INTERNATIONAL STANDARD

**ISO 19905-1**

Third edition
2023-10

# Oil and gas industries including lower carbon energy — Site-specific assessment of mobile offshore units —

## Part 1: **Jack-ups: elevated at a site**

*Industries du pétrole et du gaz, y compris les énergies à faible teneur en carbone — Évaluation spécifique du site d'unités mobiles en mer —*

*Partie 1: Plateformes auto-élévatrices : Surélévées sur un site*



Reference number
ISO 19905-1:2023(E)

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).



Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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, *Oil and gas industries including lower carbon energy*, Subcommittee SC 7, *Offshore structures,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 19905-1:2016), which has been technically revised.

The main changes are as follows:

- updates regarding operations in arctic areas in: Scope, 5.1.4, Figure 5.2-1, 6.7, 7.2, 7.6, 7.8, 10.8, Table 10.3-1 and A.10.8, and added 8.8.9;
- need for Classification revised in Scope and expanded in 5.1.7;
- Clause 3 updated to align with 19900 and other sources. Further definitions added;
- added definitions of symbols for undrained shear strength in 4.1.2;
- added definitions of symbols for horizontal and moment capacity coefficients and cyclic degradation factors in 4.1.5;
- interaction with SSA-I explained in 5.1;

 

- exposure levels (in 5.5) revised to align with ISO 19900:2019;
- requirements and information on earthquake response analysis gathered in 10.7 and A.10.7 respectively and referenced from 8.6, 8.7, 8.8, A.8.6.3, A.8.7;
- 9.3, A.9.3.1.2, A.9.3.3.1 and A.9.4.1 expanded to include foundation capacities and stiffnesses based on strength parameters rather than applied preload. Clause E.4 added to address the former;
- clarifications of Step 2 foundation checks in 9.3.6;
- 9.4.6 on cyclic mobility expanded to address liquefaction and liquefaction-induced lateral flow and A.9.4.6 expanded accordingly;
- earthquake analysis requirements (in 10.7) revised; reference to 5.5.5 added and text moved from other clauses inserted;
- minor update to alternative analysis methods (see 10.10, formerly 10.9);
- minor clarifications in 13.2;
- clarified that the $H_{max}$ to $H_{srp}$ relationships in A.6.4.2.2 are defaults in the absence of site-specific data; the application of kinematics reduction in A.6.4.2.3 is no longer by means of wave height reduction;
- most probable peak enhancement factor in A.6.4.2.7 now given as a range;
- default current profile in A.6.4.3 revised;
- alternative wind profiles now permitted in A.6.4.6.2;
- added references to ISO 19901-10 and ISO 19901-8 in A.6.5.1.1;
- added reference to liquefaction-induced lateral flows in Table A.6.5-1;
- the requirements for the geotechnical report in A.6.5.1.5.3 have been revised and expanded especially in respect of shear strength;
- penetration in clays in A.9.3.2.2 updated to address strain rate dependency and strain softening;
- squeezing of clay in A.9.3.2.6.2 revised;
- punch-through for sand overlying clay in A.9.3.2.6.4 clarified and formula revised;
- major updates to the ultimate vertical/horizontal/rotational capacity interaction function and parameters in A.9.3.3.2 for spudcans in sand and clay due to the inclusion of further soil profiles in clay and an approach for including the effects of cyclic loading on foundation capacities;
- the effect of cyclic loading on the yield surface has been added in A.9.3.3.7; incorporates text that was in A.9.3.4.2.2;
- revised guidance on the selection of shear modulus for clay in A.9.3.4;
- Step 2a foundation capacity and sliding checks in A.9.3.6.4 revised and the figures corrected;
- guidance on Cyclic mobility in A.9.4.6 significantly expanded, and this clause now also addresses liquefaction and liquefaction-induced lateral flow;

- guidance on structural and foundation modelling expanded in A.10.7.3.2 with particular reference to modelling for earthquake response analysis;
- guidance on ice added in A.10.8;
- guidance in A.12.2.3.2 on non-circular prismatic member classification and in A.12.2.3.3 on reinforced components clarified in respect of slender components;
- sketch in Table 12.3-1 b) corrected;
- clarifications in Table A.12.4-1 and correction to formula in Figure A.12.4-1;
- guidance on strength of tubular members in A.12.5 updated to align with ISO 19902:2020 (combined axial and bending loading in A.12.5.3 of cosine interaction form instead of previous form using linear interaction) and simplified combined axial, bending, beam shear and torsion checks have been added;
- clarified calculation for $e$ in A.12.6.2.3 on axial compressive local strength check;
- clarified $F_y$ in A.12.6.2.5.4 on Class 4 slender-section bending moment strength;
- beam shear area formulations for chord cross sections updated in A.12.6.3.4;
- Table B-2: revised partial resistance factor for horizontal foundation capacity for total stress (clay/undrained) and added partial resistance factors for vertical-horizontal foundation bearing capacity when considering material factored representative soil strength and for calculated foundation capacities.
- corrections to formulae in Figure C.2.4-1, "The drag-inertia method including DAF scaling factor";
- Figure E.1-1 corrected;
- Figure E.3-1 b) corrected;
- added Clause E.4 on calculated foundation capacities approach;
- added Clause E.5 providing an example of a simplified free-field liquefaction assessment calculation method;
- Norway regional requirements in H.2 updated. H.2.2 Regulatory framework and H.2.4 Technical commentary deleted. Added new H.2.3 Technical requirements for jack-up rigs operating close to a permanent occupied installation.
- US Gulf of Mexico requirements (H.3) metocean data replaced by reference to hurricane data from API RP-2MET, 2019. General updates. Unoccupied post-evacuation case expanded.



A list of all parts in the ISO 19905 series can be found on the ISO website.

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 one of the International Standards on offshore structures prepared by TC 67/SC 7 (i.e. ISO 19900, the ISO 19901 series, ISO 19902, ISO 19903, ISO 19904-1, the ISO 19905 series and ISO 19906).

NOTE 1 These are sometimes incorrectly referred to as the ISO 19900 series on offshore structures.

The International Standards on offshore structures prepared by TC 67/SC 7 address design requirements and assessments for all offshore structures used by the petroleum and natural gas industries worldwide. Through their application, the intention is to achieve reliability levels appropriate for attended and unattended offshore structures, regardless of the type of structure and the nature or combination of the materials used.

It is important to recognize that structural integrity is an overall concept comprising models for describing actions, structural analyses, design or assessment rules, safety elements, workmanship, quality control procedures and national requirements, all of which are mutually dependent. The modification of one aspect of design or assessment in isolation can disturb the balance of reliability inherent in the overall concept or structural system. The implications involved in modifications, therefore, must be considered in relation to the overall reliability of all offshore structural systems.



The International Standards on offshore structures prepared by TC 67/SC 7 are intended to provide wide latitude in the choice of structural configurations, materials and techniques without hindering innovation. Sound engineering judgment is, therefore, necessary in the use of these documents.

This document, which has been developed from the Society of Naval Architects and Marine Engineers (SNAME) Technical & Research Bulletin 5-5A (2002)[170], states the general principles and basic requirements for the site-specific assessment of mobile jack-ups; it is intended to be used for site-specific assessment and not for jack-up design.



NOTE 2 For the exposure level 1 (L1) assessment and, where appropriate, the exposure level 2 (L2) assessment prior to evacuation being effected, this document requires the use of 50 year independent or 100 year joint probability metocean extremes, together with associated partial action factors. It is based on extensive benchmarking and best practice in the international community.

Site-specific assessment is normally carried out when it is intended to install an existing jack-up unit at a specific site. The assessment is not intended to provide a full evaluation of the jack-up; it assumes that aspects not addressed herein have been addressed using other practices and standards at the design stage. In some instances, the original design of all or part of the structure could be in accordance with other International Standards on offshore structures prepared by TC 67/SC 7, and in some cases, different practices or standards could have been applied.

The purpose of the site assessment is to demonstrate the adequacy of the jack-up and its foundations for the assessment situations and defined limit states, taking into account the consequences of failure. It is important that the results of a site-specific assessment be appropriately recorded and communicated to those persons required to know or act on the conclusions and recommendations. Alternative approaches to the site-specific assessment can be used, provided that they have been shown to give a level of structural reliability equivalent, or superior, to that implicit in this document.

Annex A provides background to and guidance on the use of this document. The clause numbering in Annex A is the same as in the main text in order to facilitate cross-referencing. ISO/TR 19905-2 provides additional background to some clauses and a detailed sample 'go-by' calculation.

NOTE 3 ISO/TR 19905-2:2012 is based on ISO 19905-1:2012. The second ediiton of ISO/TR 19905-2 will be based on this document.

Annex B summarizes the partial factors. Supplementary information is presented in Annexes C to G. Annex H presents regional information.

NOTE 4 The site-specific assessment (SSA) of a jack-up normally comprises the two parts: an elevated SSA (SSA-E), addressed in this document, and an installation and removal SSA (SSA-I), which is planned to be addressed in an International Standard as part of the ISO 19905 series.

In this document, the following verbal forms are used:

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “can” indicates a possibility or a capability;

— “may” indicates a permission.

# Oil and gas industries including lower carbon energy — Site-specific assessment of mobile offshore units —

# Part 1: Jack-ups: elevated at a site

## 1 Scope

This document specifies requirements and provides recommendation and guidance for the elevated site-specific assessment (SSA-E) of independent leg jack-up units for use in the petroleum and natural gas industries. It addresses:

a) occupied non-evacuated, occupied evacuated and unoccupied jack-ups;

b) the installed (or elevated) phase at a specific site.

It also addresses the requirement that the as-installed condition matches the assumptions used in the assessment.



This document does not address the site-specific assessment of installation and removal (SSA-I).

To ensure acceptable reliability, the provisions of this document form an integrated approach, which is used in its entirety for the site-specific assessment of a jack-up.

When assessing a jack-up operating in regions subject to sea ice and icebergs, it is intended that the assessor supplements the provisions of this document with the relevant provisions relating to ice actions contained in ISO 19906 and procedures for ice management contained in ISO 35104. This document does not address design, transit to and from site, or installation and removal from site.

This document is applicable only to independent leg mobile jack-up units that are structurally sound and adequately maintained, which is normally demonstrated through holding a valid recognized classification society, classification certificate. Jack-ups that do not hold a valid recognized classification society certificate are assessed according to the provisions of ISO 19902, supplemented by methodologies from this document, where applicable.

NOTE 1 Well conductors can be a safety-critical element for jack-up operations. However, the integrity of well conductors is not part of the site-specific assessment process for jack-ups and is, therefore, not addressed in this document. See A.1 for guidance on this topic.

NOTE 2 RCS rules and the IMO MODU code (International Maritime Organisation Mobile Offshore Drilling Unit code) provide guidance for the design of jack-ups.

## 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 19900:2019, *Petroleum and natural gas industries — General requirements for offshore structures*

 

ISO 19901-1:2015, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Metocean design and operating conditions*

ISO 19901-2, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 2: Seismic design procedures and criteria*

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

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

ISO 19906:2019, *Petroleum and natural gas industries — Arctic offshore structures*

ISO 35104, *Petroleum and natural gas industries — Arctic operations — Ice management*

ISO 35106, *Petroleum and natural gas industries — Arctic operations — Metocean, ice, and seabed data*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19901-2, ISO 19901-4, ISO 19906 and the following apply.

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

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

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



**3.1**
**abnormal environmental event**
environmental *hazardous event* (3.31) having probability of occurrence not greater than $10^{-3}$ per annum (1 in 1 000 years)

[SOURCE: ISO 19900:2019, 3.1]



**3.2**
**abnormal wave crest**
wave crest with probability of typically $10^{-3}$ to $10^{-4}$ per annum

**3.3**
**accidental event**
non-environmental *hazardous event* (3.31) having probability of occurrence not greater than $10^{-3}$ per annum (1 in 1 000 years)

Note 1 to entry: Accidental events, as referred to in this document, are associated with a substantial release of energy, such as vessel collisions, fires, and explosions.

Note 2 to entry: Lesser accidents that could be expected during the life of the structure, such as dropped objects and low energy vessel impact, are termed incidents and are addressed under operational design situations.

[SOURCE: ISO 19900:2019, 3.2]

**3.4**
**action**
external load applied to the *jack-up* (3.36) (direct action) or an imposed deformation or acceleration (indirect action)

EXAMPLE An imposed deformation can be caused by fabrication tolerances, differential settlement, temperature change or moisture variation. An imposed acceleration can be caused by an earthquake.

 