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Petroleum and natural gas industries — General requirements for offshore structures

Industries du pétrole et du gaz naturel — Exigences générales relatives aux structures en mer

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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, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 7, *Offshore structures*.

This third edition cancels and replaces the second edition (ISO 19900:2013), which has been technically revised. The main changes compared to the previous edition are as follows:

— Terms and definitions have been updated;

— Design/assessment situations are described, and the process for limit state design/assessment verification has been clarified;

— Contents have been reorganized and many clarifications to provisions have been made;

— Annex A has been reorganized to mirror the numbering of the normative clauses and it has been updated with substantial guidance moved from normative clauses.

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 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, ISO 19906) constitute a common basis addressing design requirements and assessments of all types of offshore structures used by the petroleum and natural gas industries worldwide.

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

Through their application, the intention is to achieve adequate structural integrity and performance based on reliability levels appropriate for manned and unmanned offshore structures, whatever the nature or combination of the materials used.

Structural integrity is an overall concept comprising: models for describing actions, structural analyses, design rules, safety elements, workmanship, quality management, and national requirements, all of which are mutually dependent. The modification of any of these elements in isolation can cause an imbalance or inconsistency, with possible impact on the reliability inherent in the offshore structure. The implications involved in modifying one element, therefore, need to be considered in relation to all the elements and the overall reliability of the offshore structure.

The International Standards on offshore structures prepared by TC 67/SC 7 are intended to provide latitude in the choice of structural configurations, materials and techniques and to allow for innovative solutions. Sound engineering judgement is, therefore, necessary in the use of these documents.

Figure 1 gives a general indication of the relationships between the International Standards on offshore structures prepared by TC 67/SC 7.

This document, i.e. ISO 19900, follows the principles of ISO 2394 and is the unifying document for International Standards on offshore structures prepared by TC 67/SC 7, which encompass both specific requirements for offshore structures (the ISO 19901 series) and "structure type" documents (ISO 19902, ISO 19903, ISO 19904-1, ISO 19905-1, ISO 19905-3, and ISO 19906).

The ISO 19901 series addresses particular aspects of the design, construction, and operation of offshore structures for the petroleum and natural gas industries. The provisions can be applicable to structures of different types, materials and operating environments.

In addition to the relationships between the "structure type" documents and the ISO 19901 series, there is also some interdependence among the "structure type" documents, in that one can reference another, e.g. ISO 19906 on arctic offshore structures builds upon the requirements of ISO 19902 on fixed steel offshore structures.

In ISO International Standards, the following verbal forms are used:

— "shall" and "shall not" are used to indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted;

— "should" and "should not" are used to indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited;

— "may" is used to indicate a course of action permissible within the limits of the document;

— "can" and "cannot" are used for statements of possibility and capability, whether material, physical or causal.

Additional information and guidance are given in Annex A, where the clause numbering mirrors the normative clauses to facilitate cross referencing.

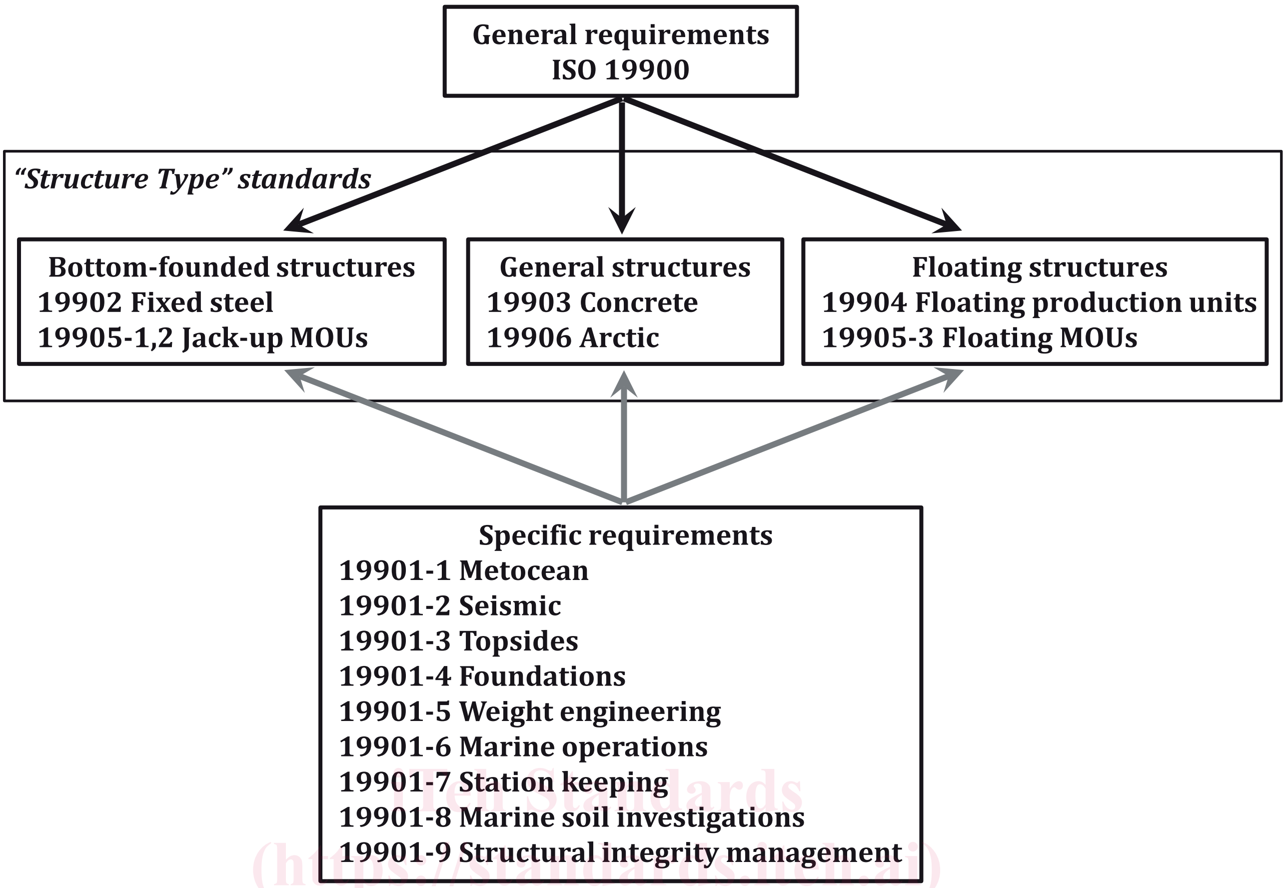

Figure 1 — Relationship of International Standards on offshore structures prepared by TC67/SC7

Petroleum and natural gas industries — General requirements for offshore structures

1 Scope

This document specifies general requirements and recommendations for the design and assessment of bottom-founded (fixed) and buoyant (floating) offshore structures.

This document is applicable for all phases of the life of the structure, including:

— successive stages of construction (i.e. fabrication, transportation, and installation),

— service in-place, both during design life and during any life extensions, and

— decommissioning, and removal.

This document contains general requirements and recommendations for both the design of new build structures and for the structural integrity management and assessment of existing structures.

This document does not apply to subsea and riser systems or pipeline systems.

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

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

ISO 19901-3, *Petroleum and natural gas industries — 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 19901-5, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 5: Weight control during engineering and construction*

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

ISO 19901-7, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 7: Stationkeeping systems for floating offshore structures and mobile offshore units*

ISO 19901-8, *Petroleum and natural gas industries — Specific requirements for 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 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*

ISO 19903, *Petroleum and natural gas industries — Concrete offshore structures*

ISO 19904-1, *Petroleum and natural gas industries — Floating offshore structures — Part 1: Monohulls, semisubmersibles and spars*

ISO 19905-1, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 1: Jack-ups*

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

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

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
abnormal environmental event
environmental *hazardous event* (3.27) having probability of occurrence not greater than 10^{-3} per annum (1 in 1 000 years)

3.2
accidental event
non-environmental *hazardous event* (3.27) 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.

3.3
action
external load applied to the *structure* (3.53) (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.

3.4
action effect
result of *actions* (3.3) on a *structural component* (3.49) (e.g. internal force, moment, stress, strain) or on the *structure* (3.53) (e.g. deflection, rotation)

3.5
air gap
distance between the highest water elevation and the lowest exposed part of the primary deck *structure* (3.53) not designed to withstand associated environmental *action effects* (3.4) for a defined *return period* (3.42)

Note 1 to entry: This definition can be refined for different platform types in their respective standards.

3.6
appurtenance
accessory or attachment to the *structure* (3.53) which typically assists installation, provides access or protection, or carries fluids or gas

Note 1 to entry: Appurtenances do not normally contribute to the stiffness of the structure but can attract significant hydrodynamic loading.

EXAMPLE Riser, caisson, boat landing, fender, and protection frames.

3.7
basic variable
variable representing physical quantities which characterize *actions* (3.3) and environmental influences, geometric quantities, or material properties including soil properties

Note 1 to entry: Basic variables are typically uncertain random variables or random processes used in the calculation or assessment of representative values of actions or resistance.

3.8
calibration
process used to determine and optimize partial factors using *structural reliability analysis* (3.52) and target reliabilities

3.9
characteristic value
value assigned to a *basic variable* (3.7) with a prescribed probability

Note 1 to entry: In some design/assessment situations, a variable can have two characteristic values, an upper value and a lower value.

3.10
conductor
tubular pipe set into the ground to provide the initial stable structural foundation for setting the surface casing and protecting the internal well string from metocean actions

Note 1 to entry: The conductor provides lateral and, in some cases, axial support, enables circulation of drilling fluid, and guides the drill string to facilitate setting of the surface casing.

3.11
decommissioning
process of shutting down a *platform* (3.37) enabling preparations for cleaning, dismantling and/or removal from location at the end of *total service life* (3.18)

3.12
design resistance
resistance limit calculated using factored *representative values* (3.40) of *basic variables* (3.7) or from factored expressions based on unfactored *representative values* (3.40) of *basic variables* (3.7)

EXAMPLE Examples of basic variables relevant to resistance are material properties.

3.13
design service life
planned period for which a *structure* (3.53) is used for its intended purpose with anticipated maintenance, but without substantial repair being necessary

3.14
design value
value derived from the *representative value* (3.40) for use in *limit state verification* (3.32)

Note 1 to entry: Design values can be different in different design/assessment situations due to different partial factors.

3.15
design/assessment criteria
quantitative formulations describing the conditions to be fulfilled for each *design/assessment situation* (3.16)

3.16
design/assessment situation
set of physical conditions for which the *structure* (3.53) or its components are verified

3.17
deterioration
process that adversely affects *structural integrity* (3.50) over time

Note 1 to entry: Deterioration can be caused by naturally occurring chemical, physical, or biological actions including corrosion, by severe environmental actions, by incidents and accidental actions, by repeated actions such as those causing fatigue, by wear due to use, and by improper operation and maintenance of the structure.

3.18
total service life
design service life (3.13) plus any subsequent operational life extension period(s)

3.19
durability
ability of a *structure* (3.53) or *structural component* (3.49) to maintain its function throughout its *total service life* (3.18)

3.20
exposure level
classification system used to establish relevant criteria for a *structure* (3.53) based on consequences of failure

3.21
extreme environmental event
environmental *hazardous event* (3.27) typically having probability of occurrence of 10^{-2} per annum (1 in 100 years)

3.22
fit-for-service
fulfilling defined *structural integrity* (3.50) and *performance* (3.36) requirements

Note 1 to entry: A structure not meeting all the specific provisions can be fit-for-service, provided it does not cause unacceptable risk to life-safety or the environment.

3.23
fitness-for-service assessment
engineering evaluations to demonstrate that a *structure* (3.53) or a *structural component* (3.49) which deviates from its design basis, is *fit-for-service* (3.22)

Note 1 to entry: Deviations can include deterioration or damage, life extension, and other changes and modifications to the structure or to the design basis.

3.24
fixed structure
structure (3.53) that is bottom founded and transfers most of the *actions* (3.3) on it to the *seabed* (3.47)

3.25
floating structure
structure (3.53) where the full weight is supported by buoyancy

3.26
hazard
potential source of harm

Note 1 to entry: Harm is typically differentiated between harm to people, harm to the environment, or harm in terms of costs to organization(s) or society in general.

3.27
hazardous event
event which occurs when a *hazard* (3.26) interacts with a *structure* (3.53)

EXAMPLE Wave impacting the structure, iceberg impacting the structure, excessive topside weight added to the structure, vessel collision, fire, explosion, and landslip in the vicinity of structural anchors (piles).

3.28
ice gouge
ice scour
incision in the *seabed* (3.47) or removal of seabed material by an ice feature

3.29
incident
non-environmental *hazardous event* (3.27) considered in an operational *design/assessment situation* (3.16)

Note 1 to entry: Incident, as referred to in this document, is a lesser accidental event, associated with possible local damage or damage to structural components, occurring with low probability, most typically associated with probabilities not less than 10^{-2} per annum (1 in 100 years).

3.30
jack-up
mobile offshore unit with a buoyant hull and one or more legs that can be moved up and down relative to the hull

Note 1 to entry: A jack-up reaches its operational mode by lowering the leg(s) to the seabed and then raising the hull to the required elevation. The majority of jack-ups have three or more legs, each of which can be moved independently and which are supported in the seabed by spudcans.

3.31
limit state
state beyond which the *structure* (3.53) or *structural component* (3.49) no longer satisfies the *design/assessment criteria* (3.15)

3.32
limit state verification
demonstration that the total design *action effect* (3.4) in each *design/assessment situation* (3.16) does not exceed the *limit state* (3.31) *design resistance* (3.12)

3.33
nominal value
value assigned to a variable specified or determined on a non-statistical basis, typically from acquired experience or physical conditions, or as published in a recognized code or standard

Note 1 to entry: In some design/assessment situations, a variable can have two nominal values, an upper value and a lower value.

3.34
offshore
situated in water some distance from the shore

Note 1 to entry: Alternatively, near shore can be used to specify locations next to the coast or in mouths of rivers.

3.35
operator
representative of the company or companies leasing the site

Note 1 to entry: The operator is normally the oil company acting on behalf of co-licensees.

Note 2 to entry: The operator can be termed the owner or the duty holder.

3.36
performance
ability of a *structure* (3.53) or a *structural component* (3.49) to fulfil specified requirements

Note 1 to entry: Specified requirements include requirements for structural integrity and functionality.

3.37
platform
complete assembly of structural and non-structural systems for the purpose of development and production of petroleum and natural gas fields

Note 1 to entry: The platform includes the structure and non-structural systems such as topsides equipment, piping and accommodation.

Note 2 to entry: The platform includes the structural conductors and risers but does not include the non-structural components of the hydrocarbon wells.

Note 3 to entry: The platform does not include the geological strata supporting the foundation. However, site-specific geotechnical parameters provide the boundary conditions necessary to model the platform's foundation or anchoring.

3.38
reference period
period of time used as a basis for determining the *representative value* (3.40) of operational, environmental, accidental and/or repetitive actions

3.39
reliability
performance (3.36) over a specified period of time

Note 1 to entry: When reliability is used in the context of limit states, it can be expressed as the probability that the limit is not exceeded.

Note 2 to entry: The specified period of time is typically one year.

3.40
representative value
value assigned to a *basic variable* (3.7) for verification of a *limit state* (3.31) in a *design/assessment situation* (3.16)

Note 1 to entry: Two types of representative value used in design verification are characteristic value and nominal value.

3.41
resistance
ability of a *structure* (3.53), or a *structural component* (3.49), to withstand *action effects* (3.4)

3.42
return period
average time between occurrences of an event

Note 1 to entry: The offshore industry commonly uses a return period measured in years for environmental events. The return period in years is equal to the reciprocal of the annual probability of occurrence of the event.

