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Second edition
2020-11

Petroleum and natural gas industries — Fixed steel offshore structures

Industries du pétrole et du gaz naturel — Structures en mer fixes en acier

Reference number
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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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*.

This second edition cancels and replaces the first edition (ISO 19902:2007), which has been technically revised. It also incorporates the Amendment ISO 19902:2007/Amd.1:2013. The main changes compared to the previous edition are as follows:

— duplication of symbols has largely been eliminated (see Clause 4);

— use of metocean versus environmental has been rationalized. Metocean now refers to wind, wave and current actions only while environmental encompasses metocean, ice and seismic;

— high strength steel: applicable specified minimum yield strength increased to 800 MPa but only with respect to non-material requirements;

— hazards and designing for hazards moved from 10.1.1 and 10.1.2, respectively, to 6.2.2 and 6.2.3, respectively;

— deck elevation (6.3.3.2) expanded to include air gap plus need to consider crest levels 15 % higher than calculated values;

— exposure levels (6.6) are addressed in ISO 19900 so text modified accordingly;

— damage tolerance now more appropriately addressed in 7.10.2 rather than 10.1.6.1;

— reserve strength ratio (7.11.1): detailed procedure introduced because of general lack of adequate, appropriate documentation;

— structural reliability analysis (7.13): text reordered and supplemented by text from completely rewritten A.9.9.3.3;

— onshore lifting (8.3): because offshore lifting is now addressed in ISO 19901-6, the text and tabulated information on DAFs have been modified accordingly;

— multi-crane lifts (8.3.4): for consistency with ISO 19901-6, now considered in place of dual lifts;

— gravity load partial action factors for extreme conditions reduced from 1.1 to 1.0 (Table 9.10-1 and Table 8.2-1);

— clarified that for abnormal design situations, verification is required even if wave-in-deck events do not occur to ensure that the appropriate robustness requirement is realized;

— ELE structural and foundation modelling: new first paragraph added in response to questions to Seismic Panel (responsible for ISO 19901-2) regarding the appropriate weight of personnel to consider during an event;

— tubular member diameter to thickness ratio non-dimensionalized (13.1);

— shear and torsion now included in all tubular member strength formulae including those addressing hydrostatic pressure;

— tubular member strength formulae for combined axial and bending loading now of cosine interaction form instead of previously adopted linear interaction;

— formulae (13.6-2) and (13.6-3) relating to conical transitions corrected;

— tubular joint strength formulae nearly all changed through adoption of the API RP 2A-WSD 21st Edition Supplement 2 (October 2005) tubular joint formulae supplemented by some limited non-linear FEA;

— grouted connections: pile outer diameter limited (15.1.5.2);

— use of HSS in fatigue applications: warning re possible hydrogen embrittlement when yield strength exceeds 700 MPa (16.11.2);

— fatigue damage design factors: effect of considering life cycle (16.12.2);

— Clause 17: detailed pile design requirements moved to ISO 19901-4 so no longer addressed;

— Clause 19: expanded to include more detailed requirements for Design class approach;

— Clause 20: expanded to include more detailed requirements for Design class approach;

— Clause 21: some requirements for Design class approach added to Tables 21.2-1 and 21.4-1 (previously 21.7-1);

— particular standards identified for NDT personnel qualification (21.3.3);

— Clause 21: existing 21.4 to 21.6 moved to ISO 19901-6;

— Clause 22: reference to ISO 19901-6 added where appropriate. Requirements for flotation (22.3.2.4) and crane barges (22.3.2.5) combined (22.3.3.4);

— Clauses 23 to 25 (and A.23 to A.25) deleted because ISO 19901-9 *Structural integrity management* approved;

— Annex A modified to accommodate above changes to normative text as appropriate;

— Table C.1: extra strength groups for chord cans and padeyes;

— Table C.4 enlarged considerably;

— Annex D completely rewritten;

— E.3: 100 % CVI now required for all welding;

— Annex F: substantially rewritten and expanded. Now important to consider whether LAST is $\geq -10°C$ or $< -10°C$;

— new Table F.5 and Figure F.1 similar to existing requirements in Table D.3 and Figure D.1, now deleted from Annex D;

— new Table F.6 addressing subsea structures whereas Table F.5 only concerns jacket structures;

— minimum RSR requirement added for North West Europe (H.2.3.1);

— H.3.3.2 Canadian welding references revised;

— US Customary units have been deleted;

— a number of figures have been corrected.

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 covering those aspects that address design requirements and assessments of all offshore structures used by the petroleum and natural gas industries worldwide. Through their application, the intention is to achieve reliability levels appropriate for manned and unmanned offshore structures, whatever 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 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 concept or structural system. The implications involved in modifications, therefore, need to be considered in relation to the overall reliability of all offshore structural systems.

These documents applicable to the various types of offshore structure are intended to provide wide latitude in the choice of structural configurations, materials and techniques without hindering innovation. Sound engineering judgment is therefore crucial in the use of these documents.

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

Materials, welding and weld inspection requirements can be based either on a “material category” or on a “design class” approach, as discussed in Clauses 19 and 20. If the material category approach is used, see the corresponding provisions of Annexes C and E; if the design class approach is used, see the corresponding provisions of Annexes D and F.

Annex G gives requirements on fabrication tolerances.

Regional information on the application of the document to certain specific offshore areas is provided in Annex H.

To meet certain needs of industry for linking software to specific elements in this document, a special numbering system has been permitted for figures, tables, formulae and bibliographic references.

Petroleum and natural gas industries — Fixed steel offshore structures

1 Scope

This document specifies requirements and provides recommendations applicable to the following types of fixed steel offshore structures for the petroleum and natural gas industries:

— caissons, free-standing and braced;

— jackets;

— monotowers;

— towers.

In addition, it is applicable to compliant bottom founded structures, steel gravity structures, jack-ups, other bottom founded structures and other structures related to offshore structures (such as underwater oil storage tanks, bridges and connecting structures).

This document contains requirements for planning and engineering of the design, fabrication, transportation and installation of new structures as well as, if relevant, their future removal.

NOTE 1 Specific requirements for the design of fixed steel offshore structures in arctic environments are presented in ISO 19906.

NOTE 2 Requirements for topsides structures are presented in ISO 19901-3; for marine operations in, ISO 19901-6; for structural integrity management, in ISO 19901-9 and for the site-specific assessment of jack-ups, in ISO 19905-1.

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 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10414-1, *Petroleum and natural gas industries — Field testing of drilling fluids — Part 1: Water-based fluids*

ISO 12135, *Metallic materials — Unified method of test for the determination of quasistatic fracture toughness*

ISO 15653, *Metallic materials — Method of test for the determination of quasistatic fracture toughness of welds*

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 19901-2, *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 19901-6, *Petroleum and natural gas industries — Specific requirements for offshore structures — Part 6: Marine operations*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19901-1, ISO 19901-2, ISO 19901-4, ISO 19901-9 and the following 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 having a probability of occurrence typically between 10^{-3} and 10^{-4} per annum (i.e. return periods between 1 000 years and 10 000 years)

[SOURCE: ISO 19900:2019, 3.1, modified]

3.2
accidental event
non-environmental hazardous event having a probability of occurrence typically of 10^{-4} per annum (i.e. return period of 10 000 years)

EXAMPLE Impact, fire, explosion, local structural failure, loss of intended differential pressure (e.g. buoyancy).

[SOURCE: ISO 19900:2019, 3.2, modified]

