SLOVENSKI STANDARD
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Naftna in plinska industrija, vključno z nizkoogljično energijo - Posebne zahteve za naftne ploščadi - 7. del: Sistemi za vzdrževanje postaj na plavajočih strukturah in premičnih enotah (ISO/DIS 19901-7:2024)

Oil and gas industries including lower carbon energy - Specific requirements for offshore structures - Part 7: Station-keeping systems for floating offshore structures and mobile offshore units (ISO/DIS 19901-7:2024)

Erdöl- und Erdgasindustrie - Spezielle Anforderungen an Offshore-Bauwerke - Teil 7: Positions-Erhaltungssysteme für schwimmende Offshore-Bauwerke und mobile Offshore-Einheiten (ISO/DIS 19901-7:2024)

Industries du pétrole et du gaz, y compris les énergies à faible teneur en carbone - Exigences spécifiques relatives aux structures en mer - Partie 7: Systèmes de maintien en position des structures en mer flottantes et des unités mobiles en mer (ISO/DIS 19901-7:2024)

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ISO/DIS 19901-7

Oil and gas industries including lower carbon energy — Specific requirements for offshore structures —

Part 7: Station-keeping systems for floating offshore structures and mobile offshore units

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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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This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy, Subcommittee SC 7, Offshore structures.*

This third edition cancels and replaces the second edition (ISO 19901-7:2013), which has been technically revised.

The main changes are as follows:

— Reorganisation of the table of contents for a more logical flow of requirements from material and equipment selection, site survey, design considerations, criteria and associated analysis methods to integrity management during station-keeping system installation and along the system service life.

— Addition of requirements for a formal mooring integrity management system;

— Emphasis on Operator performance standard expectations definition;

— Inclusion of fibre ropes as a standard material such as chain and steel wire ropes;

— Extensive transfer of information material into the informative Annex A;

— Deletion of informative sections related to geotechnical design of anchors to incorporate the same in 19901-4;

— Inclusion of OPB fatigue guidance and Squall design cases guidance;

— Some minor corrections.

A list of all parts in the ISO series 19901 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

The series of International Standards applicable to offshore structures, ISO 19900 to ISO 19906, constitutes a common basis covering those aspects that address design requirements and assessments of offshore structures used by the petroleum, petrochemical and natural gas industries worldwide. The intention in their application is to achieve reliability levels appropriate for manned and unmanned offshore structures, irrespective type of structure and the nature or combination of materials used.

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

The series of International Standards applicable to types of offshore structures are intended to provide a wide breadth of choice for structural configurations, materials and techniques without hindering innovation. Informed engineering judgement is therefore necessary in the use of these International Standards.

This part of ISO 19901 was developed in response to the worldwide offshore industry's demand for a coherent and consistent definition of methodologies to analyse, design and evaluate station-keeping systems used for floating production and/or storage platforms of various types (e.g. semi-submersibles, spar platforms, ship-shaped structures) and to assess site-specific applications of mobile offshore units (such as mobile offshore drilling units and flotels) and construction units (such as heavy lift vessels and pipelay units).

For permanent production systems operating procedures for station-keeping systems assume as a minimum the ability to shut-in wells and the facility in case of emergency (e.g., emergency shut-down valves on the seabed), otherwise the consequence of mooring failure could be significantly different.

Station-keeping is a generic term covering systems for keeping a floating structure, which is under the constant influence of external actions, at a pre-defined location and/or heading with limited excursions. Station-keeping systems resist external actions by means of any of the following:

— mooring systems (e.g., spread moorings or single point moorings),

— dynamic positioning systems (generally consisting of thrusters), and

— a combination of mooring system and thrusters (thruster assisted moorings).

The external actions generally consist of wind, wave, current and ice actions on the floating structure, mooring and/or risers.

Some background to, and guidance on, the use of this part of ISO 19901 is provided in informative Annex A. The clause numbering in Annex A is the same as in the normative text to facilitate cross-referencing.

Regional information, where available, is provided in informative Annex B.

Oil and gas industries including lower carbon energy — Specific requirements for offshore structures —

Part 7: Station-keeping systems for floating offshore structures and mobile offshore units

1 Scope

This part of ISO 19901 specifies methodologies for:

a) the design, analysis and evaluation of station-keeping systems for floating structures used by the oil and gas industries to support any combination of:

   1) production,

   2) storage,

   3) offloading,

   4) drilling and well intervention.

b) the assessment of station-keeping systems for site-specific applications of mobile offshore units and construction units.

Most station-keeping systems used with the class of floating structures covered by a) are termed “permanent mooring systems”, for which this part of ISO 19901 is applicable to all aspects of the life cycle and includes requirements relating to the manufacture of mooring components, as well as considerations for in-service inspections. Most station-keeping systems used with mobile offshore units, the class covered by b), are termed “mobile mooring systems”. Throughout this part of ISO 19901, the term “floating structure”, sometimes shortened to “structure”, is used as a generic term to indicate any member of the two classes, a) and b).

This part of ISO 19901 is applicable to the following types of station-keeping systems, which are either covered directly in this part of ISO 19901 or through reference to other guidelines:

i) spread moorings,

ii) single point moorings

iii) dynamic positioning systems,

iv) thruster-assisted moorings.

This part of ISO 19901 is not applicable to:

— station keeping systems which do not have redundancy against failure of any single component (e.g., single anchor leg moorings (SALMs)),

— station keeping systems which use any means other than mooring lines or thrusters such as tower soft yoke systems, or tension leg platforms (TLPs) that are using tendons.

The requirements for this part of ISO 19901 address spread mooring systems and single point mooring systems with mooring lines composed of steel chain, steel wire or synthetic fibre rope.

Descriptions of characteristics and typical components found in these systems are given in Annex A.

This document includes requirements relating to the selection of mooring components, mooring system configuration and performance, components design, installation, post-installation survey, and as-installed assessments as needed for mooring integrity management.

The procedures for the design of permanent or site assessment of mobile mooring systems specified in this document are based on a deterministic approach where mooring system responses (such as line tensions, vessel offsets, and anchor loads) are evaluated for a design environment defined by an annual probability of exceedance or return period. Mooring system responses are then checked against acceptance criteria for mooring strength, offsets and orientation, clearances, anchor capacity, fatigue resistance, etc. The minimum acceptance criteria are either defined in this document or are to be specified by the Operator.

NOTE 1 Station-keeping systems designed based on this deterministic approach might have differing levels of reliability.

For moored structures (vessels), system responses are calculated and compared to minimum acceptance criteria for:

— **Ultimate limit states** (ULS)**:** Mooring component strength. Vessel offset, orientation, and clearance constraints. Herein the ULS includes both intact and single failure condition for station-keeping systems.

— **Serviceability limit states** (SLS): Vessel offset, orientation, and clearance constraints. For mooring components this includes clearances with the vessel, risers, umbilicals, seabed, water surface, field infrastructure, exclusion zones, etc.

— **Fatigue limit states** (FLS) **:** Cumulative mooring component fatigue damage.

— **Accidental limit state** (ALS): no criteria are given for accidental or abnormal limit state which are left to owner decision or local Authorities requirements.

The methodology described in this part of ISO 19901 identifies a set of coherent analysis techniques that, combined with an understanding of the site-specific metocean conditions, the characteristics of the floating structure under consideration, and other factors, can be used to determine the adequacy of the station-keeping system to meet the functional requirements of this document.

NOTE 2 For moorings deployed in ice-prone environments, additional requirements are given in ISO 19906 subclause 13.7.

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 9089, *Marine structures — Mobile offshore units — Mooring positioning windlasses and winches*

ISO 18692-1:2018, *Fibre ropes for offshore stationkeeping — Part 1: General specification*

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 19901-3, *Oil and gas industries including lower carbon energy — Specific requirements for offshore structures — Part 3: Topsides structure*

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

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

ISO 19901-8, *Oil and gas industries including lower carbon energy — Offshore structures — Part 8: Marine soil investigations*

ISO 19901-9, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 9: Structural integrity management*

ISO 19905-3, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 3: Floating units*

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

ISO 20438, *Ships and marine technology — Offshore mooring chains*

IACS UR W22, *Offshore Mooring Chains*

API RP 2MET, *"Derivation of Metocean Design and Operating Conditions" Second Edition – January 2021*

API RP 2I, *"In-service Inspection of Mooring Hardware for Floating Structures", 3rd Edition, 2007*

API RP 2MIM, *"Mooring Integrity Management", 1st Edition, September 2019*

API RP 2SK, *"Design and Analysis of Station-keeping Systems for Floating Structures" Fourth Edition – July 2024*

API RP 2SM, *"Recommended Practice for Design, Manufacture, Installation, and Maintenance of Synthetic Fiber Ropes for Offshore Mooring" Second Edition – July 2014*

API SPEC 9A, *"Specification for Wire Rope" 27th Edition, August 2020 -*

IMO MSC.1/Circ.1580, *Guidelines for vessels and units with Dynamic Positioning (DP) systems*, 16 June 2017, International Maritime Organization.

3 Terms, Definitions, Symbols, and Abbreviations

3.1 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 https://www.electropedia.org/

3.1.1
action
external load applied to the structure (direct action) or an imposed deformation or acceleration (indirect action)

Note 1 to entry: An earthquake typically generates imposed accelerations.

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

[SOURCE: ISO 19900:2019, 3.3]

3.1.2
action effect
effect of actions on structural components

EXAMPLE Internal forces, moments, stresses, strains, rigid body motions or elastic deformations.

[SOURCE: ISO 19900:2019, 3.4]

3.1.3
active station-keeping system
station-keeping systems that make use of dynamic positioning, thruster assistance, line length or pretension adjustments, planned changes in vessel draught, winching (kedging) off location, disconnection, etc. - as opposed to a *passive mooring system* (3.1.33)

3.1.4
catenary mooring
mooring system where the restoring action is provided by the distributed weight of mooring lines

Note 1 to entry: Mooring system restoring forces are due to forces from both catenary and strain deformations of the mooring lines.

3.1.5
characteristic value
value assigned to a basic variable, an action or a resistance from which the design value can be found by the application of a partial factor

Note 1 to entry: The value usually has a prescribed probability of not being violated which, in the case of an action, will normally relate to a reference return period.

Note 2 to entry: Adapted from ISO 19900:2019, 3.9.

3.1.6
close proximity
mooring systems are considered to be in close proximity to a surface installation (or facility) if any part of the other installation lies within a contour described by the set of offsets coinciding with each line reaching 100 % MBS in the intact or redundancy check condition, whichever is larger

3.1.7
common mode/common cause failure
failures of similar components on different mooring legs resulting from the same direct cause, where these failures are not consequences of each other

Note 1 to entry: The potential for common cause failures reduces the effectiveness of system redundancy.

Note 2 to entry: It is generally accepted that the failures occur simultaneously or within a short time of each other.

3.1.8
damage event
event-driven damage to mooring components including physical damage, overload, excessive bending, etc., often experienced during the installation phase

3.1.9
damaged condition
state of the station-keeping system with a weakened or missing mooring line or a failure of the thruster system or a combination of both

Note 1 to entry: A missing line can have either failed or been weakened by external damage (e.g., cut in synthetic ropes or corroded chain) or been removed for maintenance or inspection.

Note 2 to entry: A total or partial loss of a buoyancy or weight element is also a damaged condition.

Note 3 to entry: For thruster assisted mooring (TAM) systems damage condition includes the most critical case of one-leg damaged or the single worst failure (SWF) of the integrated thruster control system (ITCS) as identified by the FMEA.

3.1.10
degradation mechanisms
time-based physical or chemical mechanisms or processes resulting in reduced functionality or capacity

EXAMPLE Corrosion, wear, fatigue, etc. are degradation mechanisms