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Petroleum and natural gas industries — Modular drilling rigs for offshore fixed platforms

Industries du pétrole et du gaz naturel — Spécifications pour une foreuse modulaire à bord de plateformes fixes offshore

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

Introduction

This document is applicable to modular drilling rigs on offshore fixed platform. It is intended to provide wide latitude in the design, construction, installation and commissioning of offshore modular drilling rigs on fixed platforms, without hindering innovation. Sound engineering judgment is therefore necessary in the use of this document.

The design of a modular drilling rig includes choices of drilling equipment, layout of modules, system interface, modular structures and so on. The construction of modular drilling rigs includes the assembly of structures, welding and inspection of structures, prefabrication and installation of the piping and cables, outfitting, corrosion control and onshore installation of equipment.

Annex A provides background to, and guidance on, the use of this document, and is intended to be read in conjunction with the main body of this document. The clause numbering in Annex A follows the same structure as that in the body of the normative text in order to facilitate cross-referencing.

Annex B provides a guidance of load and resistance factor design/working stress design method.

Annex C provides a list of typical fabrication design documents of modular drilling rigs.

Annex D provides a typical loadout and seafastening design document.

Annex E provides a typical acceptance report for modular drilling rigs on offshore fixed platform.

Annex F provides a typical completion acceptance document and record for modular drilling rigs on offshore fixed platform.

Annex G provides a typical in-service inspection plan for modular drilling rigs.

Petroleum and natural gas industries — Modular drilling rigs for offshore fixed platforms

1 Scope

This document gives requirements for the design, fabrication, installation, commissioning and integrity management of modular drilling rigs on offshore fixed platforms.

The modular drilling rig includes some or all of the equipment as follows:

— drilling equipment including a derrick/mast and its controls that can be moved by skidding a drilling support structure;

— drilling support equipment which includes support facilities such as power supply/distribution system;

— mud and cement storage, mixing, monitoring and control equipment.

This document is applicable to the modular drilling equipment on offshore structures for the petroleum and natural gas industries, as follows:

— new equipment arranged in a modularized form;

— the equipment contained in several modules, each of which can be lifted and installed on to the platform, however, the equipment may be arranged within the modules as is convenient;

— the modules assembled together offshore for hook up and commissioning;

— intended for long term use on a new fixed offshore structure;

— Intended for temporary use on a number of different offshore platforms.

This document is not applicable to drilling equipment

— installed on mobile offshore units, and

— intended primarily for onshore use.

This document does not apply to those parts and functions of an offshore platform that are not directly related to drilling.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 6807, *Rubber hoses and hose assemblies for rotary drilling and vibration applications — Specification*

ISO 13501, *Petroleum and natural gas industries — Drilling fluids — Processing equipment evaluation*

ISO 13535, *Petroleum and natural gas industries — Drilling and production equipment — Hoisting equipment*

ISO 13626, *Petroleum and natural gas industries — Drilling and production equipment — Drilling and well-servicing structures*

ISO 13702, *Petroleum and natural gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidelines*

ISO 13703, *Petroleum and natural gas industries — Design and installation of piping systems on offshore production platforms*

ISO 14693, *Petroleum and natural gas industries — Drilling and well-servicing equipment*

ISO 15138, *Petroleum and natural gas industries — Offshore production installations — Heating, ventilation and air-conditioning*

ISO 15513, *Cranes — Competency requirements for crane drivers (operators), slingers, signallers and assessors*

ISO 19901-3, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 3: Topsides structure*

ISO 19901-6, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 6: Marine operations*

ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*

IEC 61892-6, *Mobile and fixed offshore units — Electrical installations — Part-6: Installation*

API RP 2FB, *Recommended Practice for the Design of Offshore Facilities Against Fire and Blast Loading*

API RP 14G, *Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms*

API RP 505, *Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2*

API Spec 16A, *Specification for Drill Through Equipment*

API Spec 16D, *Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment*

API Std 53, *Blowout Prevention Equipment Systems for Drilling Wells*

AWS D1.1/D1M, *Structural Welding Code — Steel*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
cementing module
modularized facilities that include cementing pump, mixing device and manifold system, used to provide cementing services

3.2
drilling equipment set
DES
set of equipment that includes derrick/mast, substructure, drawworks, crown block, traveling block, hook, TDS, rotary table, BOP, driller's cabin, drill floor equipment, choke and kill manifold and can also include shale shakers, degasser, desander, desilter, centrifuge, cuttings dryer, pipe handling system and BOP handling system etc., used to implement hoisting and rotating functions during drilling operations

Note 1 to entry: The drilling equipment set is generally movable by means of skid rails such that the centre can be positioned over one of a number of well slots.

3.3
drill floor clearance
clear distance between the bottom of the rotary table support beam and the BOP deck of the platform

3.4
drilling support module
DSM
structure that can include diesel generator set, fuel tank, air compressor and storage tank, sack storage and mud mixing, electric drive and associated control system, mud tank, mud pump and auxiliary equipment, pipe deck area, piping and cable tray used to provide power, circulation and other functions to the drilling rig

3.5
interface
relations between a modular drilling rig and various systems (such as safety, oil, gas, water, electricity, instrumentation, communication, structures, etc.) on the platform

3.6
modular drilling rig
MDR
modularized facilities for drilling from a fixed offshore platform consisting of drilling equipment set, drilling support, P-tank, cementing, well logging, mud logging and other equipment

3.7
monkey board
platform called racking platform located at a distance above drill floor for laterally supporting the upper end of racked downhole tubulars/drill string that also provides a space for derrickman to handle the tubulars/drill string when trip out and in during drilling operation

3.8
mouse hole
opening in the rig floor near the rotary table, in which joints of drill pipe are temporarily placed for later connection to the drill string

Note 1 to entry: The mouse hole is usually fitted underneath with a length of casing, usually with a bottom.

3.9
mud logging module
modularized facilities that include mud logging room, data acquisition system and display terminal, used to provide mud logging services

3.10
powder tank module
P-tank
modularized facilities that include bentonite tank, barite tank, cement tank, weighing equipment, control equipment, and manifold system, used to store powder materials for drilling fluid and cement slurry preparation

3.11
recognized classification society
RCS
member of the International Association of Classification Societies (IACS), with recognized relevant competence and expertise of petroleum and natural gas activities, and with established rules and procedures for classification/certification of installations in the petroleum and natural gas industries

3.12
skid rail
structural steelwork that provides smooth flat surfaces for the drilling equipment set to move in an X-Y planes to allow access over all well slots

Note 1 to entry: The upper skid rail is the slide skid rail of the upper substructure of the drilling rig; the lower skid rail is that of the lower substructure.

3.13
skidding system
equipment that can include the skid rails, skid shoe, fwd/aft skidding claws, skidding cylinders, locking claws, skidding hydraulic power unit (HPU), locking and control unit, used for horizontal movement of the DES, covering the well slot area

Note 1 to entry: Alternative rig skidding systems can be used as well.

3.14
well logging module
modularized facilities that include well logging winch, well logging room, wellhead lubricator and cable, used to provide well logging services

3.15
well slot
opening provided for individual wells that allows a path from the underside of the drilling equipment set to the seabed

Note 1 to entry: In general lateral supports are provided below each well slot from the platform structure through the topsides and through the water column to support the well tubular to withstand environmental forces and prevent excessive stress and displacements.

4 Abbreviated terms

AC	alternating current
APF	active power filter
BOP	blow out preventer
CCTV	closed circuit television
DC	direct current
DES	drilling equipment set
DSM	drilling support module
EEBA	emergency escape breathing apparatus
EER	evacuation, escape and rescue
ESD	emergency shut down
FES	fire and explosion strategy

GA	general alarm
HAZID	hazard identification
HAZOP	hazard and operability
HPU	hydraulic power unit
HVAC	heating, ventilation and air conditioning
IBOP	internal blow out preventer
LAN	local area network
LRFD	load and resistance factor design
LPG	liquefied petroleum gas
MC	mechanical completion
MCR	mechanical completion records
MCT	multi-cable cabin transit
RCS	recognized classification society
MDR	modular drilling rig
MT	magnetic particle testing
NDT	non-destructive testing
P-tank	powder tank
PA	public address
P&ID	piping and instrumentation diagram
PLC	programmable logic controller
PPE	personal protective equipment
PT	penetrant flaw testing
RT	radiographic testing
SCBA	self-contained breathing apparatus
SWL	safe working load
TDS	top drive system
UPS	uninterruptable power supply
UT	ultrasonic testing
VSD	variable speed drive

WPS welding procedure specification

WPQR welder performance qualification record

WSD working stress design

5 Overall considerations

5.1 General

A modular drilling rig is essentially a device to safely and efficiently drill a well through the geological formation under an offshore installation; the central piece of the equipment is a derrick/mast and rotary system to handle and rotate a drill string and well tubular. A modular drilling rig generally includes drilling equipment such as derrick/mast and substructure; support equipment such as mud, cement and chemical storage, mixing, monitoring and control and power generation set (if equipped). The derrick/mast with its ancillaries and controls on drill floor can be moved on drilling support structure or by skidding the drilling support structure on skid rails to cover all well slots on platform.

A modular drilling rig is grouped in a number of modules to allow the equipment to be lifted into place on a platform; the allocation of the equipment between modules depends on the functionality of the equipment and the limitations envisaged for the offshore installation.

Design conditions include all operating requirements, temporary operating conditions, environmental conditions as well as accidental and abnormal operating conditions. Sufficient planning shall be undertaken before starting detailed design to ensure a safe, functional and economic layout of equipment throughout the modular drilling rig.

5.2 Functional equipment

5.2.1 Hoisting system

A hoisting system can include equipment such as derrick/mast, deadline anchor, crown block, travelling block, hook and drawworks to handle pipe in and out of the well. Pipe handling system should also be considered.

The hydraulic or rack and pinion hoisting rigs may also be used.

5.2.2 Rotary system

A rotary system includes equipment such as top drive, rotary table (swivel and kelly, if equipped) to rotate pipe.

5.2.3 Circulation and solids control systems

A circulation system includes equipment such as mud pump, mud pit, mud piping, charging pump, transfer pump and mixing pump. The circulation system provides performance control of drilling fluid and pressure control within the well to prevent uncontrolled fluid flow.

A solids control system includes equipment such as shale shaker, degasser, desander, desilter, centrifuge, cuttings disposal system. The solids control system is provided to separate the drilling debris (cuttings) from the drilling fluid such that the fluid can be re-circulated and the drill cuttings disposed of.

5.2.4 Power and electrical systems

The power system can include equipment such as main generator set, the emergency generator set and transformer. A modular drilling rig is powered normally by dedicated generator sets or supplied by the main platform power.

The electrical system includes equipment such as distribution system (consisting of switchboards, transformers, lighting distribution boards, DC drivers or VSDs, emergency power supply, UPS, batteries and lighting equipment).

5.2.5 Well control system

The well control system includes equipment such as a diverter and diverter control unit, BOP stack and its adapter/spacer, BOP pressure test device, choke and kill manifolds, BOP control unit, mud/gas separator and vent system.

5.2.6 BOP handling system

The BOP handling equipment includes BOP storage, skidding and hoisting equipment.

5.2.7 Cementing system

The cementing system, if equipped, includes equipment such as a cementing pump skid (diesel engine, torque converter and cementing pump), cementing manifold, cement surge tank, cement mixing unit and metering unit.

5.2.8 Pipe handling system

The pipe handling system, if equipped, includes equipment inside the derrick/mast (such as monkey board), on the drill floor (such as string make-up/break-out devices, mouse hole, guiding equipment) and ramp as well as pipe conveying, moving and hoisting equipment in the pipe rack area. The pipe handling equipment with suitable anti-clash protection can be configured to be automatically operated locally or remotely.

5.2.9 Instrument communication system

The instrument communication system includes equipment such as drilling instrument, television monitoring and intercom system, broadcasting system, emergency shutdown system (including fire and gas system) and LAN.

5.2.10 Auxiliary system

The auxiliary system includes equipment such as safety related equipment, hydraulic system, compressed air system, P-tank, HVAC, steam boiler system, oil and water (such as fresh, drill and seawater, fire-fighting water) supply system.

5.3 Layout

5.3.1 General

The following factors shall be considered in the determination of the deck size when an MDR is arranged on the platform:

a) number and arrangement of well slots;

b) safety, fire control, personnel escape and lifesaving;

c) demands of drilling operation;

d) maintenance of drilling equipment;

e) platform azimuth and supply vessel berthing direction and position;

f) platform crane position and capacity, flare direction and position.