) crane safety systems;
- 3) wire rope;
- 4) prime mover;
- 5) boom inspection;
- 6) sheave;
- 7) load and pull test procedures;
- 8) emergency load lowering.

b) Non-mechanical (specific basic hydraulic):

- 1) hoist tear down and troubleshooting;
- 2) hoist brake test;
- 3) emergency load lowering.

c) Non-Mechanical (Specific Basic Electric):

- 1) hook and swing board/panel voltage measurements;
- 2) emergency load lowering.

d) Mechanical (specific basic friction):

- 1) clutches disassemble/reassemble and adjustments made;
- 2) boom band brake adjustments;
- 3) control lever adjustments;
- 4) Torqmatic converter pressure plate (clutch) adjustment;
- 5) emergency lowering.

H.4.4.2.2 Upon completion of the qualified inspector training the Qualified Inspector will be qualified in one of the following:

a) mechanical (friction);

b) non-mechanical:

- hydraulic,
- electric.

H.4.4.2.3 Upon completion of the qualified inspector training the Qualified Inspector will be issued a certificate and card with minimum information required as shown in Figure H.12 on the card and certificate.

Front Side (*Crane Inspector*)

COMPANY LOGO	(Company Name Here)		
	(Company Address Here)		
	(Company Phone/Fax Number Here)		
	Qualified Crane Inspector		
(First Name Here)		(Last Name)	(Last four ID #)
The individual named above, has satisfactorily demonstrated necessary skills through written, practical, oral evaluation and has successfully completed the course of instruction as prescribed for (<i>Course Title Here</i>) in accordance with latest edition of the API RP2D.			
Expires: ____/____/____ Date		Instructor/Examiner: _____ Name	

Back Side (*Crane Inspector*)

CRANE OWNER'S NOTES:	It is advised that all crane owners give due consideration to the following when requiring the use of a Qualified <i>Crane Inspector</i> .		
1.	The crane owner shall be responsible for Qualified <i>Crane Inspector</i> Qualifications requirements to be met in accordance with API RP2D latest edition.		
Check Box			
☐	No history of a disabling medical condition, which can be sufficient reason for disqualification.		
☐	Any corrective lenses required.		
Crane Type Qualified to Inspect			
Mechanical	☐	Friction	
Non-Mechanical	☐	Hydraulic	
	☐	Electrical	
Tracking No: _____			

Figure H.12—Crane Inspector Example Certificate

Annex I

(informative)

Loading and Unloading Offshore Support Vessels

I.1 Purpose

The information in this annex is meant to provide guidance to crane owners and operators for safe operating practices during transfers of personnel or material to and/or from offshore support vessels.

I.2 Operations

I.2.1 Vessel Operations—General

I.2.1.1 The master of the vessel is responsible for safe positioning of the vessel during lifting operations and should consult with the facilities Person in Charge (PIC) prior to a lift for details related to positioning. During lifting operations, the vessel should maintain station.

I.2.1.2 In order to prevent spillage over the vessel, or other discharges from interfering with vessel operations, an announcement should be made over public address systems to secure any discharges in way of the vessel involved in conducting lifting operations. If discharges from the installation interfere with vessel operations, the loading or unloading operation should cease.

I.2.2 Lifting Operations—General

I.2.2.1 Offboard/dynamic load charts should be used for all lifting operations involving vessels with consideration given to sea conditions and relevant significant wave heights.

I.2.2.2 Crane operators should not lift loads that exceed the crane's nominal capacity (R_n) stated in the dynamic load chart.

I.2.2.3 Crane operators shall maintain visual contact with the load. Where this is not possible, crane operators should maintain visual contact with another person who has direct visual contact with the load and direct communication with the crane operator.

I.2.3.4 Crane operators should know and obey the emergency stop signal at all times.

I.2.2.5 Loads should never be swung over the wheelhouse or crew on the vessel and should be lifted and lowered over the sea as long as possible before being swung over the boat deck.

I.3 Communications

I.3.1 Two-way radio communication is most important between the vessel master, crane operator, PIC, and designated signalman on the deck of the vessel during marine transfers. Whenever possible, vessel deck crew and deck operators on the installation should wear and communicate with radio headsets with integrated microphones that fit on or under required personal protection equipment.

I.3.3 The PIC and designated signalman should be identified and documented on the lifting plan and be communicated to the lift team and to personnel in proximity of the lift. A best practice is to have the designated signalman clearly identified by high visibility vest or hardhat cover that is different from other colors used (e.g. red vest for fire watch).

I.3.4 Signals between the crane operator and the designated signalman should be discernible—audibly or visually—at all times. When using radio communication, continuous verbal instructions should be used. The crane operator should stop the lifting operation whenever there is no clearly understood signal.

I.3.5 The effectiveness of communications should be verified, with particular attention given for blind lifts (e.g. designated channels on radio for the operation).

I.4 Lift Planning

I.4.1 Transport documents should be transferred between the installation and the vessel well in advance of the start of lifting operations in order to allow sufficient time for personnel to plan and review the lifting operation. material safety data sheets (MSDS) should be provided, when applicable.

I.4.2 The crane operator, master of the vessel, PIC, designated signalman, and all other involved personnel should carry out a pre-job/toolbox safety meeting including the review of JSA/JSEA documents before the loading or unloading operation commences.

The talk should include the following:

- discussion and review of the cargo manifest;
- review and discussion of the crane operation including positioning of load or offload, identification of persons in charge, required equipment and personnel, etc.;
- review of the standard API crane hand signals and confirmation that such hand signals will be used if radio communications are unavailable or lost;
- review of the emergency stop signal and confirmation that the emergency stop can be given by anyone and must be repeated by all personnel seeing the signal;
- review and confirmation that the emergency stop signal will be obeyed immediately by the crane operator (unless the emergency stop would result in a catastrophic failure of the crane);
- discussion of operational or environmental conditions that can create difficulties during the crane operation;
- discussion of heavy lifts or other loads that require special attention;
- discussion of sea fastenings or mooring arrangements;
- discussion of short service personnel or other factors that should be taken into consideration;
- discussion and review of MSDS's, if applicable.

I.5 Safety

I.5.1 Tag lines on loads should be of an adequate length to ensure the safety of the crew on the vessel at all times. The number, length, and strength of tag lines used should be appropriate for the load handled.

I.5.2 Pinch points and other dangers that could injure personnel handling the load should be identified.

I.5.3 Before the lifting operation commences, the vessel's master should ensure that cargo deck safety zones and escape routes are known to the vessel crew and crane operator.

I.5.4 Safety zones should be clearly defined for each vessel. Such areas should be outlined with paint of a contrasting color than the rest of the deck or other visible means to enable rapid identification and should

remain unobstructed by loads or other material at all times. Common safety areas include the forward part of the work area, aft part of the deck, and areas around fire hose stations, other fire and life safety equipment, etc.

I.5.5 Loading and unloading of the work deck should be planned with escape routes in mind that will afford the crew the ability to access and evacuate work areas safely. These areas will vary as the amount and composition of the load changes. Accordingly, escape routes should be identified prior to each lifting operation.

I.6 Cranes—Fitness-for-Service

I.6.1 Cranes should be operated, maintained, tested, and inspected in accordance with this recommended practice and any recommendations specified by the manufacturer.

I.6.2 Records of periodic tests and inspections should be maintained as required in Section 5.2 and made available upon request.

Bibliography

- [1] ASME B30.5, *Mobile and Locomotive Type Cranes*
- [2] ASTM A906/A906M, *Standard Specification for Forged Grade 80 and Grade 100 Alloy Steel Chain Slings for Overhead Lifting*
- [3] ASME B30.10, *Hooks*
- [4] ASME B30.20, *Below-the-Hook Lifting Devices*
- [5] ASME B30.26, *Rigging Hardware*
- [6] Federal Specification RR-W-410, *Wire Rope and Strand*

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