

DEP SPECIFICATION

**OFFSHORE PEDESTAL-MOUNTED CRANES
(AMENDMENTS/SUPPLEMENTS TO API SPEC 2C)**

DEP 37.92.10.30-Gen.

February 2017

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design, procurement, manufacture, testing and inspection of pedestal and king-post mounted cranes on fixed offshore structures and/or floating platform structures used in drilling and production operations.

This DEP is based on API Spec 2C, 7th edition, 2012, Errata 2013. Part III of this DEP amends, supplements, and deletes various clauses of API Spec 2C 7th edition, 2012, Errata 2013. Part III follows the clause numbering of API Spec 2C for easy reference.

All clauses of API Spec 2C 7th edition, 2012, Errata 2013 not modified by this DEP remain valid as written.

This is a revision of the DEP of the same number dated February 2015; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in offshore oil and gas drilling and production facilities. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the certifying authority concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

In API Spec 2C, the term Vendor is used and is equivalent to the term "Manufacturer/Supplier" that is used in this DEP.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

In API Spec 2C, the term Purchaser is used and is equivalent to the term "Contractor" that is used in this DEP.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Certifying Authority	Third party that may be appointed by the Principal to ensure design authenticity, fabrication compliance with this DEP and national/local regulations and that the equipment is fit-for-purpose.
load path	All structural and equipment components or parts inclusive of, and between, hook and pedestal, which provide the reactions to resist forces and moments generated during the operation of the crane.
Primary Steel	Any steel part or member of a critical component that transmits forces or moments and is essential in maintaining the structural integrity or operational safety of the crane
Specific Project Requirements	Requirements to be included in the Specific Project Requirements (SPR) document including requisition sheets DEP 37.92.10.93-Gen., DEP 37.92.10.94-Gen., DEP 37.92.10.95-Gen. and DEP 37.92.10.96-Gen., as applicable to the crane in question. <i>The SPR document has the same number as this DEP but with a project-specific suffix instead of "-Gen." Example: 37.92.10.30 – "Project".</i>
secondary steel	Any steel part or member that is not essential in maintaining the structural integrity or operational safety of the crane

1.3.3 Abbreviations

Term	Definition
CI	crane inclination
CM	crane motion
CTOD	Crack Tip Opening Displacement
Cv	dynamic coefficient
d	rope diameter
Dsh	sheave diameter
FL	factored load
FMA	failure mode assessment
HAZ	Heat-Affected Zone
HFE	Human Factors Engineering
IWRC	independent wire rope core
LAST	Lowest Anticipated Service Temperature
LMIS	load-moment indicator system

Term	Definition
MBL	Minimum Breaking Load
MOC	Management of Change
MT	magnetic particle examination
NDE	Non-destructive examination
OEM	Original Equipment Manufacturer
RT	Radiographic Testing
SPR	Specific Project Requirements
SWLH	Safe Working Load Hook
UT	Ultrasonic Testing

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced in this DEP are listed in (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2015. This is a complete revision and it is not practical to summarise all the main changes here.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

PART II GENERAL**1.1 GENERAL**

1. Part III of this DEP is written as amendments and supplements to API Spec 2C, 7th edition, 2012, Errata 2013.
2. Wherever reference is made to API Spec 2C, it shall be understood to mean API Spec 2C, 7th edition, 2012, Errata 2013 as amended/supplemented by this DEP.
3. For ease of reference, the clause numbering of API Spec 2C has been used throughout Part III of this DEP.
4. Clauses in API Spec 2C, which are not mentioned in this DEP, shall remain valid as written.

1.3 CONFLICTS IN DOCUMENTS

1. For conflicts in documents, the following descending order of precedence shall apply:
 - a. national and local regulations;
 - b. purchase order/contract document;
 - c. SPR document;
 - d. this DEP;
 - e. requisition sheets;
 - f. API Spec 2C.
2. Any conflict between this DEP and other referenced documents shall be referred to the Principal for resolution prior to contract award.

1.4 MANUFACTURER/SUPPLIER PROPOSAL

1. The Manufacturer/Supplier proposal shall address all items requested in this DEP.
2. As part of the proposal, the Manufacturer/Supplier shall complete the SPR, and applicable requisition DEPs, where required (e.g., diesel exhaust emission control, maximum vibration levels, instrument duties).
 - a. All provisional information shall be stated as such.

1.5 MANUFACTURER QUALITY MANAGEMENT SYSTEM

1. The Manufacturer/Supplier quality management system shall comply with and be certified to ISO 9001.
2. The Manufacturer/Supplier shall be authorized to use the API monogram on the cranes and shall provide it as part of the crane name plates.
3. If the Manufacturer/Supplier has standard quality management practices that are more stringent than those specified in this DEP, they shall apply.

PART III AMENDMENTS/SUPPLEMENTS TO API SPEC 2C**1 Scope****1.1 General**

Add the following to this clause:

1. Pedestal-mounted cranes shall be suitable to perform the duties specified by the Principal in this DEP and the SPR, including applicable requisition DEPs.

2 Normative References

Add the following to this section:

1. Documents referenced in this DEP are listed in Part IV.

3.3 Units

Add the following to this clause:

1. Once a system of units has been selected for use, then the Contractor shall consistently use that system throughout the design.

4 Documentation

Add the following to this section:

1. In addition to maintaining the original inspection and testing records, the Manufacturer/Supplier shall furnish to the Principal a complete set of inspection and testing records with the crane Manufacturer/Supplier's data books prior to crane delivery.
2. Additionally, the crane plans and information specified in the applicable regulations (e.g., 46 CFR subpart 107.309 in the USA) shall be furnished to the Principal as they are completed during the design and fabrication phases.

The Principal normally provides the necessary information to regulatory agencies.

5 Loads**5.4 In-service Loads****5.4.1 General****5.4.1.1**

Add the following to this clause:

1. The crane minimum lift capacities and corresponding sea states shall be as specified in the SPR.

5.4.1.4

Replace this clause with the following:

1. For cranes on floating platforms and vessels, the Contractor shall use the "Vessel Specific Method" of establishing crane ratings.
 - a. The details for platform and supply vessel motions shall be as specified in the SPR.
2. For fixed platform cranes the Contractor shall use the "Default Dynamic Method" of establishing crane ratings.

5.4.5 Vertical Factored Loads

5.4.5.2 Offboard Lifts

Add the following to this clause:

1. The main load hoist winch at maximum reeving shall be capable of sustaining a minimum line speed as specified in the SPR with the wire rope operating on the lowest layer of the winch drum.
2. The auxiliary load hoist winch shall be capable of sustaining a minimum line speed of 60 m/min (197 ft/min), regardless of sea state, with a single line configuration and with the wire rope operating on the highest layer of the winch drum.
3. If specified in the SPR, both the main and the auxiliary load winches shall have slow- and high-speed capabilities.
4. The modulus of elasticity and surface area of the wire rope used in stiffness calculations shall be supplied by the wire rope Manufacturer/Supplier.

5.4.6 Horizontal Loads

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

Add the following to this clause:

1. A minimum additional 0.5° off lead and 0.5° side lead shall be added to the crane motions.
 - a. this additional off lead and side lead shall be combined and taken at full value (100% of each) when the crane base angle is 45°.
2. The non-stowed and stowed out of service conditions shall be as specified in the SPR.

5.6 Wind, Ice and Seismic Loads

Add the following to this clause:

1. Environmental loads including wave criteria, wind, ice and seismic loads shall be as specified in the SPR.

6 Structure

6.1 General

Add the following to this clause:

1. The crane shall operate without loss of performance when installed about an axis that is one degree out of true in any direction.
2. All padeyes for offshore handling shall be designed for three times the dead weight of the item being lifted.

6.2 Pedestal, Kingpost, and Crane Supporting Foundation

Add the following to this clause:

1. The crane lateral deflection shall not exceed the unsupported extended length (L) divided by 180 (i.e., L/180) measured from the heel pin of the boom.
 - a. Crane lateral deflection shall not exceed limits specified by the swing bearing Manufacturer/Supplier.
2. The maximum lateral deflection at the boom heel pin shall not exceed 45 mm (1.75 in) noting this deflection is a combination of the pedestal deflection and the support structure deflection for the crane operating loads only.

6.4 Structural Fatigue

Add the following to this clause:

1. Fatigue calculations shall be prepared as described in the first paragraph of (6.4), and also as described herein.
 - a. The crane design shall satisfy both criteria.
2. The pedestal, kingpost and all other critical structural components shall be designed for fatigue based on the following provisions, unless specified otherwise in the SPR:
 - a. the dead weight of the boom and offload and side loads shall be added to the crane vertical factored load (FL) to compute the total cyclical load;

Per API, the FL is defined as the Safe Working Load Hook (SWLH) times the vertical dynamic coefficient (Cv), used for offboard lifts.
 - b. stress ranges shall include the full stress range between tensile and compressive stresses, assuming the crane rotates 180 degrees (i.e., stress range = 2 x nominal stress);
 - c. fatigue life shall be calculated based on the provisions of Table 6.4 dependent on crane usage (i.e., drilling or production);
 - i. the type of crane use shall be as specified in the SPR;
 - d. fatigue life shall be calculated using Miner's Rule for summation of damage due to variable amplitude stress cycles;
 - e. the FLs to be used shall correspond to a 2 m (6.6 ft) significant wave height;
 - f. the number of stress cycles shall be increased, per the SPR, if the crane is to be used for construction and/or commissioning activities;
 - g. the computed fatigue lives for the critical components shall be reported to the Principal with the quotation.

Table 6.4 Fatigue analysis provisions

Crane Use	(a) Field Life (years)	(b) No. of Lifts – Daily Average		(c) = 365 x (a) x (b) No. of Lifts - Total Life		% FL = % Cv x SWLH		(d) Factor of Safety on Fatigue Life	(e) = (a) x (d) Minimum Total Fatigue Life (years)
		Main Hoist	Aux. Hoist	Main Hoist	Aux. Hoist	Main Hoist	Aux. Hoist		
Drilling	50	1.5	60	27,375	1,095,000	50 % of Maximum	50 % @ 45° boom angle	3	150
Production	50	0.5	10	9,125	182,500	50 % of Maximum	50 % @ 45° boom angle	3	150

7 Mechanical

7.2 Critical Rigging Components

7.2.2 Wire Rope

7.2.2.2 Construction

Add the following to this clause:

1. In addition to conforming to API Spec 9A, wire ropes may also be constructed to meet ISO 2408 or another Principal-approved equivalent standard.
2. Load hoist wire ropes shall be low rotational, multi-strand independent wire rope core (IWRC) construction.
3. Load hoist and boom hoist wire supplier shall be approved in accordance with the Principal.
4. Boom hoist wire rope shall be multi-strand IWRC construction.
 - a. All pendant wire ropes for use on cranes in offshore duty shall be drawn galvanised to minimise the effects of saline corrosion.
5. All wire ropes shall be of a size and type of construction readily available from the Manufacturer/Supplier's standard ranges.
 - a. Unique sizes shall not be used.
 - b. Contractor shall provide a fully authenticated and identifiable certificate of test with each wire rope supplied with the crane.

7.2.2.4 Design Factors

7.2.2.4.2 Standing Rigging (Pendant Line Suspension Systems)

Add the following to this clause:

1. The Contractor shall notify the Principal, in the proposal, if a bridle and pendant assembly will be utilized.
 - a. Details of the bridle and pendant assembly suspension system shall be provided.
2. Pendant lines shall not exceed 51 mm (2 in) diameter.
 - a. If additional strength is required, the number of pendant lines is to be increased but the diameter shall not exceed 51 mm (2 in).
3. Pendants shall be as short as practical to minimise fatigue in the live wire rope system.
 - a. If a pendant system is used to facilitate boom length modifications the following shall apply:
 - i. space is to be made available of the boom hoist drum to accommodate these changes;
 - ii. bridle and tip geometry are to allow such changes;
 - iii. gantry sheave cluster and support plate geometry are to also allow such changes.

7.2.2.5 Reeving System Efficiency

Add the following to this clause:

1. Reeving (sheave) efficiencies shall be included when calculating the wire rope breaking strength.
 - a. Load ratings shall not exceed 90% of the SWLH of the wire rope including sheave losses.

7.2.3 Wire Rope End Terminations

Add the following to this clause:

1. All end fittings/terminations design specifications shall be submitted by the Contractor to the Principal.
2. For wire rope end termination, only wedge sockets for running ropes and poured spelter or swaged sockets (by Principal-approved supplier) for pendant lines shall be used (i.e., no U-bolt or eye splice terminations are permitted).
3. A means, such as a work platform, shall be provided to access the boom hoist dead end connection.
4. A means, such as an auxiliary winch, shall be provided to pull slack for release and lowering of the dead end connection to the main crane deck for maintenance, wire change, socket make-up, and all other movements.
5. The dead end on the auxiliary line shall be looped back or terminated so that it does not become entangled in the anti-two block weight.

This can be achieved by means of a loop on the wire or a carpenter's stop above the wedge socket.

7.2.3.3 Wedge Sockets

Add the following to this clause:

1. Wedge socket efficiency shall be no greater than 80% - 90% of the wire rope capacity.
 - a. Spelter socket and swaged-sleeve socket efficiencies may be assumed to be 100%.
 - b. Wire rope ends shall be formed into a loop to prevent the end of the wire rope from snagging on appurtenances such as anti-two block weights.
2. All wedge sockets shall have either socket Original Equipment Manufacturer (OEM) or crane OEM designed bolted connectors with nut and cotter pin assemblies.

7.2.3.4 Termination Efficiency

Add the following to this clause:

1. Tied loop splices, with or without thimbles, shall not be used, as termination efficiency can be below 80%.

7.2.4 Sheaves

7.2.4.1

Add the following to this clause:

1. The Contractor shall provide the sheave material specification in the proposal.

Steel sheaves are preferred in order to increase wire rope life and efficiency.
2. Fleet angles from the farthest wrap on the winch drum to the lead sheave shall be less than 7.2.4.2.

7.2.4.2

Replace this clause with the following:

1. The sheave diameter (Dsh) to wire rope diameter (d) ratio (Dsh/d) shall be at least 20.
 - a. This ratio applies to all sheaves except for boom hoist sheaves which shall have a ratio of at least 28.
 - b. The required ratio shall be specified in the SPR.

7.2.4.11

Add the following to this clause:

1. All grease lubrication points, including sheave bearings that are not directly accessible, shall be equipped with remote grease fittings.
 - a. All sheaves shall be of the roller bearing type in order to minimise sheave losses.

7.2.5 Load Block Assemblies

Add the following to this clause:

1. The Contractor shall notify the Principal, in the proposal, as to the Manufacturer/Supplier, model number, size, weight and number of sheaves for each type of hook block and overhaul ball assembly.
2. Hook blocks and overhaul balls shall be of sufficient weight to prevent unravelling of wire rope on the hoist drum during zero load lowering operations.
3. Hook blocks and overhaul balls shall be sized so that the rope stays on the boom, and spooling on the drum is effective, even during high cross-winds.
4. The Contractor shall verify with the wire rope Manufacturer/Supplier that rotational resistant wire rope is acceptable for use with hook blocks and overhaul balls equipped with a swivel.
5. All hook blocks and overhead balls shall be painted orange with high visibility, reflective paint to improve their visibility at night.
6. The Contractor shall perform nondestructive examination (NDE) to check for cracks on all hook blocks and overhead balls.
 - a. Any surface indications found will require the hook block or the overhead ball to be replaced.
7. On spars, FPSOs, drill ships, or floating vessels with large horizontal accelerations and crane inclinations, hook blocks and overhead balls shall be capable of being "parked" into a boom stop so that they do not swing freely when not in use.

7.2.5.1 Hook Block

Add the following to this clause:

1. The hook block shall be a swivel safety lock type capable of supporting odd part reeving (e.g., three parts of line requires a dead-end on the hook block).

7.2.5.3 Load Block

Add the following to this clause:

1. The lowest design service temperature shall be 0 °C unless specified otherwise in the SPR.

7.2.5.6 Prototype Design Verification

7.2.5.6.1

Replace this clause with the following:

1. The Contractor shall inform the Principal, with the proposal, if the load block being proposed is a prototype.
 - a. If the load block is a prototype, it shall be proof load tested.
 - i. Contractor shall also inform the Principal of the NDE techniques that will be performed subsequent to the proof load test.

7.3 Boom Hoist, Load Hoist, Telescoping, and Folding Boom Mechanism

7.3.1 Hoist

7.3.1.1 General

Add the following to this clause:

1. All hoists shall be fitted with padeyes to assist installation and removal and shall have direct overhead access for installation and removal.

7.3.1.3 Brake Requirements

Add the following to this clause:

1. Brakes shall be fail safe in operation, that is, held off by hydraulic pressure and shall be spring-loaded.
2. All winches shall be equipped with an external auxiliary disc or band brake.
3. The sequencing of the application of the main brake, auxiliary brake and ratchet and pawl shall be designed so that overall winch performance is not adversely affected.
 - a. Pressure traces shall be produced during the load testing to demonstrate the signal to engagement timing of the brakes and other components.

7.3.1.5 Drums

Add the following to this clause:

1. The crane operator shall have either direct sight or a warning indicator to check for rotation of all drums.
 - a. Drums shall be striped black and yellow with high visibility, reflective paint along the flange to detect rotation.
 - b. Lights shall be provided at all drums to help in seeing rotation during night operations.
2. In addition to API minimum flange clearance, keeper plates and/or safety guards shall be provided.

3. The boom hoist drums shall have lebus type grooves, or a Principal-approved equivalent, to facilitate spooling.
 - a. Other hoists (main and auxiliary) may use lebus grooving provided the grooving is allowed for the type of wire rope used (some wire rope Manufacturer/Supplier's do not recommend lebus grooving with rotation-resistant rope).
 - b. The lebus grooving shall be designed for the size, type and brand of wire rope used.
 - i. The grooving shall match the pitch of the wire rope selected.
 - c. Lebus grooving cast into the drum is preferred to lebus grooving shells welded to the exterior of the drum; however both types are acceptable.
4. The boom hoist shall be configured for power lowering and lifting the boom from the maximum operating radius to the minimum operating radius within 150 seconds.
5. For load hoist speed performance, refer to (5.4.5.2).
6. Hoist drum rope anchorages shall be either light tail rope or rope clamp.
 - a. Details of all anchorages shall be in accordance with the Manufacturer/Supplier's recommendations and are subject to approval by the Principal.
7. The break out load shall be established through analysis in the failure mode assessment (FMA).
 - a. The break out load shall be strong enough to hold or resist the SWLH but not stronger than other critical components;
 - b. The clamping system shall be designed so that it is one of the first components to fail.

7.3.1.7 Mounting

Add the following to this clause:

1. The Manufacturer/Supplier shall inform the Principal if the mounted hoist assembly is considered a prototype.
2. If the mounted hoist assembly is considered a prototype, it shall be load/distortion tested.
 - a. The Contractor shall include a description of the NDE techniques that will be performed subsequent to the load/distortion test.
3. Winch surfaces and the adjoining crane mounting surface shall be match-machined so that they do not exceed 75% of the Manufacturer/Supplier's specifications for mounting surface flatness.
 - a. The Contractor shall submit documentation confirming that this has been achieved.