SLOVENSKI STANDARD
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Petroleum and natural gas industries - Drilling and production equipment - Offshore conductor design, setting depth, and installation (ISO/DIS 3421:2021)

Erdöl- und Erdgasindustrie - Bohr- und Förderausrüstung - Offshore-Leiterauslegung, Setztiefe und Einbau (ISO/DIS 3421:2021)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 of 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 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*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is applicable to conductors utilized by the offshore petroleum and natural gas industries. It provides requirements and guidance on the design, setting depth, and installation of offshore conductors, without hindering innovation. Sound engineering judgment is necessary in the use of this document.

Conductor design addresses actions and action combinations, strength and stability checks, and fatigue analysis. Setting depth provides calculation methodologies for different installation methods. Installation addresses selection of the installation method, and of procedures and operation parameters.

Annex A provides calculation methods for fracture pressure of seabed soil.

Annex B provides calculation methods for ultimate bearing capacity of seabed soil.

Annex C provides a means to optimize platform conductor installation sequence when driving considering pile group effect.

Annex D provides a method for determining the bit stick-out when jetting.

Petroleum and natural gas industries – Drilling and production equipment – Offshore conductor design, setting depth, and installation

1 Scope

This document gives requirements for the design, setting depth and installation of conductors used by the offshore petroleum and natural gas industries. This document covers:

— design of the conductor, i.e. determination of the diameter, wall thickness, and steel grade;

— determination of the setting depth for three installation methods, namely, driving, drilling/cementing, and jetting;

— installation requirements for the installation methods, i.e. selection principles, operating procedures and parameters.

This document is applicable to:

— Platform conductors: installed through a guide hole in the platform drill floor and then through guides attached to the jacket at appropriate intervals through the water column to support the conductor withstand metocean actions and prevent excessive displacements.

— Jack-up supported conductors: a temporary conductor used only during drilling operations, which is installed by a jack-up drilling rig. In some cases, the conductor is tensioned by tensioners attached to the drilling rig.

— Free-standing conductors: a self-supporting caisson in cantilever mode installed in shallow water, typically depths of about 10 m to 20 m. It provides sole support for the well and sometimes supports a small access deck and boat landing.

— Subsea wellhead conductors: a fully submerged conductor extending only a few metres above the seafloor.

This document does not apply to drilling risers.

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 19900, *Petroleum and natural gas industries — General requirements for offshore structures*

ISO 19901-1, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Metocean design and operating considerations*

ISO 19901-4, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 4: Geotechnical and foundation design considerations*

ISO 19901-8, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 8: Marine soil investigations*

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

API RP 16Q, *Design, Selection, Operation, and Maintenance of Marine Drilling Riser Systems*

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:

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

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

3.1
bearing capacity
capacity of conductor to resist vertical action effects without soil failure

Note 1 to entry: Bearing capacity can be divided into initial bearing capacity, real-time bearing capacity and ultimate bearing capacity, based on the interaction time between the conductor and the soil. Initial bearing capacity refers to the capacity immediately after installation; real-time bearing capacity refers to the capacity after a period of time; and ultimate bearing capacity refers to the capacity when the soil recovers its strength before disturbance.

3.2
conductor
outermost casing and foundation of offshore oil and gas well

3.3
design situation
set of physical conditions for which the *conductor* (3.2) is verified

Note 1 to entry: The design situations typically addressed are operational design situations that occur during installation and normal use of the conductor, and extreme design situations that occur rarely during the use of the conductor. Extreme design situations include survival conditions, e.g. the emergency capping condition for a subsea wellhead conductor.

3.4
effective weight
weight in sea water or drilling fluid

3.5
metocean action
effect of wind, wave and current on a conductor

Note 1 to entry: The determination of these effects includes the influence of marine growth, tide, surge, and related processes, as appropriate.

3.6
seabed
materials below the seafloor, whether of soil such as sand, silt or clay, cemented materials or of rock

[SOURCE: ISO 19901-4:2016, 3.15]

3.7
seafloor
interface between the sea and the seabed

[SOURCE: ISO 19901-4:2016, 3.16]

3.8
setting depth
depth-into-seabedvertical depth from the seafloor to the conductor shoe

Note 1 to entry: A minimum setting depth is set to provide sufficient bearing capacity to ensure formation integrity at the conductor shoe during the surface drilling phase.

3.9
undrained shear strength
maximum shear strength in the undrained condition

4 Abbreviated terms and symbols

4.1 Abbreviated terms

APB annulus pressure build-up

BHA bottom hole assembly

BOP blowout preventer

WOB weight on bit

WOC wait on cement

4.2 Symbols for conductor design

A cross-sectional area of the conductor

C_m moment reduction factor

D outer diameter of the conductor

D_R a non-dimensional number

E Young's modulus of elasticity

E_e extreme quasi-static metocean action due to wind, waves and current

E_o metocean action due to owner defined operating wind, wave and current parameters

F_d factored design actions

f_b representative bending strength

f_c representative axial compressive strength

f_e Euler buckling strength

f_v representative shear strength

f_y representative yield strength

G permanent action

I moment of inertia of the conductor's cross-section

K effective length factor

K_{LE} local experience factor

L unbraced length of the conductor

L_f calculated fatigue life

M maximum bending moment on the cross-section due to factored actions

N_i number of cycles to failure under constant amplitude stress range

n_i number of cycles of stress range

Q_{th} thermal annulus pressure build-up (APB) action

r conductor's radius of gyration

T time period over which Palmgren-Miner's sum was determined

t wall thickness of the conductor

U_m utilization of the conductor

V shear due to factored actions

Z_e elastic section modulus

Z_p plastic section modulus

σ_b bending stress due to forces from factored actions

σ_c axial compressive stress due to forces from factored actions

τ_b shear stress due to forces from factored actions

γ_G partial action factor for permanent actions

γ_f partial action factor of which the value reflects the uncertainty or randomness of the action (in accordance with ISO 19900)

γ_{FD} a fatigue damage design factor

$\gamma_{R,b}$ partial resistance factor for bending strength

$\gamma_{R,c}$ partial resistance factor for axial compressive strength

$\gamma_{R,v}$ partial resistance factor for shear strength

4.3 Symbols for setting depth

A_s the side surface area of the conductor in soil

D outer diameter of the conductor

d_{mud} surface section drilling fluid (mud) density

F_{s1}, F_{s2} partial safety factors

F_{xial} axial force in the conductor

F_{xsur} axial force applied to the conductor during the surface casing installation stage

F'_{xsur} axial force applied to the conductor after the surface casing cementing

F_{xBOP} axial force applied to the conductor during the BOP installation stage

F_{xst} axial force applied to the conductor during the subsequent casings and tubing installation stage

F_{xwt} axial force applied to the conductor in the wellhead and christmas tree installation stage

F_{xcap}	axial force applied to the conductor in the extreme design situation
$f(z)$	unit skin friction
G_{con}	conductor effective self-weight
g	acceleration of gravity
H	setting depth for a jetted conductor
h_{min}	minimum setting depth of the conductor meeting the circulation channel function
K_{con}	axial stiffness of the conductor
K_{cs}	axial stiffness of the coupled foundation composed of the surface casing and the conductor
K_{sys}	stiffness of the wellbore coupled system composed of all casings and conductor
L_a	length of conductor above the seafloor
N_{load}	axial force applied to a jetted conductor
P_f	soil fracture pressure at the conductor shoe
P_l	annular pressure loss of drilling fluid
P_{mud}	drilling fluid circulation pressure at the conductor shoe during surface section drilling
Q	axial bearing capacity for a driven or drilled conductor
Q_f	skin friction resistance for a driven or drilled conductor
Q_t	real-time bearing capacity for the conductor after jetting
Q_0	initial bearing capacity right after jetting
Q_{setup}	real-time recovery bearing capacity for a jetted conductor
R	design safety factor of conductor bearing capacity
S	utilization rate of WOB
Su_{ave}	mean soil undrained shear strength within the setting depth range
W_{BHA}	effective weight of the jetting BHA
W_{BOP}	effective weight of BOP
W_{cap}	effective weight of capping equipment
W_{con}	effective weight of the conductor
W_{land}	effective weight of surface casing in cementing condition
W_{RT}	effective weight of running tool
W_{sur}	effective weight of the surface casing applied on conductor during cementing
W_{squ}	effective weight of subsequent casings after cementing
W_{tub}	effective weight of tubing