

# 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.

## Revision history

VERSION	DATE	PURPOSE
2.0	January 2025	Second Edition
1.0	December 2018	First Edition

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## 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 cancels and replaces 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, 8<sup>th</sup> Edition, published October 2020 and 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 2C, following the API 2C clause structure. Clauses from API 2C not amended by this specification apply as written. Modifications to API 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 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 2C.

## 2 Normative References

### Add to first paragraph

The following documents are referred to in this specification, 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 these specification documents.

### Add to section

API Recommended Practice 14C, *Analysis, Design, Installation, and Testing of Safety Systems for Offshore Production Facilities*

API Specification 2B, *Specification for the Fabrication of Structural Steel Pipe*

Dropped Object Prevention Scheme Recommended Practice:2020,

EN 614-1:2006, *Safety of machinery – Ergonomic design principles – Part 1: Terminology and general principles*

EN 13852-1, *Cranes – Offshore cranes – Part 1: General purpose offshore cranes*

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

### 3.1 Terms and Definitions

#### Add new term 3.1.140

#### **3.1.140**

#### **common cause failure**

Failures of different items, resulting from a single event, where these failures are not consequences of each other.

### 3.2 Acronyms and Abbreviations

#### Add to section

CAS	conformity assessment system
CIS	component identification system
CSV	comma-separated values
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
OEM	original equipment manufacturer
PDS	procurement data sheet
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) applicable regulatory requirements.

#### *Justification*

*The purchaser normally provides the necessary information to regulatory agencies (e.g. 46 CFR 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 new list item*

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

#### *Justification*

*4.4 lists the purposes of Annex B through Annex F and the addition of this list item is in accordance with the addition of new Annex G.*

## 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 original 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 requirement amends the sentence to be inclusive of all uncontrolled movements.*

## **6 Structure**

### **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.*

### **6.6 Structural Fatigue**

#### Add to section

Bolts subject to combined tension and fatigue shall be pre-tensioned in accordance with the AISC minimum pretension for fully-tightened bolts values.

#### **Justification**

*This requirement ensures that bolts are pre-tensioned, which mitigates fatigue.*

#### Add new section

### **6.7 Pedestal Adapter and/or Kingpost Fabrication**

The pedestal adapter and pedestal shall be fabricated in accordance with API 2B.

#### **Justification**

*This requirement ensures that the fabrication of structural members is to a recognized structural steel pipe standard.*

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 that 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 or cause twisting of the lower block or hook block during hoisting operations.

### ***Justification***

*Boom protectors are provided to protect the boom from the running of wire ropes during operation and rope replacement. Boom protectors can potentially create snag points transferring shock loads to the hoisting systems or damaging a lacing. This requirement ensures that the layout and location of boom protectors are designed to prevent snag points and subsequently to prevent 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 reduces crushing and fatigue on the rope. A 20:1 ratio is commonly specified by operators and has a proven performance track record. This requirement also promotes 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 diameters regardless of the 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 (see Figure 7).

#### **Justification**

*This list section 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 line of sight or using winch cameras.

#### **Justification**

*The visibility of drums is essential for 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 safe operation of the crane. The radially striping of highly-contrasting colors along the flange assists in the visual confirmation of the rotation of the drum.*

Lights shall be directed on drums to increase the crane operator's visibility of the 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**

#### **7.4.1.1 General**

##### Add to section

If specified, a minimum of two swing drives shall be provided.

### **Justification**

*If one swing drive goes out, the second (redundant) swing drive is a safe way to get the boom back to the boom rest. This is an optional requirement as it may not be required for smaller cranes.*

If swing drives do not have a means of adjusting backlash on site, the provided system shall not have performance degradation from fabrication and installation tolerances.

### **Justification**

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

The crane shall have a means to install a slew bearing replacement system.

### **Justification**

*Slew bearings are 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 is minimized. To do this as a retro fit and without the proper means in place substantially increases the time during which the crane is 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.*

If the slew angle required is greater than 359 degrees, the crane swing shall allow for unrestricted and continuous rotation in the clockwise and counter-clockwise directions.

### **Justification**

*This requirement prevents crane operators from unknowingly damaging crane components (primarily slip ring internals) due to over rotation. This requirement is for cranes with a slew angle greater than 359 degrees (i.e. not applicable to cranes with restricted slew angles).*

The crane shall be designed 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.*

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

### **Justification**

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

## **7.4.2 Swing-circle Assembly**

### **7.4.2.2 Design**

#### **7.4.2.2.5 Ultimate Strength Criteria for Swing-circle Assembly Fasteners**

##### Add to first paragraph

When a bolted transition piece below the swing mechanism is required, the requirements of this section shall be applicable.

### **Justification**

*In crane configurations that have a second series of fasteners due to a transition piece bolted below the swing mechanism and fastened to the pedestal, the fastener criteria and verification of 7.4.2.2.5 are to be extended to this second series of fasteners.*

### **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 13).

NOTE This requirement is a major interface to be worked between the crane manufacturer and the topsides primary.

### **Justification**

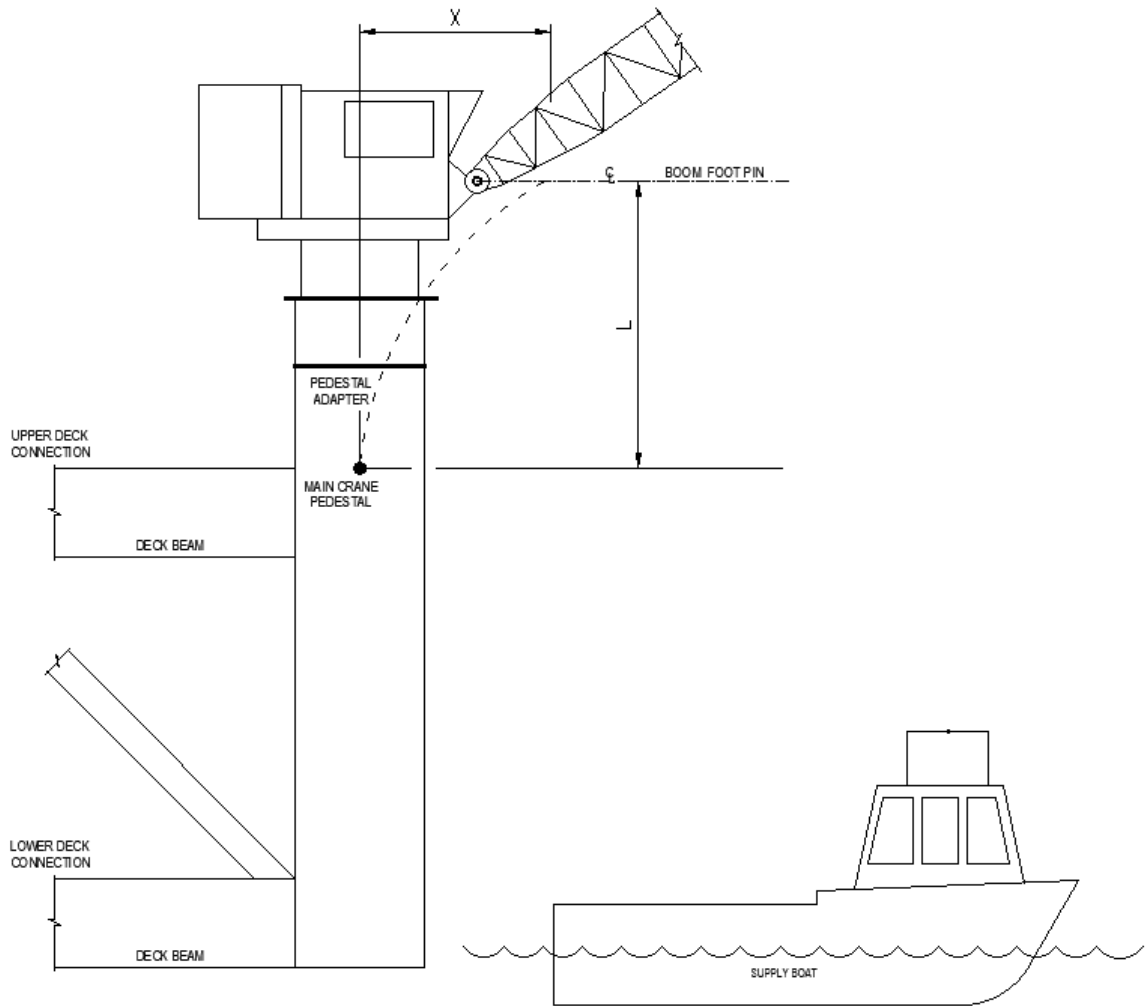
*The  $L/180$  criterion improves human factors and the crane operator's comfort (i.e. prevents the feeling of the crane tipping over).*

The swing-circle assembly of pedestal-mounted cranes and the swing-drives of kingpost 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 deliberate overload protection for the swing-circle / swing-drives. This requirement also protects the slew drives. In kingpost cranes, there is no way to protect the backlash so this requirement ensures that the design can accommodate large deflections. This requirement also ensures that machinery is designed for more deflection than the crane is expected to experience.

**Add new Figure 13**



**Figure 13—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.

## 7.5 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 perform. Failure of the prime mover can lead to unpredictable performance of the crane.*

When 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 can allow a temporary overload or overheat. This requirement prevents any allowance of overload or overheat.*

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

##### **Justification**

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

Hoisting motions shall have priority over luffing and swing operations.

##### **Justification**

*This requirement 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.*

Luffing and swing motions shall not fall below 50 % speed when operated simultaneously with hoisting motion.

##### **Justification**

*This requirement 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 Ignition Prevention Measures

The engine exhaust and other hot surfaces shall comply with the ignition prevention measures of API 14C.

#### **Justification**

*Inadvertent release of hydrocarbons and hot surfaces can result in ignition risks. API 14C is the companion standard for ignition prevention measures. Hot surfaces are defined in API 14C.*

## 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.*

If specified, a drip pan shall be provided under the nozzle or fixture.

#### **Justification**

*A drip pan can collect any drippage and ease maintenance.*

Add new section

### 7.5.3.3 Fuel Tank Capacity

The fuel tank shall be sized to accommodate fuel consumption with the engine running at 4 hr maximum fuel burn and 20 hr at idle speed.

#### **Justification**

*This 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 can vary depending on the project and is an interface between the manufacturer and the purchaser.*

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

#### **Justification**

*Floating platforms move around and can cause sloshing which can negatively affect the platform and fuel efficiency.*

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

### **Justification**

*316L stainless steel is a material used for corrosion protection.*

A handhole or manway for internal cleaning of the fuel tank 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 are 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 in accordance with the specific project requirements.

### **Justification**

*Fire and gas detectors 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**

### Add new section

## **9.6 Manual Overload Protection System (MOPS)**

### **9.6.1 General**

If a manual overload protection system (MOPS) is specified, the MOPS shall be provided in accordance with the requirements given in 9.6.2 through 9.6.5.

### **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.*

### **9.6.2 System Criteria**

The MOPS shall be capable of activation during either of the following:

- operation only;
- operation and normal stop;
- operation, normal stop and emergency/power failure stop (e.g. prime mover failure, loss of hydraulics, main power supply failure or shutdown of the crane during an offboard lift).

### **Justification**

*An entangled supply vessel does not only move up and down, but can also drift away from the crane, gradually. The crane operator may already have pushed the emergency stop beforehand.*

When overloads due to entanglement and relative motions occur, the MOPS shall be capable of activation.

**Justification**

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

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 (e.g. from a single-part reeving to a four-part reeving to a six-part reeving).*

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

**Justification**

*When the MOPS is activated, the crane operator has to be able to deactivate the MOPS when needed. The MOPS is activated by pushing the MOPS button and deactivated by pushing the MOPS button again.*

Activation of the MOPS shall disengage the hoisting brakes if this has not already been done when entering the offboard lift zone.

**Justification**

*This requirement ensures that when the MOPS is activated, the hoisting brakes open if they are not already open in offboard. The MOPS will not work as intended if the brakes do not disengage.*

If activated, the MOPS shall maintain a retaining force in the hoisting system that is suitable to prevent free fall of an onboard lift, allowing the wire rope to be spooled completely off the drum, without causing significant damage to the crane.

**Justification**

*Damage to the crane will occur if a retaining force is not present.*

### **9.6.3 Operation During Power Failure or Emergency**

If specified, 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**

*The MOPS is a last resort protection before the crane collapses (if an AOPS is not included). If the load is entangled in the supply vessel and the crane power is lost, the MOPS needs to be operational. This requirement is a PDS option as there are companies that do not have and will not specify a MOPS on any of their API cranes. However, it is recognized that other companies do require MOPS.*

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

**Justification**

*The entangled vessel may drift, causing the wire length to be longer than the motion limiter length. This requirement allows wire to be spooled out completely without stopping. This requirement is a PDS option as there are companies that do not have and will not specify a MOPS on any of their API cranes. However, it is recognized that other companies do require a MOPS.*

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

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

##### **Justification**

*This requirement ensures that the MOPS is marked based on typical coloring for emergency devices.*

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

##### **Justification**

*This requirement ensures that some type of dual action (e.g. a flip cover or pull push button) is used in the MOPS mechanism, thus preventing inadvertent activation.*

#### 9.6.5 Manual Overload Protection System (MOPS) Control System Indicators and Alarms

The MOPS shall have control system indicators in accordance with this section.

##### **Justification**

*This requirement lets operators know that the system is ready for operation. Control system indicators are used during personnel lifts because 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 be located in the control station.

##### **Justification**

*This requirement ensures easy access for the crane operator.*

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

##### **Justification**

*This requirement lets operators know that the system is ready for operation. Control system indicators are used during personnel lifts because 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 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**

*This requirement ensures that a warning is given to the crane operator and personnel near the crane working area that the MOPS is activated. The indicator that the MOPS is activated is important information to the crane operator.*

### **Add new section**

## **9.7 Automatic Overload Protection System (AOPS)**

If specified, an AOPS shall be provided.

NOTE The recognized standard for the AOPS is EN 13852-1.

### **Justification**

*AOPS requirements are not provided in API 2C. If the purchaser requires an AOPS (optional), the recognized standard is EN 13852-1.*

The AOPS shall have indicator alarms in accordance with Table 23.

### **Justification**

*Alarms and indicators assist in both operation of the crane and troubleshooting.*

## **10 Human Factors—Health, Safety, and Environment**

### **10.1 Controls**

#### **10.1.1 General**

##### **10.1.1.2 Automatic Return**

### **Add to section**

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

### **Justification**

*This requirement prevents unintentional/accidental activation. For instance, the crane operator may turn the engine on for pre-inspection and unintentionally/accidentally activate the crane.*

##### **10.1.1.4 Emergency Stop**

### **Add to section**

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 arrest the load in certain failures.*

Emergency stop shall shut down the power plant.

**Justification**

*The ability to shut down the engines by shutting off the air intake is required by outer continental shelf regulations.*

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

**Justification**

*This requirement ensures that the action of putting the crane back into service is a deliberate action that prevents unintentionally putting the crane into service.*

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

**Justification**

*This requirement prevents activating the emergency stop during an operation that is not an emergency and/or inadvertently hitting a separate control during an emergency that delays the emergency stop.*

**Add new section****10.1.1.7 Control System Response**

Crane motions 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 the required speed for the main motions shall be as follows:

- 1 s for brakes to engage;
- 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 of single fault or common cause failures 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 capable of simultaneous hook movements in vertical, radial and lateral (i.e. hoist, boom and swing).

### **Justification**

*This requirement prevents the need 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, the crane operator struggles 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 Lifts**

Cranes equipped with a GOPS, a MOPS or motion compensators (e.g. constant tension systems) 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. Lockable personnel selectors are only used if a GOPS, a MOPS or wave followers are installed, otherwise there are no changes to the crane operation that the switch would control.*

## **10.2 Cabs and Enclosures**

### **10.2.1 General**

#### **Add to section**

Crane operators' cabs 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 cab or of an uncontrolled load swinging towards the cab and putting the crane operator at risk. Enclosed cabs prevent possible fire hazards as well as electrical shorts due to water ingress. Enclosing the cab is a good safety practice that provides a level of precaution against these risks. An enclosed cab is also advantageous to prevent DROPS incidents from the gantry, potentially hitting the crane operator.*

Cab 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 term "metal" is used instead of "steel" due to aluminum being commonly used for the construction of cabs.*

Enclosed crane cabs shall be designed with proper regard to the body dimensions of the expected population of operators as referenced in EN 614-1:2006, 4.3.2.

**Justification**

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

Roofs of enclosed cabs shall withstand a concentrated load of at least 300 lbs (1.33 kN).

**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 cab. The concentrated load of 300 lb (1.33 kN) is the recommended value given in ASCE-7, Table 4.3-1 for roof surfaces subject to maintenance workers.*

Enclosed cabs 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 cab.*

The crane operator's seat shall be equipped with 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 cab shall be provided for an instructor behind the operator's seat.

**Justification**

*Cabs 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 the crane operator.*

The cab 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 made of shatterproof glass or laminated safety glass.

#### **Justification**

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

Window glass or laminate of windows 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

The size and location of windows shall provide an unobstructed line of sight from the crane operator's seat to the boom, hooks and load in all of the crane's operating positions.

#### **Justification**

*This requirement ensures that the crane operator does not have blind spots that prevent them from seeing the crane hook and load regardless of position.*

Add to section

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

#### **Justification**

*This requirement maintains the operator's visibility and reduces glare from sunlight through the use of blinds. Adjustable sun blinds are preferred over window tint due to the fact that window tint decreases visibility during night conditions.*

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

#### **Justification**

*This requirement provides access to clean the windows, which increases the frequency at which the windows are cleaned. Clean windows improve the crane operator's visibility and increase 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 throughout 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**

Delete "if specified by the purchaser"

### **Justification**

*This deletion makes window wipers and washers mandatory for API 2C cranes. Providing window wipers and washers on crane cabs is a common requirement that is requested. Removing the option helps promote standardization.*

Add to section

Access for window wipers and wiper motor maintenance shall be provided.

### **Justification**

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

### **10.2.3 Doors**

Add to section

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

### **Justification**

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

Doors of enclosed cabs shall be equipped with a window.

### **Justification**

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

Cab door openings shall have a clearance of at least 71 in. (1.8 m) high and 24 in. (0.609 m) wide.

### **Justification**

*This requirement is the minimal human factors performance requirement accepted by a majority of operating companies.*

### **10.2.5 Platforms and Walkways**

Add to section

When permanently installed platforms are not provided, an alternative means to facilitate wire rope replacement shall be provided.

**Justification**

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

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

**Justification**

*Wire ropes are heavy and stiff to handle. Permanent platforms are a safer practice 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 specified in Table 30.

**Justification**

*This requirement provides a consistent set of conditions and criteria for maximum noise levels.*

Add new Table 30

**Table 30—Noise Level Testing**

Test Number	Test Conditions	Allowable Noise Level
1	Inside the crane operator's cab with the cab door closed with maximum noise condition. — Noise measurement includes simultaneous operation of engine, pumps and HVAC at full capacity. — Noise measurement does not include alarms or horns.	70 dB(A) time weighted average with an 85 dB(A) peak, assessed for at least 60 min
2	On the access level to the crane cab with maximum noise condition. — Noise measurement includes simultaneous operation of engine, pumps and HVAC at full capacity. — Noise measurement does not include alarms or horns.	90 dB(A) time weighted average assessed for at least 60 min

**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 also prevents cumulative damage and hearing loss due to noise.*

Add new section

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

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

**Justification**

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

HVAC units shall have adjustable ventilation.

**Justification**

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

HVAC units shall control and maintain the internal temperature between 60 °F and 80 °F (15 °C and 25 °C).

**Justification**

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

The HVAC unit design shall account for the specified operating temperature due to radiated heat from external heat sources of nearby operating equipment.

**Justification**

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

## 10.3 Miscellaneous Requirements and Equipment

### 10.3.1 Indicators, Alarms, and Limits

**Table 23—Indicators, Alarms, and Limits**

*Replace Table 23 with*

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
AOPS (if applicable)	NR	NR	X	X
Motion limit overrides (anti two block)	PO	NR	PO	PO
Motion limit overrides (high angle kick out)	PO	NR	PO	PO
<b>Key</b> Ind = indicator, AA = audible alarm, X = mandatory, Trip = function limit, VA = visual alarm, PO = purchaser option (indicated in IOGP S-613D), NR = not required. * = changes from PO to X for crane with subsea ratings.				

**This table is an adaptation of API 2C; Indicators, Alarms, and Limits; Table 23,  
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#### **Justification**

*In this amended table, some alarms have been made mandatory (standardized) rather than a purchaser's option. Alarms and indicators assist in both 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 automatically return to the "off" function when the override actuator is not manually held in the override position.

#### **Justification**

*This requirement prevents a potentially high consequence risk. The crane operator continuously holds 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 to at least 50 % of its maximum operating speed when approaching 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 follows.*

- 1) *If they malfunction, hoist and slew limits make it hard and unsafe to remove loads during offshore lifts.*
  - 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 decreases 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 among 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 is not permitted in some company specifications or on assets that have a limited amount of personnel. However, some companies allow this because two people are used during the override procedure, but some operators do not include 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 the crane operator with an indication of hook load, load radius and crane SWL whereas the LIS only provides the crane operator with load indication. This requirement has removed the option of LIS and made the LMIS mandatory.*

### **Table 24—Boom and Load Indicators**

Delete Table 24

### **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 an LIS so 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 crane 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 requirement 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 the term "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 requirement 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 the term "LMIS" in API 2C.*

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

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

### **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 prevent overloading the crane.*

When the actual hook load exceeds 90 % of the rated capacity for any lift conditions, the LMIS shall display 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 the cab.

### **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.

### **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 or accident side loading.*

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 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 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**

*A mechanical device ensures that tension load cells do not show erroneous results due to out-of-plane bending.*

If tension load cells are made from 17-4PH stainless steel material and subject to a saltwater environment, the tension load cell shall have a minimum heat-treating using an H1150 process.

NOTE 1 Tension load cells made from 17-4PH stainless steel that have been heat-treated using an H900 process are not to be used on offshore or coastal onshore sites.

NOTE 2 Other materials can be used for tension load cells provided the tension load cells material heat treatment process is suitable for prevention of environmentally assisted brittle fracture.

### **Justification**

*This requirement minimizes the effects of stress corrosion cracking. A minimum H1150 heat treatment process is suitable for prevention of environmentally assisted brittle fracture.*

If used in a marine environment, carbon materials and 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.*

### **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 straight boom chords of lattice boom type cranes.

**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**

*The justification for preventing rotation of the boom foot pins is so that the designers and maintenance crew know where the sliding surfaces are for analysis and lubrication. These are standard bearing and bushing design principles.*

On boom heel pins without maintenance-free bearings, the boom heel pins shall have a means of lubricating the entire length of sliding or rotating surfaces between the pin and the bearing or bushing.

**Justification**

*Without the ability to lubricate the full length of rotating surfaces, wear between surfaces is uneven and leads to premature performance degradation.*

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

**Justification**

*Boom foot pin bushings are 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.

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

**Justification**

*Fans, fan belts and slew drive pinions are considered exposed moving parts that constitute a hazard and require guards. This requirement has been added as some manufacturers do not consider fans, fan belts and slew drive pinions as moving parts and do not provide guards.*

#### 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**

*Guards provide superior injury protection compared to warning signs which can sometimes be ignored.*

#### 10.3.6 Anti Two-block

Add to section

The anti two-block system shall prevent functions that cause the block to travel towards the boom tip.

##### **Justification**

*This requirement ensures that 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 Powered Emergency Load Lowering and Slewing System

Replace first paragraph with

The powered emergency load lowering and slewing system shall enable operation of the crane (i.e. lowering the boom, lowering the hoist and slewing the crane) regardless of 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.

##### **Justification**

*The powered emergency load lowering and slewing system increases safety by allowing the crane operator to manage uncontrolled lifts for all lifts.*

Add to section

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

##### **Justification**

*This requirement allows the crane operator to lower the hook load 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, purchaser's requirements and specifications.

##### **Justification**

*This requirement ensures that cranes are visible to aircraft. The crane is often the highest point on a platform while in operation.*

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 to the crane is lost.*

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 the original equipment manufacturer's (OEM's) 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 located 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 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.

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

#### **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.*

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

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

#### **Justification**

*Major structural components are irregular shapes and their center of gravity is not always evident, which can lead to an unstable lift if the lift is not properly planned. Planned and engineered lifting points provide a safer lifting strategy.*

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

#### **Justification**

*Major structural components are irregular shapes and their center of gravity is not always evident, which can 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 and 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 shall incorporate a cross-over walking surface at chord 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 specified as supplied by the manufacturer, the requirements of this section shall apply.

#### **Justification**

*The communication equipment for a crane can either be free-issued to the manufacturer by the purchaser or supplied 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 lifting operations.

#### **Justification**

*This requirement allows the crane operator to have a direct line of communication during any lifting operations. A lag in communication can lead to an incident.*

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 otherwise impairs the crane operator's ability to operate the crane.*

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 help the 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 can be dependent on layouts and blind spots. A boom tip camera is provided as a default.*

If the boom tip camera is specified in accordance with this specification, the requirements of this section shall apply.

### **Justification**

*This requirement provides the option to use a customized camera system rather than the manufacturer's standard system.*

The camera system shall consist of a high-definition color camera located at the boom tip and a high-definition color monitor located in the crane operator's cab.

### **Justification**

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

The camera system shall have remote controls for camera zoom, focus and iris.

### **Justification**

*The crane operator's ability to control the camera (i.e. focus, zoom, iris) assists in safely performing lifts.*

The camera system shall be mounted in a location that is reachable and operable by the seated crane operator.

### **Justification**

*The crane operator's 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 and identifying any problems in the event of an accident. This is an optional item as some of the smaller cranes and unmanned or minimally manned platforms cranes may not require a data recorder. This requirement ensures that data recorders are provided as a default.*

The recorded data shall be reviewable by the crane operator without the OEM's intervention.

### **Justification**

*Data recorders can provide valuable information on performance trending, troubleshooting and identifying any problems in the event of an accident. The ability to record and review data is important to review trending, troubleshooting or identifying any problems in the event of an accident. The intent is that the data is reviewable by the crane purchaser or owner without needing the OEM to remove encryption or transform the data.*

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);

- crane motions;
- 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;
- lifetime load cycle history;
- overrides of alarm;
- alarms acknowledged;
- crane operator's unique identification, if specified.

**Justification**

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

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

**Justification**

*Removing the option of manual activation excludes the possibility of the data recorder accidentally not being started.*

The memory capacity of the data recorder shall be listed 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 internal storage, this requirement allows the manufacturer to provide the normal 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 crane owner without the OEM's intervention.

**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 comma-separated value (CSV) or equivalent format.

**Justification**

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

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

#### **Justification**

*This requirement ensures that the data can be directly downloaded 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 provided in a password 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.*

It shall not be possible 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 (e.g. cannot be accidentally deactivated).*

### **10.3.8.11.2 Cameras**

Cameras shall have video recording functionality.

#### **Justification**

*The ability to maintain the recording from cameras helps in root cause analysis of accidents.*

Add new section

### **10.3.9 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**

*Most operating companies use the manufacturer's standard hydraulic and pneumatic line system, especially in the Gulf of Mexico. However, alternative requirements used by some operators can be found in Annex G.*

Add new section

### **10.4 Lighting**

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

#### **Justification**

*This requirement ensures that lighting is provided to the necessary and expected brightness for the crane operator's safety.*

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 the crane operator's safety.*

Emergency lighting covering escape routes from the crane cab 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 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 or a platform emergency lighting supply.

### **Justification**

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

Where emergency light fixtures are connected to an integral charger and backup battery, the battery shall last at least 90 min.

### **Justification**

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

Lighting shall not directly impair the vision of the crane operator (e.g. lights shining directly into the crane cab).

### **Justification**

*Lighting is installed on platforms and walkways and around the crane (e.g. directed at drums to increase the crane operator's visibility of the rotation of the drums). It is important for the lighting design not to have any lights shining directly into the cab and impairing the crane operator's visibility.*

### Add new section

## **10.5 Other Safety Requirements and Protective Measures**

### **10.5.1 Dropped Objects**

Assessment of the crane components for the risk of dropped objects shall be performed in accordance with a recognized code or guideline (e.g. Dropped Object Prevention 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. This requirement ensures that dropped object scenarios are systematically recognized, addressed and mitigated.*

### **10.5.2 Risk Assessment**

If specified, a risk assessment shall be performed in accordance with the principles of EN ISO 12100 for relevant hazards that are not covered by this specification (e.g. sharp edges).

### **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 can be managed. Risk management may also be a regulatory requirement.*

If the risk assessment requires a protective/risk-reduction measure for a control system with safety functions, ISO 13849-1 shall be used to evaluate the safety-related parts of the control system.

### **Justification**

*This requirement addresses the risks in safety-related parts of control systems. The use of ISO 13849-1 as a protective/risk-reduction measure in accordance with ISO 12100 is documented in ISO 22100-2.*

In ISO 13849-1, the minimum required performance level (PL<sub>r</sub>) for safety-related parts of the control system for personnel lifting shall be "d".

NOTE Cranes covered by the scope of API 2C are designed for personnel lifting.

### **Justification**

*This requirement provides a standardized value for minimum PL<sub>r</sub> for cranes designed for personnel lifting.*

## **10.5.3 Failure Mode Effects Analysis (FMEA)**

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

### **Justification**

*An FMEA is performed to understand the crane-specific failure mode effects based on the individual project, operating conditions, etc. This can 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 failures of non-redundant components.

### **Justification**

*FMEA is performed to understand the crane-specific failure mode effects based on the individual project, operating conditions, etc. This can 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.*

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

### **Justification**

*An FMEA is performed to understand the crane-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. The FMEA allows the project to systematically address and prevent catastrophic or critical failures.*

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

### **Justification**

*An FMEA is performed to understand the crane-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. The FMEA allows the project to systematically address and prevent catastrophic or critical failures.*

## **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 prevents 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.*

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

NOTE This requirement is not applicable to surfaces that are not painted such as fiberglass walkways or galvanized steel walkways.

### **Justification**

*Non-skid paint improves safety and prevents injuries to crane operators and personnel from slipping on walkways, platforms, work areas and floors.*

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 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 to the extent that is practical.

NOTE 1 This requirement is not applicable to parts that have been modified by the manufacturer.

### **Justification**

*This requirement ensures that the operator provides the correct spare part.*

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

### **Justification**

*This requirement ensures that the operator provides 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.

NOTE 2 Equipment and components include valves, filters, fittings, bearings, seals and consumables that are in equivalent service.

### **Justification**

*Providing interchangeable parts as far as practicable minimizes spare parts.*

## 12 Design Validation by Testing

### 12.3 Operational Tests

Add to section

Cranes shall undergo an initial factory acceptance test (FAT) prior to delivery.

### **Justification**

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

As specified, the FAT shall be performed on a fully assembled crane or functional sub-assemblies.

### **Justification**

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

Add new section

## 15 Traceability

### 15.1

All components shall be traceable to the OEM's information.

#### *Justification*

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

### 15.2

If the crane manufacturer adds identification details or markings, these identification details or markings shall not interfere with or detract from the OEM'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

## 16 Component Identification System (CIS)

### 16.1 General

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

- manufacturer's CIS (see 16.2);
- integrated manufacturer-purchaser's CIS (see 16.3);
- purchaser's CIS (see 16.4).

#### *Justification*

*There are three CIS (tagging) that are commonly used by operating companies.*

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

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

#### *Justification*

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

The overall crane assembly shall be assigned a project-specific tag number.

### **Justification**

*This prevents multiple equipment tags (e.g. separate tag number for boom, tag number for cab, tag number for pedestal) for one crane. 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 does not follow the CIS as the CIS is used to identify components of the overall crane.*

## **16.2 Manufacturer's Component Identification System (CIS)**

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

### **Justification**

*There are three CIS (tagging) that are commonly used by operating companies. This option allows the manufacturer to use their own internal CIS without any intervention by the purchaser.*

## **16.3 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**

*There are three CISs (tagging) that are commonly used by operating companies. Integrated manufacturer-purchaser's CIS option allows the manufacturer to use their own internal CIS except for the components identified in Table 31 and Table 32.*

Systems and components detailed in Table 31 shall be identified with the purchaser's CIS.

### **Justification**

*There are three CISs (tagging) that are commonly used by operating companies. Integrated manufacturer-purchaser's CIS option allows the manufacturer to use their own internal CIS except for the components identified in Table 31 and Table 32.*

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

### **Justification**

*There are three CISs (tagging) that are commonly used by operating companies. Integrated manufacturer-purchaser's CIS option allows the manufacturer to use their own internal CIS except for the components in Table 31 and Table 32.*

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

Add new Table 31**Table 31—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**

*This table provides the system and typical components that are to be identified by the purchaser's CIS.*

The sub-assemblies detailed in Table 32 shall be assigned a single end-user identification.

**Justification**

*Sub-assembly traceability and ease of identification help 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 as described in Table 31.

**Justification**

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

Add new Table 32**Table 32—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 the slew drive system
Ram-luffing system	One identification for the ram-luffing cylinder system
Knuckle system	One identification for the knuckle cylinder system
Telescoping system	One identification for the telescoping system
Crane cab	One identification for the crane cab
Prime mover	One identification for the prime mover assembly, including gearbox and pumps
Emergency operating system	One identification for the emergency operating system
Pedestal adaptor	One identification for the pedestal adaptor

**Justification**

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

## **16.4 Purchaser's Component Identification System (CIS)**

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

### ***Justification***

*There are three CISs (tagging) that are commonly used by operating companies. The purchaser's CIS 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 manufacturer's specified wire rope information used on the crane.

#### ***Justification***

*As per the commentary in B.5.4.5.1, there can be up to a 300 % variation in the range of wire rope stiffness depending on the wire rope construction and grade. This requirement ensures that the correct nominal properties of the manufacturer's specified wire rope information are used 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 annex 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.*

#### G.2 Design Standard

The hydraulic system shall comply with the international standard ISO 4413 or an equivalent recognized standard.

##### *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 site acceptance test (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

##### G.4.1

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

##### *Justification*

*This requirement reduces preventative and corrective maintenance.*

##### G.4.2

Hydraulic tanks not manufactured from 300 series stainless steel shall be coated internally and externally by a coating that provides corrosion prevention.

### **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 eases 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 Labeling**

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 labeled.

### **Justification**

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

### **G.10.3**

Isolation valves shall be secured in the 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 prevents frequent replacement of components or dismantling and flushing offsite.*

### **G.11.2**

If specified, a 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.*

### **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 used to verify the pre-charge pressure.*

**G.13 Test Points**

**G.13.1**

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

***Justification***

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

**G.13.2**

Test points shall be clearly labeled.

***Justification***

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

**G.14 Cleanliness Testing and Certification**

**G.14.1**

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

***Justification***

*The cleanliness test is an indication that the crane and the filtration system are in good working condition. Some level of contamination is expected in new systems at startup. A cleanliness test prior to the FAT ensures that 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 are in good working condition.*

## Bibliography

### Add to start of Bibliography

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

### Add to Bibliography

- [30] ASCE 7 \*, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*
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\* Cited in IOGP S-618J only.

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