International Association of Oil & Gas Producers

SPECIFICATION
IOGP S-618J

September 2023
Version 1.1

Supplementary Specification to API Specification 2C for Offshore Pedestal-mounted Cranes

NOTE This version (S-618J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-618.

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.1	September 2023	Issued for Public Review
1.0	December 2018	First Edition

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

This second edition will cancel and replace the first edition published in December 2018.

Due to technical writing requirements leading to extensive changes, this second edition should be treated as a new document.

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Introduction

The purpose of the IOGP S-618 specification documents is to define a minimum common set of requirements for the procurement of offshore pedestal-mounted cranes in accordance with API Specification 2C, 8th Edition, Errata 1, published June 2021, Offshore Pedestal-mounted Cranes, for application in the petroleum and natural gas industries.

The IOGP S-618 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a procurement data sheet (PDS), an information requirements specification (IRS) and a quality requirements specification (QRS). These four specification documents, together with the purchase order, define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Requirements Specification (TRS)

This specification is to be applied in conjunction with the supporting PDS, IRS and QRS as follows.

IOGP S-618: Supplementary Specification to API Specification 2C for Offshore Pedestal-mounted Cranes

This specification defines technical requirements for the supply of the equipment and is written as an overlay to API Specification 2C, following the API Specification 2C clause structure. Clauses from API Specification 2C not amended by this specification apply as written. Modifications to API Specification 2C defined in this specification are introduced by a description that includes the type of modification (i.e. *Add*, *Replace* or *Delete*) and the position of the modification within the clause.

NOTE Lists, notes, tables, figures, equations, examples and warnings are not counted as paragraphs.

IOGP S-618D: Procurement Data Sheet for Offshore Pedestal-mounted Cranes (API)

The PDS defines application-specific requirements. The PDS is applied during the procurement cycle only and does not replace the equipment data sheet. The PDS may also include fields for supplier-provided information required as part of the purchaser's technical evaluation. Additional purchaser-supplied documents may also be incorporated or referenced in the PDS to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-618L: Information Requirements for Offshore Pedestal-mounted Cranes (API)

The IRS defines information requirements for the scope of supply. The IRS includes information content, format, timing and purpose to be provided by the supplier, and may also define specific conditions that invoke the information requirements.

IOGP S-618Q: Quality Requirements for Offshore Pedestal-mounted Cranes (API)

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the PDS or in the purchase order.

The specification documents follow the editorial format of API Specification 2C and, where appropriate, the drafting principles and rules of ISO/IEC Directives Part 2.

The PDS and IRS are published as editable documents for the purchaser to specify application-specific requirements. The TRS and QRS are fixed documents.

The order of precedence of documents applicable to the supply of the equipment, with the highest authority listed first, shall be as follows:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser-defined requirements (e.g. PDS, IRS and QRS);

d) this specification;

e) API Specification 2C.

2 Normative References

Add to first paragraph

The following publications are referred to in this document, the PDS (IOGP S-618D) or the IRS (IOGP S-618L) in such a way that some or all of their content constitutes requirements of this specification.

Add to section

Dropped Object Prevention Scheme Recommended Practice:2020

IEC 31010, *Risk management – Risk assessment techniques*

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

NFPA 70, *National Electrical Code*

3 Terms, Definitions, Acronyms, Abbreviations, Units, and Symbols

3.2 Acronyms and Abbreviations

CAS conformity assessment system

CIS component identification system

CSV comma-separated values

CTS constant tension system

EOS emergency operating system

FAT factory acceptance test

FMEA failure mode effects analysis

HVAC heating, ventilation and air conditioning

IRS information requirements specification

LED light emitting diode

MBL minimum breaking load

MOPS manual overload protection system

NDT non-destructive testing

OEM original equipment manufacturer

PDS procurement data sheet

PLC programmable logic controller

PLr required performance level

QRS quality requirements specification

SAT site acceptance test

TRS technical requirements specification

4 Documentation

4.2 Purchaser-supplied Information Prior to Purchase

Add new list item m)

m) any applicable regulatory requirements.

Justification

The purchaser normally provides the necessary information to regulatory agencies (e.g. 46 CFR subpart 107.309 in the USA) throughout the design process. This allows manufacturers to be aware of any regulatory implications.

4.4 References to Annexes

Add to section

— Hydraulic systems and pneumatic lines; see Annex G (informative).

— Factory acceptance test (FAT) guidance; see Annex H (informative).

— Site acceptance test (SAT) guidance; see Annex I (informative).

Justification

4.4 lists the purposes of Annex B through Annex F in API 2C and the addition of these three list items is in accordance with the addition of new Annex G, new Annex H and new Annex I.

5 Loads

5.2 Critical Components

In first sentence, replace "whose failure shall result in an uncontrolled descent of the load or uncontrolled rotation of the upper structure" with

whose failure results in an uncontrolled movement of the crane or load

Justification

The existing sentence in API 2C limits the critical component definition to "uncontrolled descent of the load or uncontrolled rotation of the upper structure" and is not inclusive of all uncontrolled movements. This overlay amends the current sentence to be inclusive of all uncontrolled movements. For example, if the crane is booming up and the control valve gets stuck, the boom can continue moving up and the crane can be pulled backward. The critical components definition is not applicable to items that have redundancy.

Add to section

Critical components shall have a risk assessment performed using a technique recognized by IEC 31010.

Justification

The knowledge and experience of design, manufacturing, installation, transportation, assembly, dismantling, use, maintenance, incidents, accidents and harm, etc. related to lifting equipment are used by the manufacturer in order to assess the risks of lifting equipment during all phases. Risks are assessed so that they may be managed. Also, risk management may be a regulatory requirement. IEC 31010 gives guidance on many different types of techniques that are acceptable and known by operators.

Risk assessment of critical components shall contain determination of the limits of the machinery.

Justification

This requirement has been added to target the risk assessment to the crane itself and to point to the general requirements and intent of ISO 12100 without making ISO 12100 mandatory (normative).

NOTE The risk assessment should be performed in accordance with ISO 12100 for European locations. For all other locations, the manufacturer may propose the risk assessment method.

5.4 In-service Loads

5.4.4 Legacy Method

5.4.4.1

In list section b) of second paragraph (offboard ratings), replace "restrained relative to the crane-supporting structure" with

maintained constant to the crane-supporting structure

Justification

Dynamic positioning systems provide the same type of positional accuracy as tethering (restraining). Due to dynamic positioning systems, tethering has become a rare occurrence.

5.4.6 Horizontal Loads

5.4.6.3 Loads due to Crane Inclinations (CI Forces) and Crane Motions (CM Forces)

Add to section

A minimum additional 0.5° offlead and 0.5° sidelead shall be added to the crane motions.

Justification

An additional sidelead and offlead angle increase is provided to account for deflection and pedestal fabrication tolerances.

When the crane base angle is 45°, the additional offlead and sidelead shall be combined at 100 % full value.

Justification

This requirement ensures that the full 100 % additional load is added to the sidelead and offlead rather than 70.7 % of each when the crane base angle is 45°. This reduction is not allowed when adding the tolerance values.

6 Structure

6.1 General

Add to section

The crane shall have an installation tolerance of 1° out of true in any direction about the axis.

Justification

This requirement provides a specific alignment tolerance standardized for all operators. The crane is expected to operate as purchased (i.e. meet the requirements of this specification) if installation is out of alignment up to 1° out of true in any direction. There should be no impact to the performance if the installation of the crane is not perfectly aligned.

The performance and operation of the crane shall not be impacted within the installation tolerance of 1°.

Justification

This requirement provides a specific alignment tolerance standardized for all operators. The crane is expected to operate as purchased (i.e. meet the requirements of this specification) if installation is out of alignment up to 1° out of true in any direction. There should be no impact to the performance if the installation of the crane is not perfectly aligned.

6.4 Pedestal, Kingpost, and Crane-supporting Foundation

Add to section

The pedestal adaptor shall have lifting points for use during installation.

Justification

Operators have experience of the adapter not being provided with proper lifting points, which is a safety issue. This requirement ensures that properly engineered lifting points corresponding to the size and weight of pedestal adapters are provided.

Add new section

6.7 Pedestal Adapter and/or Kingpost Fabrication

The pedestal adapter and/or kingpost and transition sections shall have section properties greater than or equal to the section properties of the main structures pedestal at the point of transition.

Justification

This requirement prevents the limitation of the crane capacity being the section properties at the pedestal adapter and/or kingpost at the point of transition.

The outside diameter to wall thickness ratio of the pedestal adapter and/or kingpost shall not exceed 60.

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface.

The out-of-roundness tolerance of the pedestal adapter and/or kingpost shall not exceed ± $^{1}/_{8}$ in. (3 mm).

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface.

The circumference of the pedestal adapter and/or kingpost shall be within ± 1/8 in. (3 mm) of the nominal circumference.

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface.

The straightness deviation of the pedestal adapter and/or kingpost shall not exceed 1/8 in. (3 mm) for any 10 ft (3 m) section.

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface.

If the pedestal adapter and/or kingpost has a tapered angle, the tapered angle shall not have a change in the angle throughout the tapered length.

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface.

The pedestal adapter and/or kingpost shall have no changes in wall thickness at offshore field welds.

Justification

This requirement is the minimum structural tolerance to ensure robustness and dimensional compatibility at the critical weld area of the kingpost and/or pedestal adapter to the pedestal (mating point). The mating point is a critical interface and a constant wall thickness is needed for offshore field welds.

The pedestal adapter and/or kingpost shall have an outside diameter that allows access for maintenance of the swing bearing bolts.

Justification

This requirement ensures that there is appropriate space to properly check, tighten and perform maintenance on bolts.

The pedestal or pedestal adapter shall be equipped with a manway that is at least 18 in. (460 mm) wide.

Justification

This requirement safely allows for periodic inspection and maintenance of the inside of the pedestal.

7 Mechanical

7.2 Critical Rigging Components

7.2.2 Wire Rope

Add new section

7.2.2.8 Hoist Wire Rope Wear Protectors on Booms

Booms shall be protected from running wire rope.

Justification

Hoist wire rope wear protectors on booms is a safe practice and prevents additional or increased maintenance on the lacings due to running wire rope forces.

Wire rope boom protectors shall not create a snag point with the running rope.

Justification

The boom protectors are provided to protect the boom from the running of wire ropes during operation or rope replacement. The boom protectors could potentially create snag points transferring shock loads to the hoisting systems or damaging a lacing. The layout and location of the boom protectors should be designed to prevent snag points and subsequently to prevent the shock loads.

7.2.3 Wire Rope End Terminations

7.2.3.2 Eye Splice

Replace section with

U-bolt or eye splice terminations shall not be permitted.

Justification

U-bolt and eye splice terminations cause reliability issues.

Poured spelter or swaged sockets shall be used for pendant line and non-running wire rope end termination.

Justification

The use of poured spelter or swaged sockets for pendant lines and non-running wire rope end termination results in the highest efficiency in termination.

7.2.4 Sheaves

7.2.4.2

In first sentence, replace "18" with

20

Justification

This requirement replaces 18 with 20 to reduce crushing and fatigue on the rope. A 20:1 ratio is commonly specified by operators and has a proven performance track record. This requirement may also promote standardization of components with original equipment manufacturers (OEMs).

Delete second sentence

Justification

As the first sentence has been amended to require a 20:1 ratio for all wire rope diameter regardless of motion compensation system, this second sentence is no longer required and has been deleted.

7.3 Hoisting, Boom Luffing, Telescoping, and Folding

7.3.2 Hoisting

7.3.2.5 Drums

Replace list section a) with

a) Drums shall provide a first layer rope pitch diameter of not less than 20 multiplied by the nominal rope diameter (Figure 7).

Justification

This requirement has been rewritten to be aligned with the requirement in 7.2.4.2.

Add to section

The crane operator shall have the ability to check the rotation of drums by direct sight or by a warning indicator that checks for rotation.

Justification

The visibility of drums is essential for the safe operation of the crane.

Drums shall be radially striped black and yellow with high visibility, reflective paint along the flange.

Justification

The ability to visually see the rotation of drums is essential for the safe operation of the crane. The radially striping of high contrasting colors along the flange assists in the visual confirmation of the rotation of the drum.

To increase the crane operator's visibility of drums, lights shall be directed on drums.

Justification

Lights are provided at all drums in locations that help the crane operator see the drum rotation during night operations. Lights increase visibility for crane operators.

7.4 Swing Mechanism

7.4.1 Swing Rotation Mechanism

7.4.1.3 Swing Rotating

Add to section

Swing drive mechanisms shall not be the SWLH limiting component.

Justification

This requirement ensures that swing drives are not the limiting factor in crane capacity limitation charts. This requirement has been added due to operating companies past experience.

7.4.1.5 Dynamic Friction Brake

In first sentence, replace "may" with

shall

Justification

This modification makes this sentence a requirement instead of an option. This requirement allows the crane operator to make sudden stops without having to command the swing in an opposite direction (which also causes premature wear to swing components).

Delete "When provided," from second sentence

Justification

As the first sentence has been made a requirement, "when provided" in this second sentence is no longer relevant or required.

7.4.2 Swing-circle Assembly

7.4.2.1 General

Add to section

A minimum of two swing drives shall be provided.

Justification

"Two swing drives" is a redundancy safety requirement. If one swing drive goes out, the second (redundant) swing drive is a safe way to get the boom back to the boom rest.

Swing drives shall have a means of adjusting backlash on site.

Justification

This requirement ensures that periodic maintenance at the site can be performed and that the backlash can be corrected/adjusted.

Crane design shall require a means to install a slew bearing replacement system.

Justification

Slew bearings will be replaced during the lifetime of the crane. Manufacturers are in the best position to recommend a system to replace the slew bearings that is convenient and workable for their specific cranes. If a manufacturer provides the means to replace the slew bearing, the time out of service will be minimized. To do this as a retro fit and without the proper means in place will substantially increase the time the crane will be out of service.

The soft spot location on the swing bearing ring shall be clearly and permanently marked.

Justification

It is important to permanently mark the location of the soft spot on the swing bearing as this denotes the weak point where no hardening has occurred during the heat treatment process. It is the manufacturer's option on how to make it permanent and visible based on their type of bearing. One type of marking on a bearing may not be suitable for the next type of bearing.

The soft spot on the swing bearing shall be positioned to avoid highly loaded areas.

Justification

The soft spot is to be mounted away from the highest loads to increase the capacity and service life of the bearing.

The crane swing shall be designed for unrestricted and continuous rotation in clockwise and counter-clockwise directions.

Justification

This requirement prevents crane operators from unknowingly damaging crane components (primarily slip ring internals) due to over rotation.

Crane design shall be suitable for the maintenance requirements specified in API 2D.

Justification

API 2C introduction states that the API crane standards (i.e. API 2C, API 2D and API 2D-2) are intended to be used together, which is not a hard requirement. This new requirement ensures that the crane has been designed and manufactured to allow for proactive monitoring, preventive maintenance and corrective maintenance as described in API 2D.

7.4.2.4 Mounting

Replace section 7.4.2.4.2 title with

7.4.2.4.2 Pedestal and Swing-Circle Assembly Deflection

Add to section

The crane pedestal lateral deflection shall not exceed the unsupported extended length (L) divided by 180 (i.e. $L/180$) where L is the distance from the centerline of the boom fit of the pin to the upper deck connection (see Figure 14).

Justification

The $L/180$ criteria in this requirement improves human factors and the crane operator's comfort (i.e. prevents the feeling of the crane tipping over).

The crane pedestal lateral deflection shall not exceed the limits specified by the swing bearing manufacturer/supplier.

Justification

This requirement ensures that lateral deflection limits meet the deflection specifications of the swing bearing manufacturer/supplier and ensures compliance with API 2C.

The swing circle assembly of pedestal mounted cranes and the swing drives of king post type cranes shall be designed for a lateral crane pedestal deflection of $L/120$.

Justification

The $^{L}/_{120}$ criterion results in a larger deflection. This requirement ensures that the swing system is designed for the larger deflection and provides a deliberate overload protection for the swing circle/swing drives. This requirement will also protect the slew drives. In kingpost cranes, there is not a way to protect the backlash but this requirement ensures that the design can accommodate large deflections.

Add new Figure 14

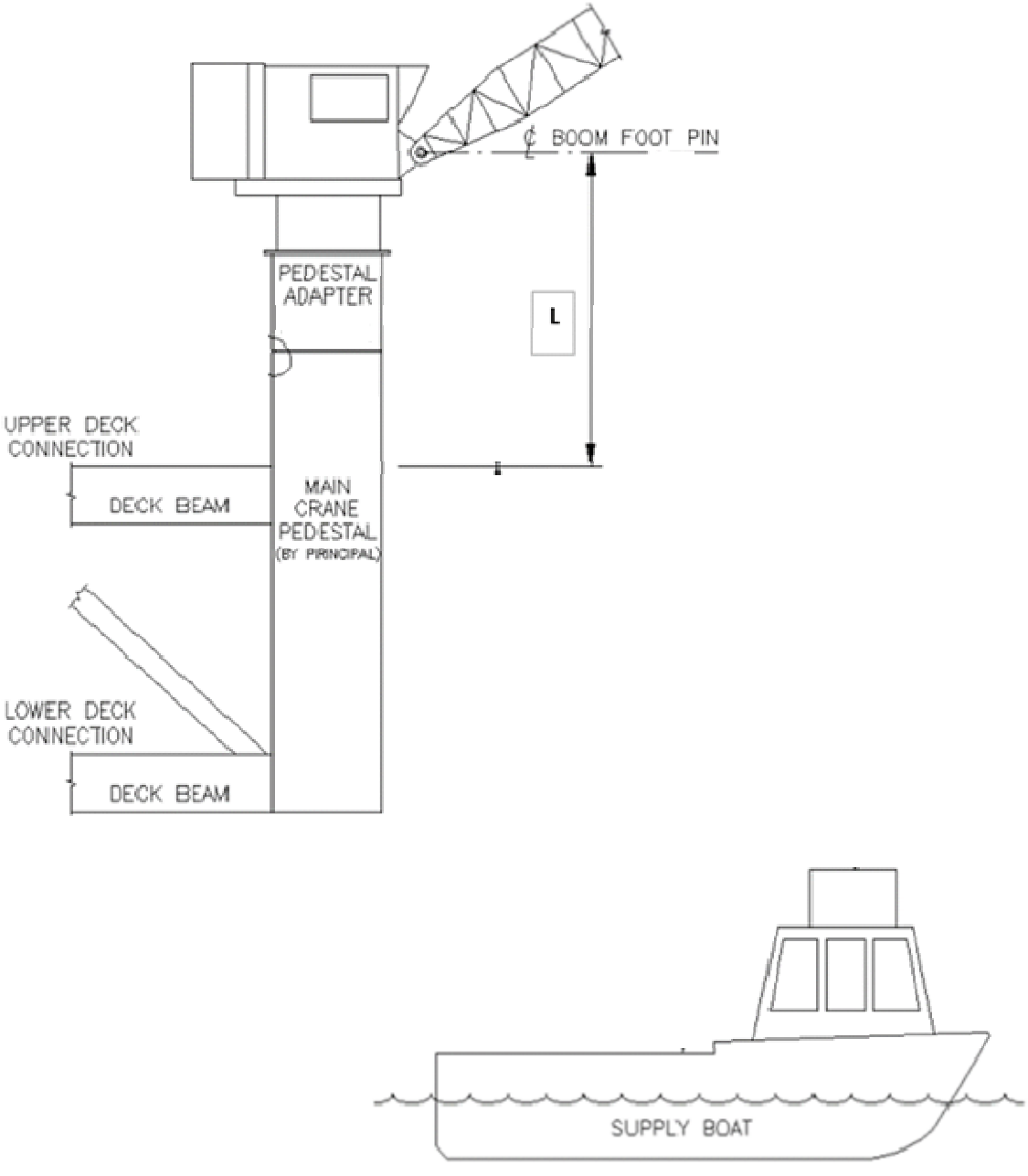

Figure 1—Crane Pedestal Lateral Deflection Unsupported Length

Justification

This figure has been added to give clarity on the L dimension to be used in deflection calculations.

7.4.2.5 Threaded Fasteners

7.4.2.5.3 Fatigue Life

Add to section

Bolts subjected to tension and fatigue shall be pre-tensioned to AISC or ABMA (as applicable).

Justification

AISC or ABMA may not require pre-tension for bolts in fatigue. This requirement ensures that bolts are pre-tensioned, which mitigates fatigue.

7.5 Power Plant

7.5.1 General

7.5.1.2 Power Plant Sizing

Add to section

The main power supply, power transmission and power control elements shall be sized for full power demands in any combination of load, speed and motion.

Justification

This requirement prevents the engine from stalling and power transmission components from exceeding their horsepower requirements.

The prime mover shall not overspeed, overheat, trip, stall or fall below the nominal speed of the prime mover at the rated load of the crane.

Justification

This requirement ensures that the prime mover is sufficiently sized for the operations that the crane is intended to do. Failure of the prime mover could lead to unpredictable performance of the crane.

If an external power source is used, the external power source shall not overload, overheat, trip or stall below the nominal speed of the external power source at the rated load of the crane.

Justification

Some applications may allow a temporary overload or overheat. This requirement is to prevent any allowance of this.

The installed power shall be sized for 100 % hoisting speed, 50 % luffing speed and 50 % swing speed simultaneously.

Justification

API 2C does not give guidance on simultaneous operations performance. This requirement achieves a minimum accepted criterion.

Hoisting motions shall have priority.

Justification

This is a safety precaution. Hoisting motions take priority to prevent other motions from taking priority and hoisting being slower. Hoisting is the most important operation.

Remaining motions shall not fall below 50 % speed when operated simultaneously with hoisting motion.

Justification

This is a safety precaution. Hoisting motions take priority to prevent other motions from taking priority and hoisting being slower. Hoisting is the most important operation.

7.5.2 Exhaust Systems of Internal Combustion Prime Movers

Add new section

7.5.2.4 Cooling Systems

If the temperature of exhaust manifolds and mufflers systems exceeds 660 °F (350 °C), a cooling system shall be included.

Justification

Ignition risks increase at higher temperatures.

7.5.3 Fuel Tanks

7.5.3.2 Fuel Tank Drains

Add to section

The tank drain shall be placed at a location that allows the contents of the tank to be removed.

Justification

This requirement allows the contents of the tank to be removed during maintenance. Draining the tank is a preferable solution compared to pumping out contents.

Add new section

7.5.3.3 Fuel Tanks Capacity

The fuel tank shall be sized to accommodate one day's worth of fuel without the need for refilling.

Justification

Requirement gives a definitive value on the size of the fuel tank based on the individual needs of projects. One day's worth of fuel could vary depending on the project and is an interface between the manufacturer and the purchaser.

On cranes subject to motions, the fuel tank shall have baffles or a mechanism to reduce fluid sloshing effects.

Justification

Floating platforms move around and can cause sloshing. Also, cranes moving around can cause sloshing.

The fuel tank shall be manufactured from 316L stainless steel.

Justification

316L stainless steel (or approved equivalent) is a known material used for corrosion protection.

A handhole or manway for internal cleaning shall be sized as specified.

Justification

This requirement ensures access for internal cleaning. If the tank cannot be cleaned out, there will eventually be debris that will clog up the fuel system. The handhole/manway sizes may be dependent on the maintenance activities that will be completed inside the fuel tank.

7.5.5 Isolation of Ignition Sources and Heated Surfaces

Add new section

7.5.5.3 Fire and Gas Detection

The crane shall be equipped with fire and gas detectors and a shutdown system in compliance with the site/project fire and gas ignition source control philosophy.

Justification

Fire and gas detectors and a shutdown system are added for safety in the event of a fire and gas incident. Each project can specify the extent of the project requirement in the fire and gas ignition source control philosophy.

9 Gross Overload Conditions

9.5 Gross Overload Protection System (GOPS)

Add new section

9.5.2 Requirements for Manual Overload Protection System (MOPS)

9.5.2.1 General

If a manual overload protection system (MOPS) is specified, the requirements of 9.5.2.2 through 9.5.2.4 shall apply.

Justification

An increased risk of entanglement is present if there is a power failure to the crane or in the control system during offboard lift. If this occurs, the only active technical risk reduction measure is the MOPS function before the crane collapses.

9.5.2.2 System Criteria

The MOPS shall be arranged for manual activation only, for all reeving configurations.

Justification

This requirement ensures that the MOPS works for all types of reeving configurations. The reeving of a crane can be changed daily (for example, from a single-part reeving to a four-part reeving to a six-part reeving).

The MOPS shall be capable of activation when overloads due to entanglement and relative motions occur.

Justification

The MOPS mitigates the risk of entanglement of offshore cranes and subsequent mechanical damage.

The MOPS shall be capable of activation during operation, normal stop and emergency stop.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

The MOPS shall be capable of activation in the event of main power supply failure or shutdown of the crane during an offboard lift.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

On cranes rated for personnel lifting and fitted with a personnel lifting mode, the MOPS shall be overridden (i.e. activation of the MOPS prevented) when personnel lifting mode is selected.

Justification

It is unsafe to activate the MOPS during a personnel lift. This requirement is already covered in 8.13 where a lockable mode selector is required.

In any circumstances, the MOPS shall have the ability to be deactivated.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

The hoisting brakes shall disengage upon activation of the MOPS when entering the offboard lift zone.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

If activated, the MOPS shall maintain a retaining force in the hoisting system of 10 % to 20 % of the maximum rated capacity for an onboard lift, allowing the wire rope to be spooled completely off the drum, without causing significant damage to the crane.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

The MOPS shall continue to operate in the event of a prime mover failure or loss of hydraulics.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

In the event of a prime mover failure or loss of hydraulics, the MOPS stored capacity shall allow activation and/or reset at least three times in succession over a period of 5 min.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

When the MOPS is activated, the motion limiters for the low hook shall be automatically overridden.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

9.5.2.3 Manual Overload Protection System (MOPS) Activation Mechanism Location and Marking

The MOPS activation mechanism shall be located in the control station.

Justification

This requirement ensures that the MOPS activation mechanism is located at the same place in each crane for standardization and safety.

The location of the MOPS activation mechanism shall be at the left-hand side of the crane operator.

Justification

This requirement ensures that the MOPS activation mechanism is located at the same place in each crane for standardization and safety.

The MOPS activation mechanism shall be permanently marked with yellow color against a contrast background.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

The MOPS activation mechanism shall be protected against inadvertent use (e.g. a flip cover or pull-push button).

Justification

Some type of dual action (e.g. a flip cover or pull push button) is required to prevent inadvertent activation.

9.5.2.4 Manual Overload Protection System (MOPS) Control System Indicators and Alarms

The MOPS shall have control system indicators as per 9.5.2.4.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

MOPS control system indicators shall be located at the control station.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

MOPS control system indicators shall indicate when the system is operational by means of a continuous visual signal (i.e. no visual signal when system is not in operation).

Justification

This requirement lets operators know that the system is "ready" for operation. This is needed because during personnel lifts it is important to know that the MOPS is not on (i.e. not available for use). This is a safety precaution.

MOPS control system indicators shall indicate when the MOPS is activated by means of a distinguishable continuous visual and an audible signal.

Justification

This is a safety precaution that lets both the operator and surrounding personnel know when the MOPS is activated.

MOPS control system indicators shall indicate when the MOPS is activated with an external audible alarm giving a sound level of approximately 110 dB(A) measured at 3.28 ft (1 m) from the alarm.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

10 Human Factors—Health, Safety, and Environment

10.1 Controls

10.1.1 General

10.1.1.2 Automatic Return

Add to section

The controls shall have the ability to be deactivated when not in use.

Justification

This requirement is to prevent unintentional/accidental activation. For instance, the crane operator may turn the engine on for pre-inspection and unintentionally/accidently activate the crane.

10.1.1.4 Emergency Stop

Add to section

The emergency stop shall semi-instantaneously suspend hydraulic functions with the control levers in any position and set the emergency brakes.

Justification

The expectation for this requirement is that the hydraulics stop and the emergency brakes engage almost instantaneously. Hydraulics alone might not be able to arrest the load in certain failures.

The emergency stop shall not shut down the power plant.

Justification

If the power plant shuts down, the restart might be more difficult with a load on the hook.

The emergency stop button shall have a manual reset function only (i.e. not have an automatic reset).

Justification

The action of putting crane back into service is to be a deliberate action to avoid unintentionally putting the crane into service.

The emergency stop button shall be positioned away from controls to prevent unintentional activation.

Justification

This requirement is to prevent activating the emergency stop during an operation that is not an emergency and/or inadvertently hitting a separate control during an emergency that would delay the emergency stop.

Add new section

10.1.1.7 Control System Response

CMs shall be proportional to the control system lever signal.

Justification

Without a proportional system, the crane is an on-off system that is not suitable for offshore cranes.

The maximum response time to reach required speed for the main motions shall be as follows:

— 2 s for hoisting;

— 3 s for luffing, folding and telescoping;

— 4 s for swinging.

Justification

A maximum response time limits the lag between command and response. This leads to safer crane operations.

The response time for the main functions (e.g. hoisting, swinging, luffing, folding and telescoping) shall be the time from control lever activation at standstill to the achievement of the required motion velocities at 100 % lever actuation.

Justification

This requirement creates a baseline to measure and assess the response time.

Single fault or common cause failures shall not result in uncontrolled movements.

Justification

This requirement improves safety. Examples from operators include when a heave compensated system unintentionally activated and caused damage. The term "common cause failure" is defined in ISO 13849-1.

The control system shall be designed for simultaneous hook movements in vertical, radial and lateral (i.e. hoist, boom and swing).

Justification

This requirement avoids having to operate different functions (e.g. buttons, joysticks, levers) to achieve movement of the hoist, boom and/or swing. If the crane operator cannot operate functions simultaneously, he/she will struggle to put the load in the desired location. In addition, if a load is swinging back and forth, this requirement allows the crane operator to safely catch the load using simultaneous functions.

Add new section

10.1.1.8 Controls for Personnel Rated Cranes

Add to section

Cranes rated to lift personnel shall have a lockable mode selector at the control station.

Justification

Deliberately selecting the personnel lift mode automatically displays the correct load charts and associated safety features. A lockable mode selector allows the crane to stay in the "personnel lift" mode. Without the lockable mode selector, the crane operator would be required to hold the button down and could unintentionally unselect the "personnel lift" mode.

When personnel lift mode is selected, the activation of the GOPS or MOPS shall be prevented.

Justification

This requirement ensures the GOPS or MOPS is not activated while a person is on the hook.

When personnel lift mode is selected, motion compensators and constant tension systems (CTSs) shall be deactivated.

Justification

It is unsafe for the motion compensators or CTSs to be activated during a personnel lifting. The design of the lockable mode selector should prevent the inadvertent activation of these systems.

10.2 Cabs and Enclosures

10.2.1 General

Add to section

Crane operators' cabins that are on the rotating portion of the crane shall be enclosed and weatherproof.

Justification

When operating the crane on the rotating portion, there is always a threat of falling out of the cabin or of an uncontrolled load swinging towards the cabin and putting the crane operator at risk. Enclosed cabins *prevent possible fire hazard as well from electrical shorts due to water ingress. Enclosing the cabin is a good safety practice that provides a level of precaution against these risks.*

Cabin enclosures shall be constructed of fire-resistant insulated welded metal.

Justification

This requirement prevents a possible fire hazard and electrical shorts due to water ingress. The word "metal" is used instead of "steel" due to aluminum being commonly used for the construction of cabins.

Room dimensions of enclosed cabins shall be at least 71 in. (1.8 m) wide x 71 in. (1.8 m) deep x 87 in. (2.2 m) headroom.

Justification

This requirement is based on operator experience to meet ergonomic and other needs.

Roof of enclosed cabins shall withstand a uniform static load of 1.43 psi (1 t/m^2).

Justification

The roof load chosen in this requirement ensures that the roof can withstand personnel climbing on the roof for maintenance. This requirement indirectly provides a minimal level of drop protection to personnel inside the cabin.

Enclosed cabins shall have a secondary means of escape (e.g. pop-up window).

Justification

This requirement improves safety by providing a secondary means of escape in the event of a fire in the cabin. Examples of means include a pop-up window.

The crane operator's seat shall have arm supports.

Justification

This requirement provides ergonomic comfort to the crane operator.

The crane operator's seat shall be fully adjustable in the up/down and forward/backward directions of movement.

Justification

This requirement provides ergonomic comfort to the crane operator.

A foldable seat attached to the cabin shall be provided for an instructor behind the operator's seat.

Justification

Cabins have minimal room to add a free-standing seat for a second person during training. This requirement enables a trainer to have a seat while instructing crane operators.

The cabin shall have a dedicated space for a life jacket and a fire extinguisher.

Justification

This requirement ensures that cranes meet regulatory requirements for life jackets and fire extinguishers in certain regions such as the Gulf of Mexico.

10.2.2 Windows

10.2.2.1 General

Replace first sentence with

Windows shall be of shatterproof glass or of the safety laminated type.

Justification

Safety laminate and shatterproof glass are safety requirements to protect the operator from any accidental drops that might land on the crane window.

Windows glass or laminate shall be at least 0.25 in. (6 mm) thick.

Justification

The minimum thickness of 0.25 in. is added in lieu of impact criteria.

Replace second and third sentence with

Windows shall be sized and located to provide an unobstructed line of sight from the crane operator's seat to the boom, hooks and the load in all of the crane's operating positions.

Justification

The intent of this requirement is to avoid blind spots that would prevent the crane operator from seeing the crane hook and load at all possible positions.

Add to section

Windows shall be provided with adjustable sun blinds positioned to shade the crane operator from sunlight from any direction.

Justification

Blinds are required to maintain the operator's visibility and reduce glare from sunlight. Adjustable sun blinds are preferred over window tint due to the fact that window tint will decrease visibility during night conditions.

The interior and exterior sides of the windows shall be accessible from inside the cabin for cleaning.

Justification

The ability to open the windows and clean from inside and outside while in the cabin provides safe conditions for cleaning the windows (versus climbing on the cab). The ease in being able to clean the windows may also increase the frequency at which the windows are cleaned. Clean windows improve the crane operator's visibility and increases the overall safety of crane operations.

Protection bars shall not obstruct the crane operator's view.

Justification

The crane is one of the highest points on a platform. This requirement ensures that the crane operator can see the load the entire path of the load.

When open, operable windows shall remain secured in position.

Justification

On platforms that are subject to motions or due to wind, there is a danger of open windows slamming shut. Providing a mechanism that fixes the windows prevents this accidental action from happening.

10.2.2.2 Window Wipers and Washers

Add to section

Window wipers shall clear at least 80 % of the screen area.

Justification

This requirement provides a large amount of visibility for the safe operation of the crane during rainy weather or fog/mist and snow.

Access for window wipers and wiper motor exchange or repair shall be provided.

Justification

This requirement provides safe and accessible means to access and repair wipers and wiper motors.

10.2.3 Doors

Add to section

Doors of enclosed cabins shall be the self-closing type.

Justification

This requirement provides standardization of cabin doors and improves safety for the surrounding walkways.

Doors of enclosed cabins shall have a window.

Justification

A window in the door provides visual confirmation of personnel in the walkway and allows for visual view of the surroundings.

Doors dimensions of enclosed cabins shall be at least 71 in. (1.8 m) high and 31.5 in. (0.8 m) wide.

Justification

This requirement is the minimal human factors performance requirement accepted by a majority of crane operators.

10.2.5 Platforms and Walkways

Add to section

Permanently installed platforms shall be provided to facilitate wire rope replacements.

Justification

Wire ropes are heavy and stiff to handle. Permanent platforms are a safer practice rather than harnessing up. This requirement improves maintenance efficiency, safety and quality.

10.2.7 Noise Level

Add to section

Noise levels shall not exceed the maximum allowable noise level at the testing conditions and locations shown in Table 29.

Justification

A consistent set of conditions and criteria for maximum noise levels will provide a measurement to conform and comply to.

Add new Table 29

Table 29—Noise Level Testing

Test Number	Testing Condition	Maximum Allowable Noise Level	Measurement Location
1	Prime mover running at idle while the crane controls are in the neutral position	70 dB(A)	At the crane operator's normal position with the cabin door closed
2		85 dB(A)	3 ft (1 m) from the outside of the machine house/hood
3		85 dB(A)	From any engine exhaust
4	Prime mover running at full throttle with maximum rated loads	70 dB(A)	At the crane operator's normal position with the cabin door closed
5		85 dB(A)	3 ft (1 m) from the outside of the machine house/hood
6		85 dB(A)	From any engine exhaust
7	Prime mover running at full throttle without maximum rated loads	70 dB(A)	At the crane operator's normal position with the cabin door closed
8		85 dB(A)	3 ft (1 m) from the outside of the machine house/hood
9		85 dB(A)	From any engine exhaust

Justification

Crane operators have extended noise exposure due to long shifts. This requirement lowers the noise level to 70 db(A) at the operator seat with the cabin door closed, preventing cumulative damage and hearing loss due to noise. 85 db(A) is a regulatory requirement that prevents cumulative damage and hearing loss due to noise.

Add new section

10.2.8 Heating, Ventilation, and Air Conditioning (HVAC) Unit

Enclosed cabins shall be equipped with a heating, ventilation and air conditioning (HVAC) unit.

Justification

This requirement improves the crane operator's comfort level. An enclosed cabin without a HVAC system could produce an unsafe environment and overheat the operator.

HVAC units shall have adjustable ventilation.

Justification

This requirement ensures the air quality and ventilation is comfortable for the operator. It is important that the operator be able to adjust based on their comfort level rather than the HVAC be regulated automatically.

HVAC units shall control the internal temperature between 60 °F and 80 °F (15 °C and 25 °C) for highest and lowest 30-day temperature average.

Justification

This requirement provides specific criteria to size the HVAC unit. This requirement ensures necessary operation of the HVAC system.

If specified, the design temperature of the HVAC unit shall account for impacts from external heat sources of nearby operating equipment.

Justification

External heating sources can have a great impact on an efficiency and design of a HVAC Unit.

HVAC units shall defrost and demist windows for the highest and lowest 30-day average temperature and humidity.

Justification

This requirement provides specific criteria to size the defrost and demist features of the HVAC unit. This requirement ensures that these features are operable for the local environment.

10.3 Miscellaneous Requirements and Equipment

10.3.1 Indicators, Alarms, and Limits

Replace Table 23 with

Table 23—Indicators, Alarms, and Limits

Indicators, Alarms, and Limits	Ind	Trip	AA	VA
Hydraulic system pump pressure	X	PO	PO	X
Hydraulic oil temperature	X	PO	PO	X
Hydraulic control system pressure (if applicable)	X	PO	X	X
Engine start system pressure (if applicable)	X	PO	PO	PO
Hydraulic fluid level (required on reservoir)	X	PO	PO	X
Engine lube oil pressure (if applicable)	X	PO	X	X
Engine coolant temperature (if applicable)	X	PO	PO	X
Engine tachometer (if applicable)	X	PO	PO	PO
Engine overspeed (if applicable)	PO	X	X	X
Fuel level (required on reservoir)	X	PO	PO	PO
Hoist slack rope	PO	PO	PO	PO
Hoist low hook limit	PO *	PO *	PO *	PO *
Wind speed	PO	PO	PO	PO
Hook position	PO *	PO	PO	PO
Motion compensator parameters	PO *	PO	PO	PO
Hook speed and direction	X	PO	PO	PO
Engine fire and smoke	X	X	X	X
Crane slew limits	PO	PO	PO	PO
LMIS	NR	NR	X	X
MOPS (if applicable)	NR	NR	X	X
Motion limit overrides (A2B)	PO	NR	PO	PO
Motion limit overrides (HAKO)	PO	NR	PO	PO

Key
Ind = indicator, AA = audible alarm, X = mandatory, Trip = function limit, VA = visual alarm, PO = purchaser option (indicated in the data sheet), NR = not required.
* = changes from PO to X for crane with subsea ratings.

Justification

In this amendment, alarms have been made mandatory (standardized) rather than a purchaser's option. Alarms and indicators aid in both the operation of the crane and troubleshooting.

10.3.2 Boom Equipment

10.3.2.2 Boom Angle Limiters and Shut-off Devices

Replace second sentence with

For cranes fitted with boom winches, a low-angle limiter shall be provided.

Justification

Cranes are not usually rated to go past a certain angle. For some cranes without a low-angle limiter, there is a potential to run out of wire rope.

Add to section

The high-angle limiter shall be configured such that upon activation, the load hoists and swing mechanisms remain operable.

Justification

This requirement allows the crane operator to boom down immediately without override intervention. This adds operational workability.

If specified, a high-angle limiter override device shall be provided.

Justification

Sometimes, high-angle limiter devices are not reliable or there are operations that require the limiter to be overridden.

If a high-angle limiter override device is specified, the override device shall be installed external to the cabin.

Justification

This requirement prevents a single person from taking a potentially high consequence risk. This requirement ensures this task is deliberately planned by requiring two people to execute.

If a high-angle limiter override device is specified, the override device shall automatically return to its "off" function when its actuator is not manually held in the override position.

Justification

This requirement prevents a potentially high consequence risk. The crane operator has to continually hold the device in the override position to perform the task. This requirement makes this task a very deliberate action and prevents the override device from accidentally being left on.

The boom hoist speed shall be automatically reduced by 50 % of its normal operating speed within a 10 ft (3.48 m) radius of the boom hoist limiting device engagement.

Justification

This requirement helps prevent accidental boom contact with the backstops. This requirement has been added to only include luffing limits as per the following:

1) if they malfunction, hoist and slew limits make it hard and unsafe to remove loads during offshore lifts and

2) manufacturers have safety systems that work in different ways.

Having these limit switches hinders those safety systems. For example, if the high-angle kick off is at 45 ft radius, when the crane reaches 55 ft radius, the boom speed will decrease by 50 %.

If specified, manual override of motion limiters shall be by a hold-to-run device.

Justification

This requirement provides a hold-to-run device for maintenance and unusual scenarios such as high angle kick out and low angle kick out. If a motion limiter device fails, this requirement allows the operator to still perform an operation and override the device. This has been entered as an option due to different requirements amongst operators for the following reasons. The use of a hold-to-run device requires the operator to use one hand to keep the hold-to-run device over-ridden, leaving only one hand free to operate the crane. This may not be permitted in some company specifications or on assets that have a limited amount of people. However, some companies may allow this because two people are used during the override procedure, but some operators may not have this in their procedures.

10.3.2.5 Boom and Load Indicators

Replace list section c) with

c) a load-moment indicator system (LMIS) shall be provided.

Justification

The LMIS provides crane operator an indication of hook load, load radius, and crane SWL whereas the LIS only provides crane operator with load indication. This requirement has removed the option of LIS and made the LMIS mandatory.

Delete Table 24

Table 24—Boom and Load Indicators

Justification

Table 24 provided guidance on the usage of LIS versus LMIS. The amendment to 10.3.2.5 c) has removed the option for LIS. This guidance table is no longer required.

Add to section

The LMIS shall have a continuous visual display.

Justification

This requirement allows for continuous monitoring by the operator and reduces the chances of missing vital data.

For offboard lifts, the continuous visual display of the LMIS shall show the selected wave height, actual hook load, load radius and rated capacity for the selected wave height.

Justification

This allows for continuous monitoring by the crane operator and reduces the chances of missing vital data. This requirement is in line with the definition of LMIS in API 2C with the addition of wave height for offboard lifts. It is important to know the correct wave height and corresponding load limits during offboard lifts. This is a safety precaution for both the crane operator and the function of the crane.

For platform lifts, the continuous visual display of the LMIS shall show the actual hook load, load radius and rated capacity at the radius.

Justification

This allows for continuous monitoring by the crane operator and reduces the chances of missing vital data. This requirement ensures that the display shows the minimum requirements as per the definition of LMIS in API 2C.

The accuracy of hook load values shown on the LMIS display shall be within ± 2.5 % of full scale reading at an agreed height and boom angle.

Justification

This requirement meets most operating companies' tolerance of readings. The LMIS is an important safety device and the crane operator relies on it to avoid overloading the crane.

NOTE Full scale reading is the maximum capacity of the crane for the different hoists.

When the actual hook load exceeds 90 % of the rated capacity for any lift conditions, the LMIS shall emit a visual warning.

Justification

When getting close to the maximum capacity of the crane, it is important that the crane operator knows and reacts accordingly. This is a safety and operational caution.

When the actual hook load exceeds 95 % of the rated capacity for any lift conditions, the LMIS shall emit a continuous audible and visual warning inside and outside the cabin.

Justification

When getting close to the maximum capacity of the crane, it is important that the crane operator knows and reacts accordingly. This is a safety and operational caution. There are conditions when the load exceeds 95 % rated capacity such as transient spikes in the wave heights or during commission and regulatory testing.

Reverse motions that reduce the overload or over-moment shall not be prevented.

Justification

It is important that the crane is still operational when the load exceeds 95 % to prevent the possibility of leaving a workload swinging on the hook. This requirement allows the crane operator to release the crane from the overload or over-moment.

Add new section

10.3.2.6 Tension Load Cells

Tension load cells shall maintain a ratio of 5:1 of the minimum breaking load (MBL) to the SWLH at all times.

Justification

The industry standard is 4:1. The 5:1 ratio provides a higher level of safety and is normally required by most operating companies. The higher ratio prevents premature performance issue due to lack of robustness and side loading.

The tension load cell ratio for load cells shall be in pure tension.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

Tension load cell design shall account for the offboard dynamic loading, sidelead and offlead forces of the crane in accordance with API 2C.

Justification

Tension load cells are subject to the same forces as a primary member of the crane. This requirement enforces that tension load cells are to be treated as primary member in API 2C and not as a rigging accessory.

Tension load cells shall not be side loaded.

Justification

Tension load cells that are side loaded show erroneous results.

Where the tension load cell is attached to a rigid body dead end (see Figure 15) and where side-loading the tension load cell is likely due to long hook drops (i.e. 1.25 times the boom length), a mechanical device shall be used to eliminate out-of-plane bending in the tension load cell.

Justification

Tension load cells that are side loaded show erroneous results.

NOTE 1 Examples of mechanical devices used to eliminate out-of-plane bending in the tension load cell includes two shackles joined together (see Figure 15) in a bow-to-bow configuration at the dead-end or specially made link plates that serve as a universal joint (i.e. U-joint) (see Figure 16).

NOTE 2 Tension load cells used just above the headache ball on a single part auxiliary line (see Figure 17) do not have the same restraints as multi-part load lines that are attached to a rigid body dead end and do not require a mechanical device to remove side loading. For cranes with the dead end mounted above the boom and sheave cluster, the side loading at the sheave is removed without the need of a mechanical device.

Add new Figure 15

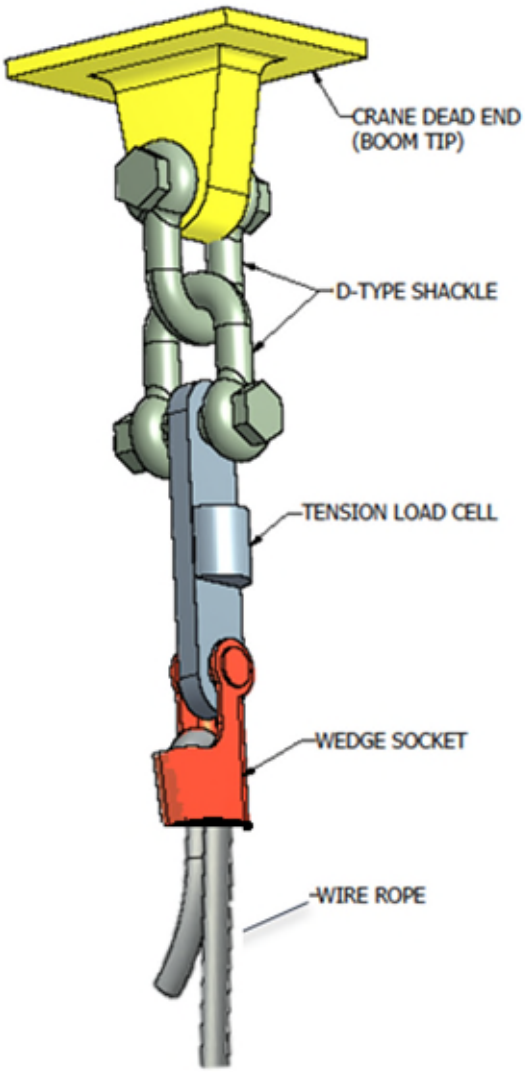

Figure 15—Tension Load Cells Type 1

Justification

Tension load cells that are side loaded show erroneous results. This figure shows an example of a proper tension load cell configuration.

Add new Figure 16

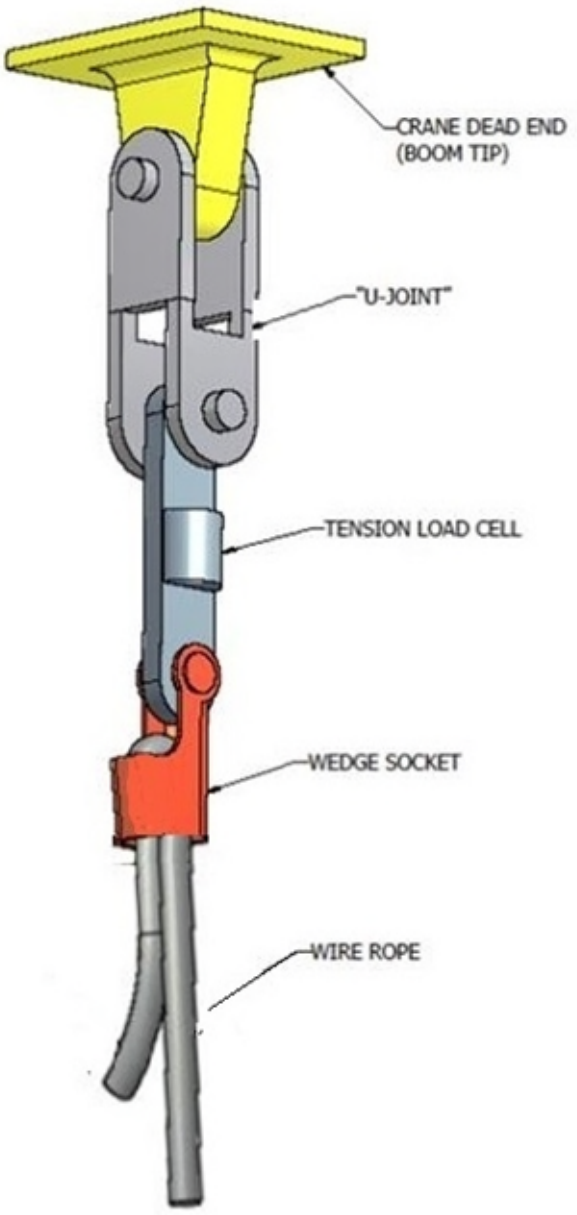

Figure 16—Tension Load Cells Type 2

Justification

Tension load cells that are side loaded show erroneous results. This figure shows an example of a proper tension load cell configuration.

Add new Figure 17

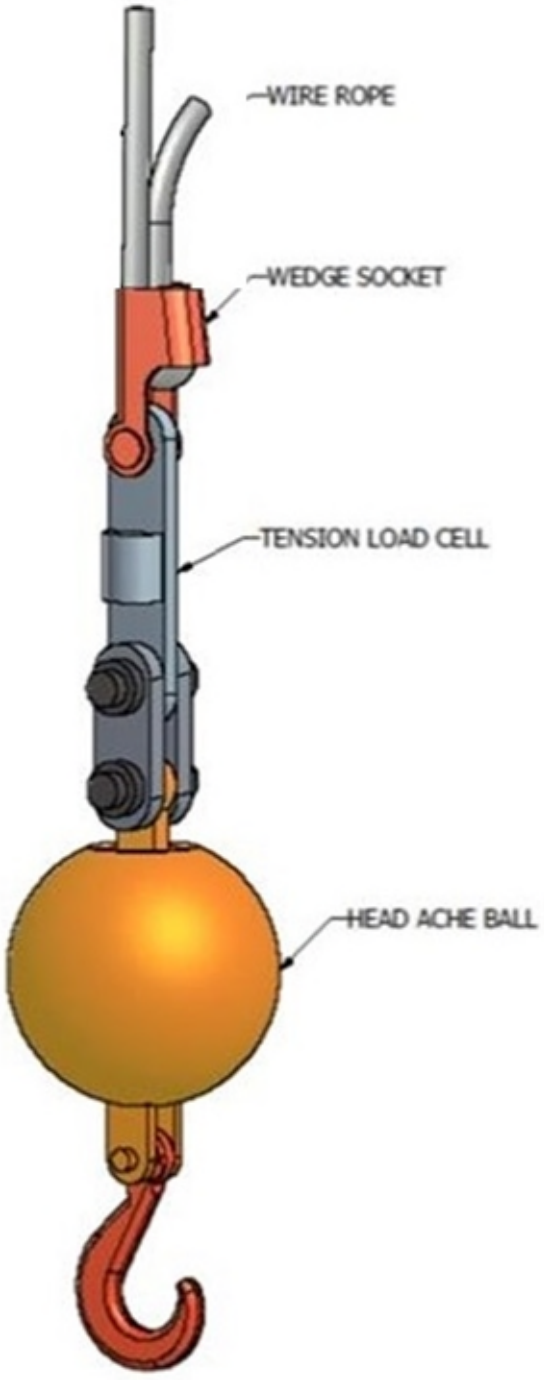

Figure 17—Tension Load Cells Type 3

Justification

Tension load cells that are side loaded show erroneous results. This figure shows an example of a proper tension load cell configuration.

Tension load cells subject to a saltwater environment and made from 17-4PH stainless steel material shall have a minimum heat-treating using an H1150 process.

Justification

This requirement minimizes the effects of stress corrosion cracking.

If used in a marine environment, carbon / low-alloy steel materials used for tension load cells shall have a Rockwell-C hardness value of 35 HRC or less.

Justification

This requirement ensures that the material is less vulnerable to brittle fracturing due to corrosive offshore environments.

Tension load cells made from 17-4PH stainless steel that have been heat-treated using an H900 process shall not be used on offshore or coastal onshore sites (i.e. on sites with a saltwater environment).

Justification

An H900 process usually results in the highest strength which is proportional to the highest hardness. Due to brittle fracturing, these materials are not appropriate for saltwater environments.

Add new section

10.3.2.7 Boom Structure

The boom sections shall not exceed a length of 40 ft (12.19 m).

Justification

This requirement makes boom replacement handling easier and steel is easier to source in 40 ft (12.19 m) lengths.

There shall be no weld splices in boom chords.

Justification

This requirement reduces the chances of fabrication eccentricities of critical members.

Boom inserts shall be interchangeable.

Justification

This requirement allows for sparing of boom sections with a single structural member type.

Boom foot pins shall have a means of preventing rotation.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

Boom foot pins shall have a means of lubricating the entire outside of the pin.

Justification

Booms can either have the heel pin rotate or the heel can rotate around the pin. Experience has shown that having the heel rotate around the pin has more reliability. Lubricating the outside of the pin to allow this rotation is necessary.

Boom foot pin holes shall be line bored.

Justification

Line boring provides a high level of precision and accuracy for the dimensions of the pin holes.

A means for replacing the boom foot pin bushings shall be provided.

Justification

Boom foot pin bushings will be replaced when worn. Manufacturers are in the best position to recommend a system that is convenient and workable for their specific crane. Providing the means during fabrication can minimize the maintenance time to replace the bushings and maximize the availability of the asset.

The boom shall be supplied with bearing plates on the bottom chords in the location of the boom rest.

Justification

This requirement provides a wear pad that prevents premature wear or damage on the boom chord when parking the crane boom in the boom rest.

10.3.3 Guards for Moving Parts

10.3.3.2 Components to Guard

Add to section

Fans, fan belts and slew drive pinions shall be guarded.

Justification

Fans, fan belts and slew drive pinions are considered to be exposed moving parts that constitute a hazard and require guards. This requirement was added as some manufacturers may not consider fans, fan belts and slew drive pinions as moving parts and not provide guards.

NOTE Fans, fan belts and slew drive pinions are considered to be exposed moving parts that constitute a hazard.

10.3.3.4 Warning Signs Instead of Guards

Replace section with

Warning signs instead of guards on moving parts shall not be allowed.

Justification

Warning signs do not adequately prevent injuries.

10.3.6 Anti Two-block

Add to section

The anti two-block system shall prevent further upward movement of the load hoists and downward movement of the boom.

Justification

This requirement ensures no further contact occurs and allows the operator to correct the two-block event without having to override.

Movements in the opposite direction for hoists shall be available for use without override intervention.

Justification

This requirement allows the operator to redirect the two-block event without having to override.

Replace section 10.3.7 title with

10.3.7 Emergency Operating System (EOS)

Replace first and second sentence of first paragraph with

The emergency operating system (EOS) shall enable operation of the crane, i.e. lowering the boom, lowering the hoist and slewing the crane, for all load conditions in the event of the following emergencies:

— single point failure or interruption of the main power supply;

— single point failure in the main power unit;

— single point failure in the control system.

NOTE See Figure 13 for EOS schematic.

Justification

The EOS system increases safety especially with regards to personnel lifts. The EOS allows the crane operator to manage uncontrolled lifts.

Add new Figure 13

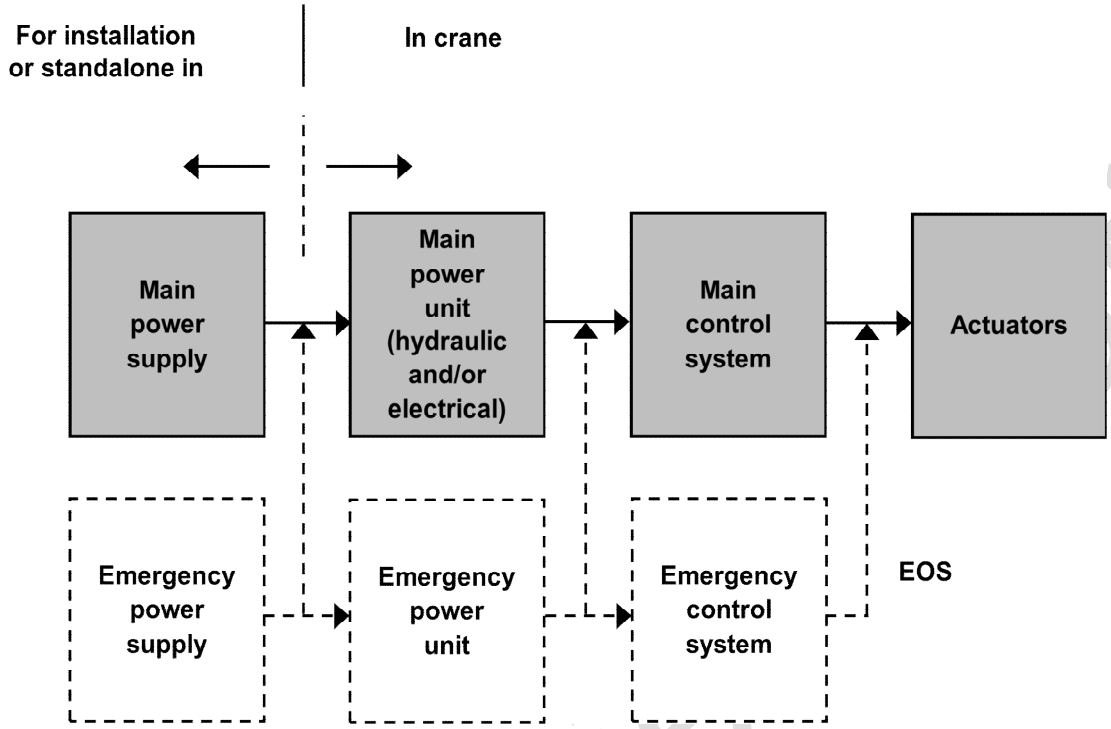

Figure 13—Emergency Operating System (EOS) Schematic

Justification

Figure 13 provides a schematic of a typical EOS system.

Replace last sentence of first paragraph with

Boom luffing mechanisms shall require emergency load lowering capacity.

Justification

This requirement provides the operator the ability to lower the boom in an emergency or power failure. This requirement allows the crane operator the ability to safely boom a load to a safe and clear location and then lower load.

Manual lowering of loads and release of slew brakes shall remain possible in the event of loss or unavailability of the main control system of the crane.

Justification

This requirement allows the crane operator to bring down loads to a safe and secure position if the main control system becomes unavailable.

10.3.8 Miscellaneous Equipment

Add new section

10.3.8.7 Aviation Warning Lights

Cranes shall be fitted with permanent aviation warning lights in accordance with statutory civil aviation regulations.

Justification

This requirement allows cranes to be visible to aircraft. The crane is often the highest point on a platform when it is in operation.

If required by the purchaser's aviation authorities, aviation warning lights shall be supplied at the A-Frame apex, boom tip and along the boom at 33 ft (10 m) spacing.

Justification

Providing aviation warning lights along high points of the crane may help pilots avoid any obstructions that might be in their landing path. The movement of the lights along the boom indicates that the crane is in operation. This allows flight pilots to call ahead and shut down crane operations to prevent accidents.

Aviation warning lights shall be powered from the uninterruptible power supply of the platform

Justification

This requirement ensures that warning lights remain on and visible to all aircraft if power is lost to the crane.

Add new section

10.3.8.8 Maintenance Access

A permanent means of access shall be provided for crane components that require routine inspection and maintenance as defined by OEM practices or the site maintenance plan.

Justification

This requirement provides the ability to quickly and efficiently perform crane maintenance, which increases the availability of the crane and decreases the need for supplemental measures such as obtaining temporary cranes and building scaffolding.

The permanent means of access shall be on the crane itself.

Justification

This requirement provides the ability to quickly and efficiently perform crane maintenance, which increases the availability of the crane and decreases the need for supplemental measures such as obtaining temporary cranes and building scaffolding.

Maintenance access shall not require special scaffolding, rope access or special equipment.

Justification

This requirement provides the ability to quickly and efficiently perform crane maintenance, which increases the availability of the crane and decreases the need for supplemental measures such as obtaining temporary cranes and building scaffolding.

Ram-luffing, telescoping and knuckle-boom cranes shall be provided with a deliberate and planned means to remove luffing cylinders without damage.

Justification

The requirement ensures that the luffing cylinders can be removed during maintenance operations without damage.

Maintenance davits, lifting beams and/or padeyes shall be provided to enable the replacement of major components without using additional cranes.

Justification

Providing permanent material handling assistance reduces crane downtime and provides a safer material handling means. Additional crane access is not always feasible or available once a crane is installed on a platform.

NOTE 1 Major components include all components in the machinery house (such as the prime mover, gearbox, cabinets and pumps), winches, sheaves and slew drive components.

Major structural components shall have lifting points or an approved lifting means for the individual lifting of the major structural components.

Justification

Major structural components are irregular shapes and the CG is not always evident, which could lead to an unstable lift if the lift is not properly planned. Planned and engineered lifting points provide a safer lifting strategy.

NOTE 2 Major structural components include the pedestal adaptor, machinery deck, cabin and machinery house.

Procedures and instructions for the use of the lifting points shall be provided in the installation, operation and maintenance manual.

Justification

Major structural components are irregular shapes and the CG is not always evident, which could lead to an unstable lift if the lift is not properly planned. Planned and engineered lifting points provide a safer lifting strategy.

Lifting points, davits, lifting beams and padeyes for operations and maintenance shall be permanently and legibly marked with a unique identification number and the SWL.

Justification

This requirement is specifically for lifting points or equipment used during operations and maintenance and does not include seafastening (used prior to installation), installation lifting points, lifting points for overhauling or lifting points used during fabrication. The marking and labeling of lifting points, beams, padeyes and davits is an industry-wide safe practice.

The boom design shall incorporate a cross-over walking surface at chords splices from the main boom walkway to provide access for inspection and maintenance of connector fasteners on the top, bottom and sides of the boom.

Justification

A cross-over walking surface allows for frequent and safe inspections and maintenance of the connector fasteners on the top, bottom and both sides of the boom.

Permanent maintenance access to the boom hoist dead end connection shall be provided.

Justification

Permanent access to the boom hoist dead end connection allows for frequent inspections, saves maintenance time and is safer for maintenance and inspection crews.

Grease nipples shall be accessible from permanently installed walkways and platforms with the crane boom stowed in the boom rest.

Justification

Permanent access to grease nipples allows for frequent inspections, saves maintenance time and is safer for maintenance and inspection crews.

Add new section

10.3.8.9 Communication Equipment

If communication equipment is provided by the manufacturer, the communication equipment shall provide the crane operator with a means to directly communicate with the platform, supply vessels and additional units involved in the lifting operations.

Justification

It is important to allow the crane operator to have a direct line of communication during any lifting operations. A lag in communication could cause an incident.

If communication equipment is provided by the manufacturer, the radio communication system shall be operable by a microphone speaker / headset system, without the crane operator's hands moving from the main control levers.

Justification

This requirement allows communication without the crane operator's hands moving from the controls which would impair the crane operator's ability to operate the crane.

If communication equipment is provided by the manufacturer, the communication equipment shall incorporate a public-address system.

Justification

A public-address system allows the crane operator to be aware of any events in the surrounding area (i.e. announcements). This allows the crane operator to safely react to events.

Add new section

10.3.8.10 Camera and Monitors

A boom tip camera shall be provided unless otherwise specified.

Justification

A boom tip camera can assist with a crane operator in centering a load while hoisting. This requirement is optional as some small cranes and unmanned platform cranes may not need or benefit from a boom tip camera. Also, boom tip cameras could be dependent on layouts and blind spots. A boom tip camera is to be provided as a default.

The boom tip camera shall be specified as either the manufacturer's system or IOGP S-618 boom tip camera system.

Justification

This requirement provides the option to use the standard camera system offered by the manufacturer instead of the requirements added in this overlay.

If IOGP S-618 boom tip camera system is specified, the camera system shall consist of a color camera located at the boom tip and a color monitor located in the crane operator's cabin.

Justification

The purpose of a boom tip camera is to help the operator. This requirement ensures the camera system provides visual assistance to the operator by placing the monitor in the cabin and ensuring both the camera and monitors are color (not black and white) to provide better visual definition.

If IOGP S-618 boom tip camera system is specified, the camera system shall have remote controls for camera zoom, focus and iris.

Justification

The ability to control the camera (focus, zoom, iris) by the crane operator will assist in safely performing lifts.

If IOGP S-618 boom tip camera system is specified, the camera system shall be mounted in a location that is reachable and operable by a seated crane operator.

Justification

The ability to readily reach the controls of the camera is a safe lifting practice.

Add new section

10.3.8.11 Data and Video Recorder

10.3.8.11.1 Data Recorder

A data recorder shall be provided unless otherwise specified.

Justification

Data recorders can be used for trending, troubleshooting or identifying any problems in the event of an accident. This has been made an optional item as some of the smaller cranes and unmanned or minimally manned platforms cranes may not require a data recorder. This requirement is worded to ensure that data recorders are provided as a default.

The data recorder shall record CMs, loads and lifetime load cycle history.

Justification

Data recorders can provide valuable information on performance trending, troubleshooting, or identifying any problems in the event of an accident. The ability to record and review data is important to reviewing trending, troubleshooting or identifying any problems in the event of an accident.

The recorded data shall be reviewable.

Justification

Data recorders can provide valuable information on performance trending, troubleshooting, or identifying any problems in the event of an accident. The ability to record and review data is important to reviewing trending, troubleshooting or identifying any problems in the event of an accident.

While the crane is operating, the data recorder shall record as a minimum the following information:

— date (using dd/mm/yyyy format);

— time (using hh/mm/ss format);

— duration(s);

— rated load at hook position for all hoists;

— actual load at hook position for all hoists;

— boom radius and angle;

— peak dynamic load at hook position for all hoists;

— load chart;

— alarm activation;

— overrides or bypass activated or alarms acknowledged;

— if specified, the crane operator's unique identification.

Justification

Recorded data can be used for trending, troubleshooting or identifying any problems in the event of an accident.

The data recorder shall be automatic (i.e. and not require manual activation).

Justification

Removing the option of manual activation will exclude the possibility of the data recorder accidentally not being started.

The memory capacity of the data recorder shall be specified in the operating manual.

Justification

The storage capacity of internal memory banks has greatly increased in recent years. The norm in storage capacity is expected to continue trending upwards or be cloud based. Rather than specify the size of the of internal storage, this requirement allows the manufacturer to provide the norm storage capacity for their data recorder and make the purchaser aware of the memory capacity.

The data stored in the memory of the data recorder shall be downloadable by the purchaser.

Justification

Data can be used for trending, troubleshooting or identifying any problems in the event of an accident. The data recorder memory download functionality facilitates this data analysis.

The output data file shall be in a comma-separated values (CSV) format or equivalent.

Justification

Data can be used for trending, troubleshooting or identifying any problems in the event of an accident. CSV is a common format to manipulate the data and is recognized by most software packages.

Software or hardware required to download the data shall be supplied with the crane.

Justification

This requirement ensures that the data can be directly downloaded by the purchaser without further involvement of a third party or the crane manufacturer after delivery of the crane.

Passwords that are required to access the data recorder shall be in the installation, operation and maintenance manual.

Justification

This requirement ensures that the data can be directly downloaded by the purchaser without further involvement of a third party or the crane manufacturer after delivery of the crane. A single location for all passwords is preferred.

There shall not be a means to deactivate the data recorder.

Justification

The continuous recording of data, without any periods of deactivation, is essential when reviewing the data for trending or troubleshooting. This requirement ensures that the data recorder remains activated (i.e. cannot be accidentally deactivated).

10.3.8.11.2 Video Recorder

Cameras shall have video recording functionality.

Justification

The ability to maintain the recording from cameras will help in root cause analysis of any accidents

Add new section

10.3.9 Miscellaneous Requirements

10.3.9.1 Dropped Objects

An assessment of the crane for the risk of dropped objects shall be performed in accordance with a recognized code or guideline (e.g. Dropped Object Recognized Scheme:2020).

Justification

Dropped object assessment is a safe and normal practice in the oil and gas industry. An offshore platform crane has the potential for a large amount of dropped object scenarios that need to be systematically recognized, addressed and mitigated.

10.3.9.2 Functional Control Systems

Safety-related parts of control systems performance levels shall be in accordance with an oil and gas industry recognized code.

Justification

This requirement addresses the risks in safety related parts of control systems.

Recognized codes include ISO 13849-1 and IEC 61508-1.

Justification

ISO 13849-1 and IEC 61508-2 are the recognized international standards for functional safety in control systems. This requirement chooses to remain silent on standardizing the code. This requirement refers to the two prevalent codes without making either code normative (similar to electrical hazard codes in 7.5.5.1).

If ISO 13849-1 is specified, the minimum required performance level (PLr) for safety related parts of the control system for hoisting, luffing, slewing, telescoping or folding shall be "c".

Justification

This requirement provides a standardized value for minimum PLr.

If ISO 13849-1 is specified, the minimum PLr for cranes designed for personnel lifting, shall be "d".

Justification

This requirement provides a standardized value for minimum PLr for cranes designed for personnel lifting.

If ISO 13849-1 is specified, the minimum PLr for emergency stops shall be "d".

Justification

This requirement provides a standardized value for minimum PLr for emergency stops.

A failure mode effects analysis (FMEA) shall be performed.

Justification

FMEA is required to be performed to understand the cranes specific failure mode effects based on the individual project, operating conditions, etc. This could also be used as input to the maintenance strategy or operating philosophy of the crane.

The FMEA shall identify the risks with single technical failures and common cause failure of non-redundant components.

Justification

FMEA is required to be performed to understand the cranes specific failure mode effects based on the individual project, operating conditions, etc. This could also be used as input to the maintenance strategy or operating philosophy of the crane. The term "common cause failure" is defined in ISO 13849-1.

FMEA results shall be used in the development of the manufacturer's recommended maintenance strategy.

Justification

FMEA is performed to understand the cranes specific failure mode effects based on the individual project, operating conditions, etc. This is used as input to the maintenance strategy or operating philosophy of the crane. FMEA allows the project to systematically address and eliminate catastrophic or critical failures.

FMEA results shall be utilized to assess the reliability of the proposed equipment.

Justification

FMEA is performed to understand the cranes specific failure mode effects based on the individual project, operating conditions, etc. This is used as input to the maintenance strategy or operating philosophy of the crane. FMEA allows the project to systematically address and eliminate catastrophic or critical failures.

Add new section

10.3.10 Hydraulic and Pneumatic Line Protection

The hydraulic and pneumatic line system shall be the manufacturer's standard system or, if specified, in accordance with Annex G.

Justification

IOGP S-618:2018 introduced requirements for hydraulic systems that were not the norm for Gulf of Mexico assets. These requirements have been moved to an optional Annex G.

Add new section

10.4 Lighting

Lighting with an intensity of 30 foot-candles (323 lux) shall be provided in the machinery house and the control cabin for use during operation and maintenance activities.

Justification

This requirement ensures that lighting is provided to the necessary and expected brightness for the operators.

General lighting for walkways and other means of access shall be 13.9 foot-candles (150 lux) or greater in the horizontal plane.

Justification

This requirement ensures that lighting is provided to the necessary and expected brightness for safety of the crane operators.

Emergency lighting covering escape routes from the control cabin and machinery house shall be light emitting diode (LED) technology.

Justification

This requirement ensures a safe and visible escape route for the crane operator in case of blackouts or power outages. LED lighting technology is the preferred technology due to safety, maintenance, reliability, and energy efficiency.

Emergency light fixtures shall be connected to an integral charger and backup battery that lasts at least 90 min duration or a platform emergency lighting supply.

Justification

This requirement ensures a safe and visible escape route for the crane operator in case of blackouts or power outages.

LED lighting technology certified for NFPA 70 Class I Division 1 or Zone 1 shall be provided below the revolving superstructure to provide visibility on the crane walk-around.

Justification

This requirement will ensure visibility on the crane walk-around platforms. This requirement is only for lighting that is below the superstructure and could be in hazardous areas zones.

11 Manufacturing Requirements

11.1 Material Requirements of Critical Components

11.1.5 Structural Steels, Castings and Forgings

11.1.5.3 Additional Requirements for Castings

11.1.5.3.1 Prototype Castings

Add to section

Prototype castings shall not be part of the final product.

Justification

This requirement is added to prevent the installation and use of prototype castings that have been through a testing regimen as part of the final production casting.

Add new section

11.4 Surface Protection

Exposed carbon steel surfaces shall be protected by a surface protection system.

Justification

A surface protection system is provided to prevent corrosion and minimize maintenance.

The surface protection system shall be specified by the purchaser.

Justification

A surface protection system is provided to prevent corrosion and minimize maintenance.

Walkways, platforms, work areas and floors that require painting shall be coated with non-skid paint.

Justification

Non-skid paint improves safety and prevents injuries from operators slipping on walkways, platforms, work areas and floors. This is not applicable to surfaces that are not painted such as fiberglass walkways or galvanized steel walkways.

Faying surfaces shall have a continuous seal weld to prevent ingress of water and corrosion.

Justification

At locations where there are fayed surfaces, corrosion occurs if ingress of water is not prevented. A seal weld at the location of fayed surfaces prevents water ingress.

Add new section

11.5 Spare Parts and Interchangeability

A list of recommended spare parts shall be identified for commissioning and operational spares.

Justification

A list of recommended spare parts from the equipment supplier, manufacturer and their sub-suppliers allows the operator to plan for commissioning and operational spares.

Each spare part item shall be referenced by its original manufacturer's name and part number.

Justification

This requirement ensures that the operator procures the correct spare part.

The spare part item shall be identified and described such that the necessary spare, whether whole item or parts can be obtained.

Justification

This requirement ensures that the operator procures the correct spare part.

Equipment and components in equivalent service shall be interchangeable to the extent that is feasible for the purpose of reducing spare parts.

Justification

Providing interchangeable parts as far as practicable minimizes spare parts.

NOTE Equipment and components includes valves, filters, fittings, bearings, seals and consumables that are in equivalent service.

12 Design Validation by Testing

12.3 Operational Tests

Add to section

Cranes shall undergo initial factory acceptance testing prior to delivery.

Justification

This requirement minimizes the probability of discovering and repairing major quality issues prior to leaving the factory and full assembly.

The factory acceptance test (FAT) shall be on a fully assembled crane or functional sub-assemblies, as specified.

Justification

This requirement minimizes probability of discovering and repairing major quality issues prior to full assembly. The testing of sub-assemblies may be more cost effective to fix errors than a fully assembled crane.

Cranes shall undergo fully assembled site acceptance testing.

Justification

After the FAT the crane is disassembled, shipped and installed at site. The SAT is the onsite test performed after crane has been installed at the final site location. This test ensures that the fully assembled crane meets all requirements (both quality and operational) of the purchaser.

FAT and SAT guidance is provided in Annex H and Annex I, respectively.

Justification

This requirement ensures that the FAT and SAT procedures are supplied to the purchaser and that the documentation meets the requirements of this specification's FAT and SAT expectations.

Add new section

15 Component Traceability and Component Identification System (CIS)

Add new section

15.1 Component Traceability

All components shall be traceable to original equipment manufacturer (OEM) information.

Justification

This requirement ensures that the crane operator can purchase spare parts directly from the OEM without assistance from the crane manufacturer.

If the crane manufacturer adds identification details or markings, this shall not interfere with or detract from OEM information.

Justification

This requirement ensures that the crane operator can purchase spare parts directly from the OEM without assistance from the crane manufacturer.

OEM parts information shall be evident and identifiable in the crane documentation including drawings and spare parts records.

Justification

This requirement ensures that the crane operator can purchase spare parts directly from the OEM without assistance from the crane manufacturer.

OEM parts information shall not be replaced by the crane manufacturer's information.

Justification

This requirement ensures that the crane operator can purchase spare parts directly from the OEM without assistance from the crane manufacturer.

Add new section

15.2 Component Identification System (CIS)

15.2.1 General

The specified component identification systems (CIS) shall be used to identify components in accordance with one of the following:

— manufacturer's CIS (see 14.3.1);

— integrated manufacturer-purchaser's CIS (see 14.3.2);

— purchaser's CIS (see 14.3.3).

Justification

JIP33 has identified three CIS (tagging) that are commonly used by purchasers.

The same CIS number shall be used to identify the equipment, components and sub-assemblies in the crane's documentation (e.g. installation, operation and maintenance manual, drawings, equipment list).

Justification

The CIS is used for multiple purposes including the management of spare parts and maintenance.

NOTE The CIS number is used for multiple purposes including the management of spare parts and maintenance. A CIS is sometimes referred to as tag numbering.

The documentation shall include the specified overall crane assembly tag number.

Justification

This prevents multiple equipment tags for one crane (example tag number for boom, tag number for cab, tag number for pedestal). The overall crane assembly tag number is a project specific tag number specified by the project/asset that the crane will be installed on. This tag number will not follow the CIS as the CIS is used to identify components of the overall crane.

15.2.2 Manufacturer's Component Identification System (CIS)

If a manufacturer's CIS is specified, the manufacturer's standard system shall be provided without purchaser modifications.

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option allows the manufacturer to use their own internal CIS without any intervention by the purchaser.

15.2.3 Integrated Manufacturer-Purchaser's Component Identification System (CIS)

If an integrated manufacturer-purchaser's CIS is specified, the CIS shall be the manufacturer's standard system with the exceptions listed in this section.

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option allows the manufacturer to use their own internal CIS except for the listed components that are to use the purchaser's CIS. This list strives to standardize the CIS.

Systems and components detailed in Table 30 shall be identified with the purchaser's CIS.

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option allows the manufacturer to use their own internal CIS except for the listed components that are to use the purchaser's CIS. This list strives to standardize the CIS.

Components that are part of another end-user facility system shall be identified with the purchaser's CIS.

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option allows the manufacturer to use their own internal CIS except for the listed components that are to use the purchaser's CIS. This list strives to standardize the CIS.

NOTE The purchaser specifies the components that are part of another end-user facility system.

Table 30—Purchaser's CIS—Identification Items

System	Typical Components
Fire and gas	Fire and gas detectors, cables, junction boxes
Facility-connected lighting	Lights, cables, junction boxes
Aircraft warning lights	Lights, cables, junction boxes
Telecommunications	Radios, telephone, cables, junction boxes
Power supply	Slipring, starter cabinet, distribution panel, junction boxes

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option allows the manufacturer to use their own internal CIS except for the listed components that are to use the purchaser's CIS. This list strives to standardize the CIS.

The sub-assemblies detailed in Table 31 shall be assigned a single end-user identification.

Justification

Sub-assembly traceability and ease of identification helps the purchaser manage and understand the documentation for the crane (e.g. parts lists, maintenance manual, operations manual).

The individual components within the sub-assembly shall be identified by the manufacturer's CIS unless the individual components are part of another end-user facility system (see Table 30).

Justification

Sub-assembly traceability and ease of identification helps the purchaser manage and understand the documentation for the crane (e.g. parts lists, maintenance manual, operations manual).

Table 31—Manufacturer's Sub-assembly—Identification Items

Sub-assembly	Identification
Winches	One identification for each winch unit (e.g. main hoist, auxiliary hoist, luff)
Slewing drives	One identification for slew drive system
Ram-luffing system	One identification for ram-luffing cylinder system
Knuckle system	One identification for knuckle cylinder system
Telescoping system	One identification for telescoping system
Crane cabin	One identification for crane cabin
Prime mover	One identification for prime mover assembly, including gearbox and pumps
EOS	One identification for EOS
Pedestal adaptor	One identification for pedestal adaptor

Justification

This table provides a list of the expected sub-assemblies that will be given a tag number by the end user.

15.2.4 Purchaser's Component Identification System (CIS)

If a purchaser's CIS is specified, the CIS details shall be provided by the purchaser.

Justification

JIP33 has identified three CISs that are commonly used by purchasers. This option is not preferred but may still be needed by purchasers whose internal quality systems may dictate a purchaser-specified CIS.

Annex B
(informative)

Commentary

B.5.4 In-service Loads

B.5.4.5 Vertical Factored Loads

B.5.4.5.1 General

Replace last sentence of third paragraph with

The stiffness calculations shall be based on the actual modulus of elasticity and the actual surface area of the wire ropes used on the crane.

Justification

Wire rope stiffness is typically the major contributor to crane flexibility. There is nearly 300 % variation in the range of wire rope stiffness depending on the wire rope construction and grade. This highlights the importance of using the correct nominal properties of the wire ropes that are on the crane when calculating the stiffness of the crane wire ropes.

Add new Annex G

Annex G
(informative)

Hydraulic Systems and Pneumatic Lines

G.1 General

When a hydraulic and pneumatic line system is specified as an IOGP S-618 Annex G system, the requirements of this section shall apply.

Justification

This annex is not used by all purchasers and depends on the project and crane usage. This annex provides standardization for hydraulic systems that can be invoked by the purchaser if required.

If specific sections (i.e. not the entirety) of Annex G are required, these sections shall be specified.

Justification

Not all cranes or all operators will use the entirety of Annex G. Individual users select the requirements on a case-by-case basis if needed.

G.2 Design Standard

The hydraulic system shall comply with the international standard ISO 4413.

Justification

ISO 4413 is a recognized hydraulic system standard. Referring to one recognized standard drives standardization. ISO 4413 includes general requirements for the engineering of a hydraulic system and safety requirements that support the essential health and safety requirements of the European Machinery Directive.

G.3 Oil Grade and Cleanliness

The hydraulic oil grade and cleanliness shall be provided for all operating, FAT and SAT conditions and operating locations.

Justification

The oil grade and cleanliness impact the performance, reliability and life of components and are provided to the purchaser for maintenance.

G.4 Corrosion Protection

Hydraulic components shall be resistant to corrosion from exposure to marine environments.

Justification

This requirement reduces preventative and corrective maintenance.

G.5 Material Requirements for Flanges, Split Flanges, and Hose Ends

Flanges, split flanges and hose ends that are not AISI 316L material shall be chromated and protected with a grease band (i.e. petroleum impregnated tape or equivalent).

Justification

Non-316L materials are susceptible to corrosion in offshore environments and lead to failure and lower reliability.

G.6 Oil Tank

The hydraulic tank shall have the means to be fully drained and cleaned.

Justification

The ability to completely drain and clean the tank reduces the risk of debris clogging or entering the crane components and reduces the maintenance time to clean the tank.

G.7 Hose Ends

Hose ends shall allow the fitting of plugs or caps for maintenance.

Justification

This requirement is added to ease maintenance.

G.8 Hydraulic Hoses Pressure Testing

Hydraulic hoses shall be pressure tested to 1.5 times the maximum working pressure.

Justification

This test is used to prove that there are no leaks in hoses or installed fittings.

G.9 Identification and Labelling

Hydraulic lines shall have permanent identification, traceable to the hydraulic schematic, hose register and certificates.

Justification

This requirement helps in troubleshooting and replacement of hoses.

G.10 Suction Lines

G.10.1

Suction lines, from the tank to the pumps, shall have isolation valves to accommodate pump and hose replacement without the need for draining the oil tank.

Justification

This requirement prevents oil leaks during maintenance.

G.10.2

Isolation valves shall be permanently and clearly labelled.

Justification

This requirement prevents unattended operation of specific lines and helps identify maintenance routines.

G.10.3

Isolation valves shall be secured in open position.

Justification

This requirement prevents unattended closure during operations.

G.11 Circulation System

G.11.1

The hydraulic system shall have provisions for adding a circulation system for continuous flushing, filtration and removal of water from the hydraulic oil.

Justification

When there is debris in the system, a circulation system for continuous flushing will prevent frequent replacement of components or dismantling and flushing offsite.

G.11.2

If specified, the circulation system shall be provided.

Justification

This requirement allows the manufacturer to provide the circulation system rather than the means to add a circulation system (see G.12.1).

G.11.3

The circulation system shall consist of a separate circulation pump and necessary filters.

Justification

This requirement prevents the main crane pumps from being used for this circulation system.

G.12 Accumulators

Accumulators shall be equipped with a pressure gauge and permanent means for draining to verify the pre-charge pressure.

Justification

Accumulators are required to verify the pre-charge pressure.

G.13 Test Points

G.13.1

Test points shall be provided on the main pressure lines, return lines and on any pilot and boost lines in the hydraulic system.

Justification

This is the minimum number of test points required/needed to adequately monitor system performance.

G.13.2

Test points shall be clearly labelled.

Justification

This requirement ensures that the test and test results are correctly performed and interpreted.

G.14 Cleanliness Testing and Certification

G.14.1

Prior to the FAT, the cleanliness of the hydraulic system shall be tested.

Justification

The cleanliness test is an indication that the crane and the filtration system is in good working condition. Some level of contamination is expected in new systems at startup at cleanliness test prior to FAT ensures components are clean and ready to operate properly and efficiently.

G.14.2

After completion of cleanliness testing, a cleanliness certification shall be provided.

Justification

The cleanliness test is an indication that the crane and the filtration system is in good working condition.

Add new Annex H

Annex H
(informative)

Factory Acceptance Test (FAT) Guidance

H.1 Factory Acceptance Test (FAT) Scope

H.1.1

The basic elements of the FAT process and procedure are provided in this annex.

Justification

Standardization of the FAT process, procedure and terminology by purchasers minimizes the in-process quality surveillance by the purchaser and the time and effort required in the planning of each FAT.
The primary purpose of the FAT is to demonstrate to the purchaser that the crane has been manufactured, and performs, in accordance with the specification.
1) The FAT enables minimization of the in-process quality surveillance by the purchaser.
2) The values recorded in the measurements assist with this verification, and provide baseline data to the user to aid future maintenance and fault-finding.
3) A successful FAT will minimize the time and effort required to conduct the SAT.
The more consistent with this annex, the more predictable the quality of the results will be between various suppliers.

H.1.2

The scope of the FAT typically includes the following:

a) manufacturer's preparation:

   1) crane assembly, preparation and function test crane;

   2) prepare test site, test equipment and information preparation.

b) information review:

   1) operating and maintenance information to be readily available;

   2) material certificate review.

c) assembly checks:

   1) visual inspection of the assembled crane;

   2) check crane and component identification checks.

d) running tests:

   1) check all start and stop devices all functions, checks including speeds and responsiveness;

   2) load, speed and continuous running tests.

e) results review:

1) assessment of results against IOGP S-618 specification;

2) agreement of actions before shipping and the SAT.

Justification

This list includes basic elements of a FAT and gives guidance to the user. The more consistent with this annex, the more predictable the quality of the results are between various suppliers.

H.2 Factory Acceptance Test (FAT) Procedure and Records

H.2.1

The FAT procedure and records shall be submitted for the specific crane tested and the specific test location.

Justification

This requirement allows the purchaser to understand and provide feedback on the testing procedure that is used for accepting the product.

H.2.2

Typical FAT records are provided in Table H.2 through Table H.10.

Justification

Standardization on the FAT templates ensures that all expected steps are completed.

H.3 Manufacturer's Factory Acceptance Test (FAT) Preparation

H.3.1

FAT preparation shall follow the guidance of H.3 and Table H.3.

Justification

FAT preparation builds confidence that the FAT will be successful, safe and efficient.

H.3.2

The crane shall be assembled (or sub-assemblies if specified) and inspected prior to the FAT.

Justification

FAT preparation builds confidence that the FAT will be successful and efficient.

H.3.3

The lubrication of mechanical components (including prime mover, bearings, winch and swing drive components, ropes, gear teeth, etc.) shall be made ready for use.

Justification

This pre-work is done to build confidence that the FAT will be successful and efficient.

H.3.4

The crane (or sub-assemblies if specified) shall be function tested including selected load lifting.

Justification

This pre-work is done to build confidence that the FAT will be successful and efficient.

H.3.5

Test loads shall be ready at the test area prior to the start of the FAT.

Justification

Waiting on test loads for the FAT can unnecessarily prolong the FAT. This requirement ensures that the preparation work for a successful and efficient FAT is completed.

H.3.6

Written confirmation that the crane is ready for the FAT shall be provided to purchaser.

Justification

This requirement ensures that the FAT does not proceed until written confirmation is received that all pre-FAT requirements have been completed. Requiring a written confirmation is a safety precaution.

H.4 Factory Acceptance Test (FAT) Conditions

Testing conditions shall mimic anticipated operating and environmental conditions as much as possible.

Justification

Suppliers FAT test conditions can be in a dramatically different environment than where the crane will be located, the results could be misleading. For example, testing a crane in tropical conditions when the crane will be located in sub-freezing (arctic) conditions would not be a good indicator of the FAT results.

H.5 Factory Acceptance Test (FAT) Equipment

H.5.1

Equipment required to complete the FAT shall be supplied by the manufacturer.

NOTE This includes equipment to measure speed, distance, pressure, voltage, current and noise.

Justification

Manufacturer will have access to the correct equipment to safely and efficiently complete the FAT of their proposed crane type and model.

H.5.2

Equipment shall be certified and calibrated in accordance with the manufacturer's quality management system.

Justification

Testing with equipment that is not certified and calibrated is unreliable and may give erroneous results.

H.5.3

Calibration certificates shall be available for review during the FAT.

Justification

This requirement ensures that purchasers can easily verify that calibrated equipment is used during the tests and purchasers have access to the calibration certificates.

H.6 Operating and Maintenance Information

H.6.1

Typical operating and maintenance information shall be readily available to purchaser during the FAT.

NOTE This includes all installation, operating, maintenance, and parts manuals, general arrangements drawings, circuit diagrams, FMEA and other typical information required for operating and maintenance of the crane.

Justification

The FAT is a good time to check the information normally required for operating and maintenance of the crane. FAT technicians can review if any items are missing or need further clarification. FAT technicians will also review that the information is consistent with the crane being supplied. Sometimes the operating and maintenance manual are reused from past projects or similar cranes.

H.7 Conformance Records and Certificates

H.7.1

Before conducting performance testing, conformance records and certificates shall be available to the purchaser.

Justification

This requirement confirms that all necessary quality activities have been completed and that there are no non-conformances.

H.7.2

This information includes material certificates as per IOGP S-618Q, Annex B, non-destructive testing (NDT) certificates, bolt torque and tension records, pressure test certificates, area classification certificates, key design calculations and hydraulic oil cleanliness certificates.

Justification

This requirement ensures that all written quality documentation is available to the quality inspector for their review during the FAT.

H.7.3

The documentation is to inspect the documentation to confirm that all necessary quality activities have been completed and that there are no non-conformances.

Justification

This ensures the FAT is being performed on a crane that has all the correct certificates in place and has no outstanding non-conformances.

H.8 Acceptance Criteria

Acceptance criteria in accordance with Table H.1 shall be used during the FAT.

Justification

Standardizing the verbiage used during FAT is beneficial to both the purchaser and manufacturer. This will give clarity on the expectations.

Add new Table H.1

Table H.1—Factory Acceptance Test (FAT) Acceptance Criteria

Code	Meaning	Explanation
P	Pass	Meets specification criteria.
A	Acceptable	Does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.
N	Not acceptable	Does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.
F	Fail	Does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

Justification

Standardizing the verbiage used during FAT is beneficial to both operators and manufactures. This will give clarity on the expectations.

H.9 Factory Acceptance Test (FAT) Assembly Checks

H.9.1

A visual inspection of the assembled crane (or sub-assemblies if specified) shall be performed.

Justification

This requirement ensures that assemblies are included in FAT activities.

H.9.2

The visual inspection shall include component identification and nameplates, access systems, leak identification, hydraulic and electric workmanship and fitting of machinery guards.

Justification

This requirement allows a visual check of major components, workmanship and leakage prior to the FAT starting.

H.9.3

All items shall be described in detail in the checklist.

Justification

Checklist will be a record of the FAT performed on the crane.

H.10 Factory Acceptance Test (FAT) Measurements

H.10.1

Baseline measurements of critical components and equipment performance shall be recorded during the FAT.

NOTE This includes measurements such as speed, distance, dimensions, pressure, voltage, current and noise.

Justification

This is to verify compliance to the specification and to provide baseline readings for future maintenance and fault finding.

H.10.2

Critical dimensional check of the assembled crane's geometry and interface pieces shall be required during FAT.

Justification

This will provide assurance that the crane is to the major dimensions required by the project. This includes the pedestal interfaces with the platform.

H.10.3

If the manufacturer submits selected verified measurement readings in other formats, the measurement readings shall be provided in an appendix to the FAT.

NOTE This may include programmable logic controller (PLC) readings, printouts or electronic records from calibrated instruments. Where values from other calibrated systems are provided, they must be included as an appendix to the FAT, to form a complete record of all results in one document.

Justification

This is to allow manufacturers the ability to provide FAT data in other formats which are often more comprehensive than a single recorded measurement. This data needs to be provided as part of the FAT (not a standalone document) to form a complete record of all results in one document.

H.10.4

The manufacturer shall include items in the checklist based on the specific crane type and design.

Justification

This is to help standardize the dimensions that will be required during an FAT by purchasers.

H.11 Factory Acceptance Test (FAT) Running Tests

H.11.1

Running tests shall be performed in accordance with Table H.7.

NOTE The items listed do not need to be performed in the order listed. Many checks can be performed in a sequence preferred by the manufacturer, to suit conditions, if the requirements are met.

Justification

Running tests are done to demonstrate that the crane performs as per the specification. The tests enable the purchaser to confirm primarily that: - the crane performance is satisfactory; - the controls operate correctly; - there are no leaks or other faults; - the crane can operate continuously, under load, as anticipated on site; - baseline data and settings have been recorded for future operations and maintenance use.

H.11.2

If crane is fitted with a GOPS and / or CTS, the manufacturer shall propose a procedure for testing of the GOPS and CTS.

Justification

Safety systems are required to be tested to ensure that they respond appropriately.

H.11.3

Where the system is based on a previously validated design, the test procedure may be based on simulation, the results shall validate the correct operation of the system.

Justification

This is a safety requirement that prevents the equipment from being damaged during real-life testing. It is preferable to have the equipment fail in simulation. H.11.4

If the procedure is based on a simulation, it shall allow the purchaser to verify that the system complies with the site-specific requirements.

Justification

This approach recognizes that these safety features rely on specific site conditions to initiate and function.

H.12 Factory Acceptance Test (FAT) Continuous Running Test Guideline

H.12.1

Minor changes may be made to suit different crane types.

Justification

This requirement gives guidance that the running test guidelines of this section may not be applicable our suitable for all crane types.

H.12.2

Load should be approximately 50 % of maximum rated onboard capacity at maximum radius.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

H.12.3

Luff in radius is a mid-radius, approximately 30 % of maximum radius.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

H.12.4

Each hour the test should be paused for five minutes for the crane operator and test team to take a break.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

H.12.5

If the continuous running test is suspended once underway, due to technical issues, then the test may have to be restarted, at the discretion of the purchaser.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

H.12.6

The manufacturer is to ensure that all test personnel are appropriately qualified and competent.

Justification

Currently no justification exists. This requirement will be deleted after public review unless a justification can be provided.

Add new Figure H.1

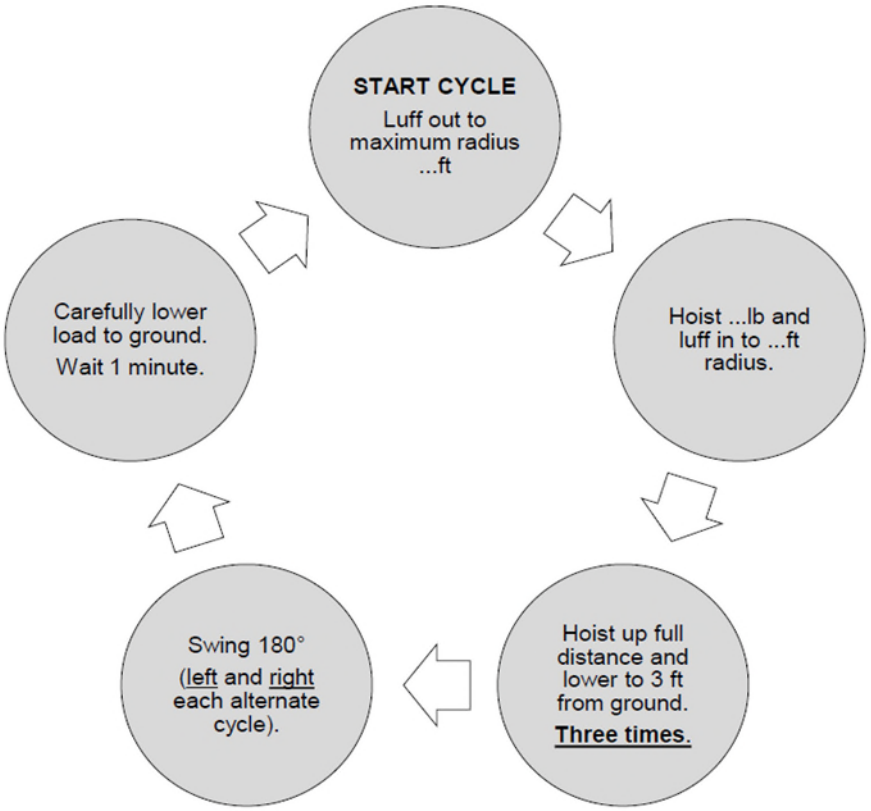

Figure H.1—Steps

Justification

This figure provides a diagram of the running test.

H.13 Factory Acceptance Test (FAT) Record Templates

Add new Table H.2

Table H.2—Factory Acceptance Test (FAT) Cover Sheet

Project and Test Details			
Manufacturer		**Purchaser**	
Project name		**Project number**	
End client			
Crane model		**Crane serial number**	
Test location		**FAT dates**	
Personnel in attendance			
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Other project information			

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.3

Table H.3—Factory Acceptance Test (FAT) Preparation Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	H.3	Crane assembled and full inspection complete				
2	H.3	Required lubrication complete. tanks at correct level				
3	H.3	Crane commissioned and function testing complete				
4	H.3	Limits set: all motions				
5	H.3	Test loads ready at test area				
6	H.3	Crane ready for FAT				
7	H.4	Test conditions are suitable				
8	H.4	Test area ready, including barriers and signage				
9	H.5	Test equipment suitable and ready				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.4

Table H.4—Factory Acceptance Test (FAT) Information Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	H.6	Installation, operation and maintenance manual is available and complete				
2	H.6	Hydraulic and electric circuit diagrams available				
3	H.6	General arrangement, assembly drawings and parts manuals available				
4	H.6	Recommended maintenance checklists and procedures available				
5	H.6	FMEA available				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.5

Table H.5—Conformance Records and Certificates Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	H.7	Material, wire rope and NDT certificates				
2	H.7	Bolt torque and tension records				
3	H.7	Pressure test certificates (pressure vessels, hydraulic hoses and tubing)				
4	H.7	Area classification certificates				
5	H.7	Function speed and prime mover power records				
6	H.7	Hydraulic oil cleanliness certificates				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.6

Table H.6—Factory Acceptance Test (FAT) Assembly Checks Template

Item [1]	Ref.[2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	H.9	Components correctly tagged and labelled.				
2	H.9	Walkways, ladders, handrails and machinery guards are in place and secure.				
3	H.9	Machine surrounds are clean and free from oil and grease. No evidence of leaks.				
4	H.9	All lubrication points and all components requiring inspection and maintenance do not require special means to access.				
5	H.9	No potential dropped objects. Secondary retention systems secure.				
6	H.9	Adjustable swing backlash system fitted.				
7	H.9	Lifting points permanently marked with identification and SWL.				
8	H.9	Hydraulic hoses protected, including end fittings.				
9	H.9	Electrical cables, wiring, junction boxes and glands fitted correctly.				
10	H.9	All machinery guards are fitted.				
11	H.9	Operator cabin meets specification requirements. Fully enclosed and weatherproof, correct minimum dimensions. Secondary means of escape. HVAC unit. Adjustable operator seat and trainer seat. Correct windows, wipers and washers.				
12	H.9	Crane and pedestal adaptor (if applicable) includes brackets for swing bearing jacking				

Table H.6—Factory Acceptance Test (FAT) Assembly Checks Template *(continued)*

Item [1]	Ref.[2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
13	H.9	No water collection areas, potential corrosion.				
14	H.9	Demonstration of data download procedure.				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.7

Table H.7—Factory Acceptance Test (FAT) Measurements Template

Item [1]	Ref. [2]	Description	Values (include units)		Code (P, A, N, or F)		Notes
			Design	Measured	Manufacturer	Purchaser	
1	H.10	Pinion/gear backlash: hoist winch drive 1	in. (mm)				
2	H.10	Pinion/gear backlash: hoist winch drive 2	in. (mm)				
3	H.10	Pinion/gear backlash: swing drive 1	in. (mm)				
4	H.10	Pinion/gear backlash: swing drive 2	in. (mm)				
5	H.10	Pinion/gear backlash: luff drive 1	in. (mm)				
6	H.10	Pinion/gear backlash: luff drive 2	in. (mm)				
7	H.10	Main hoist up speed, maximum number of falls, no load. 30 ft.	s				
8	H.10	Main hoist up speed, maximum number of falls, maximum load. 30 ft.	s				
9	H.10	Main hoist down speed, maximum number of falls, maximum load. 30 ft.	s				
10	H.10	Main hoist up speed, minimum number of falls. 30 ft.	s				
11	H.10	Aux hoist up speed, single fall, no load. 30 ft.	s				
12	H.10	Aux hoist up speed, single fall, maximum load. 30 ft.	s				
13	H.10	Aux hoist down speed, single fall, maximum load. 30 ft.	s				
14	H.10	Luff in, no load, maximum to minimum radius.	s				
15	H.10	Luff out, no load, minimum to maximum radius.	s				
16	H.10	Luff in, max hoist load on hook, maximum radius to ~36 ft. radius.	s				
17	H.10	Swing, 1 revolution - right	s				

Table H.7—Factory Acceptance Test (FAT) Measurements Template *(continued)*

Item [1]	Ref. [2]	Description	Values (include units)		Code (P, A, N, or F)		Notes
			Design	Measured	Manufacturer	Purchaser	
18	H.10	Swing, 1 revolution – left	s				
19	H.10	Knuckle maximum to minimum extension, no load.	s				
20	H.10	Knuckle minimum to maximum extension, no load.	s				
21	H.10	Noise level, in cabin, prime mover running, no motions. HVAC operating.	dB(A)				
22	H.10	Noise level, in cabin, full speed luff up, full speed main hoist up with maximum load. HVAC operating.	70 dB(A)				
23	H.10	Noise level, 3 ft. from machinery house, full speed luff up, full speed main hoist up with maximum load.	85 dB(A)				
24	H.10	Maximum load (main hoist).	lb. (kg)				
25	H.10	Maximum load (auxiliary hoist).	lb. (kg)				
26	H.10	Record ambient temperature during continuous running test.	°F (°C)				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.
3. Backlash measurements on winches apply to open pinion / gear winch designs only, not internal components.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.8

Table H.8—Factory Acceptance Test (FAT) Running Tests Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	H.11	Prime mover start and stop devices function correctly, including all emergency stops.				
2	H.11	PLC/LMIS: all load charts and alarms function correctly.				
3	H.11	PLC/LMIS: operator interfaces function correctly.				
4	H.11	Check correct operation of personnel lifting mode, when selected.				
5	H.11	All motion limits function correctly (up/down, in/out, left/right).				
6	H.11	LMIS calibrated correctly, all hoists. Record values in Table H.7.				
7	H.11	CMs are smooth, progressive, predictable and proportional to control lever movements.				
8	H.11	Confirm that maximum response times comply with Table 29.				
9	H.11	Wire rope spooling is correct for all operating variations: no-load and loads, all speeds.				
10	H.11	Hook block storage and impact protection adequate. No fouling of hooks and ropes.				
11	H.11	GOPS functions correctly (manufacturer to define testing procedure)				
12	H.11	CTS functions correctly (manufacturer to define testing procedure)				

Table H.8—Factory Acceptance Test (FAT) Running Tests Template *(continued)*

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
13	H.11	Stall test (brake hold): main hoist winch				
14	H.11	Stall test (brake hold): aux hoist winch				
15	H.11	Stall test (brake hold): luff winch				
16	H.11	Stall test (brake hold): swing				
17	H.11	All lights are fitted and working: access lights, flood lights, aviation lights.				
18	H.11	Main hoist up and down maximum load (maximum falls), full hoist speed. Record values in Table H.7.				
19	H.11	Aux hoist up and down maximum load (maximum falls), full hoist speed. Record values in Table H.7.				
20	H.11	Luff in and out full speed with max radius rated capacity on hook, full range. Record values in Table H.7.				
21	H.11	Combined hoisting, luffing and swinging under full load, to demonstrate specification power compliance and control responsiveness.				
22	H.11	All emergency functions operate as per this specification and purchaser documentation.				
23	H.11	Overload tests to be proposed, as per this specification and purchaser's documentation.				

Table H.8—Factory Acceptance Test (FAT) Running Tests Template *(continued)*

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
24	H.12	4 h continuous running test, following guideline described in H.12. Ensure that there is no leaks, abnormal temperatures or unacceptable functions.				
25	H.12	2 h continuous running test, following guideline described in H.12. Ensure that there is no leaks, abnormal temperatures or unacceptable functions.				
26	H.12	1 h continuous running test, following guideline described in H.12. Ensure that there is no leaks, abnormal temperatures or unacceptable functions.				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the FAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.9

Table H.9—Factory Acceptance Test (FAT) Notes Template

Item	Reference	Notes	Comments	Punch List (Yes, No or Not applicable)

Justification

Templates standardize the FAT procedures and reports.

Add new Table H.10

Table H.10— Factory Acceptance Test (FAT) Punch List Template

Item	Notes	Action	Action By	Agreed Date

Justification

Templates standardize the FAT procedures and reports.

Add new Annex I

Annex I
(informative)

Site Acceptance Test (SAT) Guidance

I.1 Site Acceptance Test (SAT) Scope

I.1.1

The basic elements of the SAT process and procedure are provided in this annex.

Justification

Standardization of the SAT process, procedure and terminology by purchasers minimizes the in-process quality surveillance by the purchaser and the time and effort required in the planning of each SAT. The purpose of the SAT is to verify that the crane has been installed correctly on its site pedestal, is fully commissioned and ready for use and meets specified independent verification requirements.

I.1.2

The scope of the SAT typically includes the following:

a) site preparation:

   1) prepare pedestal;

   2) install crane.

b) information review:

   1) operating and maintenance information to be readily available;

c) assembly checks:

   1) visual inspection of assembled crane.

   2) final check of marking, tags and labels.

d) running tests:

   1) check all functions;

   2) final installed overload tests.

e) review results:

   1) assessment of results against IOGP S-618 specification;

   2) resolve any outstanding issues.

Justification

This list includes the basic elements of a SAT to give guidance to the user.

I.2 Site Acceptance Test (SAT) Procedure and Records

I.2.1

The SAT procedure and records shall be submitted for the specific crane being tested and the specific site location.

Justification

This requirement allows the purchaser to understand and provide feedback on the testing procedure that is used for accepting the product.

I.2.2

Typical SAT records are provided in Table I.2 through Table I.10.

Justification

Standardization on the SAT templates ensures that all expected steps are completed.

I.3 Purchaser's Site Acceptance Test (SAT) Preparation

I.3.1

SAT preparation at the platform is by the purchaser and should follow the guidance of I.3 and Table I.3.

Justification

SAT preparation builds confidence that the FAT will be successful, safe and efficient.

I.3.2

The purchaser is to ensure that the crane is installed on the crane pedestal using the manufacturer's recommendations.

Justification

It is the purchaser's responsibility to install the crane on the crane pedestal at the site in preparation for the SAT by the manufacturer.

I.3.3

Test loads shall be ready at the test area prior to the start of the SAT.

Justification

Once the crane reaches the final site location, it is the purchaser's responsibility to assist in preparing the platform test site including having the test loads available at site.

I.3.4

Shipping materials is to be removed (e.g. packing) from the crane and test site.

Justification

Once the crane reaches the final site location, it is the purchaser's responsibility to assist in preparing the platform test site and the crane including removal of the crane packaging material.

I.3.5

Crane shall be inspected to ensure that no deterioration or damage has occurred to the crane from transport to site.

Justification

Once the crane reaches the final site location, it is the purchaser's responsibility to inspect the crane for any damage prior to the SAT.

I.3.6

Purchaser is to confirm in writing that the crane is ready for the SAT.

Justification

This requirement ensures that the SAT does not proceed until written confirmation is received that all pre-SAT requirements have been completed. Requiring a written confirmation is a safety precaution.

I.4 Site Acceptance Test (SAT) Equipment

I.4.1

Equipment required to complete the SAT is to be supplied by the manufacturer as much as feasibly possible.

NOTE This includes equipment to measure speed, distance, pressure, voltage and current.

Justification

Manufacturer will have access to the correct equipment to safely and efficiently complete the SAT of their proposed crane type and model.

I.4.2

The manufacturer should notify the purchaser of equipment that will be required to be provided by the site team.

Justification

This requirement will ensure that all the needed equipment is available for the SAT.

I.4.3

Equipment shall be certified and calibrated in the accordance with the manufacturer's quality management system.

Justification

Tests with equipment that is not certified and calibrated are not reliable and could give erroneous results.

I.4.4

Calibration certificates shall be available for review during the SAT.

Justification

This requirement ensures that purchasers can easily verify that calibrated equipment is used during the tests and purchasers have access to the calibration certificates

I.5 Operating and Maintenance Information

I.5.1

Operator and maintenance information shall be readily available to purchaser during the SAT.

NOTE This includes all installation operating, maintenance and parts manuals, general arrangements drawings, circuit diagrams, FMEA and other typical information required for operating and maintenance of the crane.

Justification

The SAT is a good time to check the information normally required for operating and maintenance of the crane. Quality inspectors can review if any items are missing or need further clarification. Inspectors will also review that the information is consistent with the crane being supplied. Sometimes the operating and maintenance manual are reused from past projects or similar cranes.

I.6 Conformance Records and Certificates

I.6.1

Copies of all conformance records and certificates shall be available to the purchaser during the SAT.

Justification

Readily available information to the purchaser's inspector will help ensure a successful and quick SAT.

I.6.2

The documentation shall have been reviewed and accepted prior to the SAT.

Justification

This ensures the SAT is being performed on a crane that has all the correct certificates in place and has no outstanding non-conformances.

I.7 Site Acceptance Test (SAT) Criteria

I.7.1

Acceptance criteria in accordance with Table I.1 shall be used during the SAT.

Justification

Standardizing the verbiage used during FAT is beneficial to both the purchaser and manufacturer. This will give clarity on the expectations.

Add new Table I.1

Table I.1—Site Acceptance Test (SAT) Acceptance Criteria

Code	Meaning	Explanation
P	Pass	Meets specification criteria.
A	Acceptable	Does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.
N	Not acceptable	Does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to finalizing the SAT, as agreed.
F	Fail	Does not meet specification criteria. Corrective action is to be completed before proceeding further with the SAT.

Justification

Standardizing the verbiage used during FAT is beneficial to both operators and manufactures. This will give clarity on the expectations.

I.8 Site Acceptance Test (SAT) Assembly Checks

I.8.1

A visual inspection of the assembled crane shall be performed.

Justification

This will ensure that assemblies are complete and fully installed.

I.8.2

The visual inspection shall verify that there are no transport damages and no leaks are identified.

Justification

This requirement ensures that the crane has no damages and is installed properly with no leaks.

I.8.3

All items shall be described in detail in the checklist.

Justification

This requirement provides a record of it being acceptable or not.

I.9 Site Acceptance Test (SAT) Measurements

I.9.1

Baseline measurements and equipment performance shall be recorded during the SAT.

Justification

This is to verify compliance to the specification and to provide baseline readings for future maintenance and fault finding.

I.9.2

Measurements shall apply to running and stationary situations.

Justification

This is to verify compliance to the specification and to provide baseline readings for future maintenance and fault finding.

I.9.3

The manufacturer shall include items in the checklist based on the specific crane type and design.

Justification

This is to help standardize the dimensions that will be required during an SAT by purchasers.

I.10 Site Acceptance Test (SAT) Running Tests

I.10.1

Running tests shall be performed in accordance with Table I.8.

Justification

Running tests are done to demonstrate that the crane performs as per the specification. The tests enable the purchaser to confirm primarily that the crane:
- has been transported, installed and commissioned correctly;
- performance is satisfactory;
- limits and other settings are set as per final operating requirements

I.10.2

The items listed in Table I.8 can be performed in a sequence preferred by the manufacturer, to suit conditions, as long as the intent of the check is met.

Justification

This requirement allows the manufacturer the ability to perform the SAT in a sequence that is safe for their particular crane and recognized by their SAT technicians.

I.11 Site Acceptance Test (SAT) Continuous Running Test Guideline

I.11.1

Continuous running test shall follow the steps of Figure I.1.

Justification

Listing the steps and expectations of the continuous running test will help standardize the requirements needed for continuous running tests.

I.11.2

Minor changes may be made to suit different crane types and site conflicting activities or restrictions.

Justification

This requirement is guidance and allows flexibility in the running test.

I.11.3

Load should be 25 % to 50 % of maximum rated on-board capacity at maximum radius.

Justification

Most continuous lift scenarios offshore will be at the 25 % to 50 % of maximum rated on-board capacity. During SAT, it is normal to test at the most likely scenarios versus the extreme scenarios.

I.11.4

Luff in radius is a mid-radius, approximately 30 % of maximum radius.

Justification

Most continuous lift scenarios offshore will be at mid radius. During SAT, it is normal to test at the most likely scenarios versus the extreme scenarios.

I.11.5

If the continuous running test is suspended once underway, due to technical issues, then the test may have to be restarted, at the discretion of the purchaser.

Justification

The validity of a continuous running test that is disturbed may be erroneous. It should be up to the purchaser to determine if an interrupted test should be restarted.

Add new Figure I.1

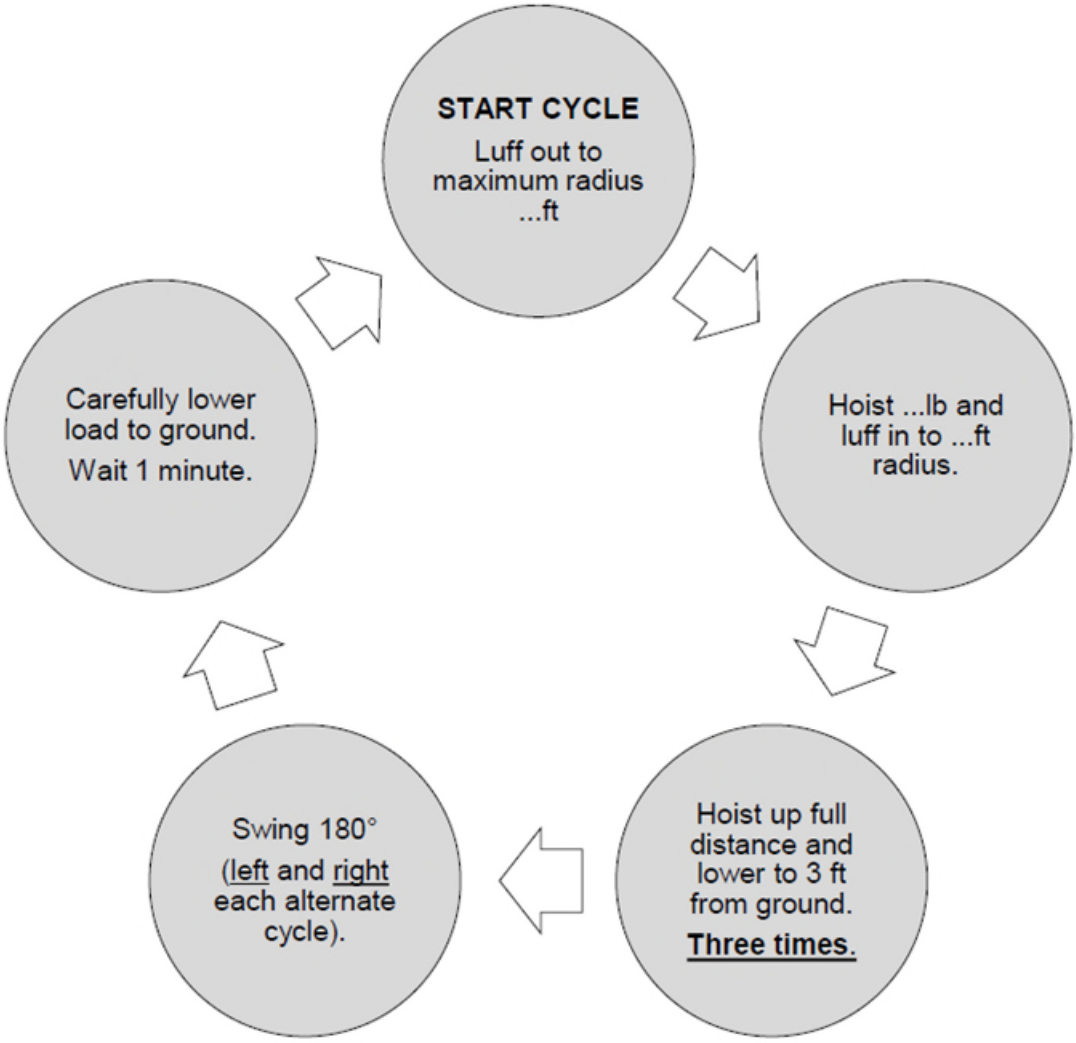

Figure I.1—Steps

Justification

This figure provides a diagram of the running test.

I.12 Site Acceptance Test (SAT) Record Templates

Add new Table I.2

Table I.2—Site Acceptance Test (SAT) Cover Sheet

Project and Test Details			
Manufacturer		**Purchaser**	
Project name		**Project number**	
End client		**Facility name**	
Crane model		**Crane serial number**	
Test location		**SAT dates**	
Personnel in attendance			
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Name / Company		**Name / Company**	
Other project information			

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.3

Table I.3—Site Acceptance Test (SAT) Preparation Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	I.3	Crane assembled and full inspection complete				
2	I.3	Required lubrication complete. Tanks at correct level				
3	I.3	Crane commissioned and function testing complete				
4	I.3	Limits set: all motions				
5	I.3	Test loads ready at test area				
6	I.3	Crane ready for SAT				
7	I.4	Test conditions are suitable				
8	I.4	Test area ready, including barriers and signage				
9	I.5	Test equipment suitable and ready				

KEY

P=pass, meets specification criteria.

A=acceptable, does not meet specification criteria but is acceptable. Documentation to be updated as appropriate.

N=not acceptable, does not meet specification criteria but testing can proceed. Corrective action is to be taken prior to shipping or the SAT, as agreed.

F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the SAT.

NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.4

Table I.4—Site Acceptance Test (SAT) Information Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	I.5	Installation, operation and maintenance manual is available and complete				
2	I.5	Hydraulic and electric circuit diagrams available				
3	I.5	General arrangement, assembly drawings and parts manuals available				
4	I.5	Recommended maintenance checklists and procedures available				

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F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the SAT.
NOTES
1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.5

Table I.5—Conformance Records and Certificates Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	I.6	All information available from the completed FAT				
2	I.6	Bolt torque and tension records for site installation				

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F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the SAT.
NOTES
1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.6

Table I.6—Site Acceptance Test (SAT) Assembly Checks Template

Item [1]	Ref.[2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	I.8	Components correctly tagged and labelled				
2	I.8	Walkways, ladders, handrails and machinery guards are in place and secure				
3	I.8	Machine surrounds are clean and free from oil and grease No evidence of leaks				
4	I.8	No potential dropped objects Secondary retention systems secure				
5	I.8	Inspect major load path structural components				
6	I.8	Check hoist and luff ropes, and / or boom cylinders and hook blocks				
7	I.8	Hydraulic hoses protected, including end fittings				
8	I.8	Electrical cables, wiring, junction boxes and glands fitted correctly				
9	I.8	All machinery guards are fitted				
10	I.8	Demonstration of PLC data download procedure				

KEY

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F=fail, does not meet specification criteria. Corrective action is to be completed before proceeding further with the SAT.

NOTES

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2. Reference to the relevant annex section.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.7

Table I.7—Site Acceptance Test (SAT) Measurements Template

Item [1]	Ref. [2]	Description	Values (include units)		Code (P, A, N, or F)		Notes
			Design	Measured	Manufacturer	Purchaser	
1	I.9	Swing bearing clearance measurements (4 points North, South, East, West, boom max / min)	in. (mm)				
2	I.9	Overload test (max rated capacity + overload at maximum radius)	lb. (kg)				
3	I.9	Overload test main hoist (max rated capacity)	lb. (kg)				
4	I.9	Overload test aux hoist (max rated capacity)	lb. (kg)				
5	I.9	Record ambient temperature during continuous running test	°F (°C)				

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NOTES

1. Insert or delete items and rows as necessary, depending on crane design.
2. Reference to the relevant annex section.
3. Backlash measurements on winches apply to open pinion / gear winch designs only, not internal components.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.8

Table I.8—Site Acceptance Test (SAT) Running Tests Template

Item [1]	Ref. [2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
1	I.10	Prime mover start and stop devices function correctly, including all emergency stops.				
2	I.10	PLC / LMIS: All load charts and alarms function correctly.				
3	I.10	PLC / LMIS: Operator interfaces function correctly.				
4	I.10	Check correct operation of personnel lifting mode, when selected.				
5	I.10	All motion limits function correctly (up / down, in / out, left / right).				
6	I.10	Rope layers confirmed correctly tensioned prior to lifting of loads.				
7	I.10	LMIS calibrated correctly, all hoists. Record values in Table I.7.				
8	I.10	CMs are smooth, progressive, predictable and proportional to control lever movements.				
9	I.10	Confirm that maximum response times comply with Table 29.				
10	I.10	Wire rope spooling is correct for all operating variations: no-load and loads, all speeds.				
11	I.10	All lights are fitted and working: access lights, flood lights, aviation lights.				

Table I.8—Site Acceptance Test (SAT) Running Tests Template *(continued)*

Item [1]	Ref.[2]	Description	Date	Code (P, A, N, or F)		Notes
				Manufacturer	Purchaser	
12	I.10	Combined hoisting, luffing and swinging under full load, to demonstrate specification and purchaser order power compliance, control responsiveness and site power supply (electric prime mover/electric cranes).				
13	I.10	All emergency functions operate as per this specification and purchaser order requirements				
14	I.10	30 min. continuous running test, following guideline described in I.11 and Figure I.1. Ensure that there is no leaks, abnormal temperatures, or unacceptable functions.				

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NOTES

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2. Reference to the relevant annex section.

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.9

Table I.9—Site Acceptance Test (SAT) Notes Template

Item	Reference	Notes	Comments	Punch List (Yes, No or Not applicable)

Justification

Templates standardize the SAT procedures and reports.

Add new Table I.10

Table I.10—Site Acceptance Test (SAT) Punch List Template

Item	Notes	Action	Action By	Agreed Date

Justification

Templates standardize the SAT procedures and reports.

Bibliography

Add to start of Bibliography

The following documents are informatively cited in the text of this document, API 2C, the PDS (IOGP S-618D) or the IRS (IOGP S-618L).

Add to section

[30] ISO 9001, *Quality management systems — Requirements*

[31] ISO 10005, *Quality management — Guidelines for quality plans*

[32] ISO/IEC Directives, Part 2, *Principles and rules for the structure and drafting of ISO and IEC documents*

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