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Oil and gas industries including lower carbon energy - Specific requirements for offshore structures - Part 4: Geotechnical design considerations (ISO 19901-4:2025)

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

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Oil and gas industries including lower carbon energy - Specific requirements for offshore structures - Part 4: Geotechnical design considerations (ISO 19901-4:2025)

Industries du pétrole et du gaz y compris les énergies à faible teneur en carbone - Exigences spécifiques relatives aux structures en mer - Partie 4: Bases conceptuelles géotechniques (ISO 19901-4:2025)

Öl und Gasindustrie einschließlich kohlenstoffarmer Energieträger-Besondere Anforderungen an Offshore-Bauwerke-Teil 4: Geotechnische Auslegungsmerkmale (ISO 19901-4:2025)

This European Standard was approved by CEN on 10 February 2025.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN ISO 19901-4:2025) has been prepared by Technical Committee ISO/TC 67 "Oil and gas industries including lower carbon energy" in collaboration with Technical Committee CEN/TC 12 “Oil and gas industries including lower carbon energy” the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2025, and conflicting national standards shall be withdrawn at the latest by August 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 19901-4:2016.

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Endorsement notice

The text of ISO 19901-4:2025 has been approved by CEN as EN ISO 19901-4:2025 without any modification.

International Standard

ISO 19901-4

Third edition
2025-02

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

Part 4: Geotechnical design considerations

Industries du pétrole et du gaz y compris les énergies à faible teneur en carbone — Exigences spécifiques relatives aux structures en mer —

Partie 4: Bases conceptuelles géotechniques

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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 document 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, *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 19901-4:2016), which has been technically revised.

The main changes are as follows:

— guidance extended on representative and design values for soil parameters (Clause 5);

— guidance added for geotechnical design of intermediate foundations for fixed structures and clause renamed to ‘Design of shallow and intermediate foundations’ (Clause 7);

— requirements added on installation resistance, yield envelope approaches for ultimate limit state, and performance- based design for shallow skirted and intermediate foundations (Clause 7);

— new unified CPT method for axial capacity in sands to replace the former main text method, new TZ curve definition in sands, new unified CPT method for clays introduced into the Clause A.8, new PY curve methodology for clays to replace the existing method (Clause 8);

— new requirements added on reassessment of pile capacity for existing structures (Clause 9);

— a new clause for pipelines, conductors and risers (Clause 10);

— references have been reviewed, updated and reduced where possible.

A list of all parts in the ISO 19901 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

The International Standards on offshore structures prepared by TC 67 (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 oil and gas industries worldwide. Through their application, the intention is to achieve reliability levels appropriate for offshore structures, whatever the type of structure and the nature of the materials used. Application specific requirements for different energy industries are given in the relevant standards. For example, for the offshore wind industry, IEC 61400-1 and IEC 61400-3-1 outline the design requirements (e.g. return periods) for offshore wind turbine support structures.

This document may be applied for the design of foundations used in the offshore wind industry. In this case, it should be verified that the type and dimension of the foundation, as well as the type of actions acting upon it, are consistent with those used in the development of the design methods. For example, the pile design methods of Clauses 8 are not necessarily applicable to the design of monopiles for which L/D is less than 10 and their validity for such cases should be assessed. Offshore wind structures can also have other requirements, such as a characterisation of foundation stiffness, that are beyond the scope of this document. Reference should be made to the overarching application specific codes and standards such as IEC 61400-3-1.

It is important to recognize that structural integrity is an overall concept comprising models for describing actions, structural analyses, design rules, safety elements, quality of work, 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, should be considered in relation to the overall reliability of all offshore structural systems.

For geotechnical design (engineering science dealing with the properties of soil: sand, silt, clay and rock), some additional considerations apply. These include the time, frequency and rate at which actions are applied, the method of installation, the properties of the surrounding soil, the overall behaviour of the seabed, effects from adjacent structures and the results of drilling into the seabed. All of these, and any other relevant information, should to be considered in relation to the overall reliability of the structure.

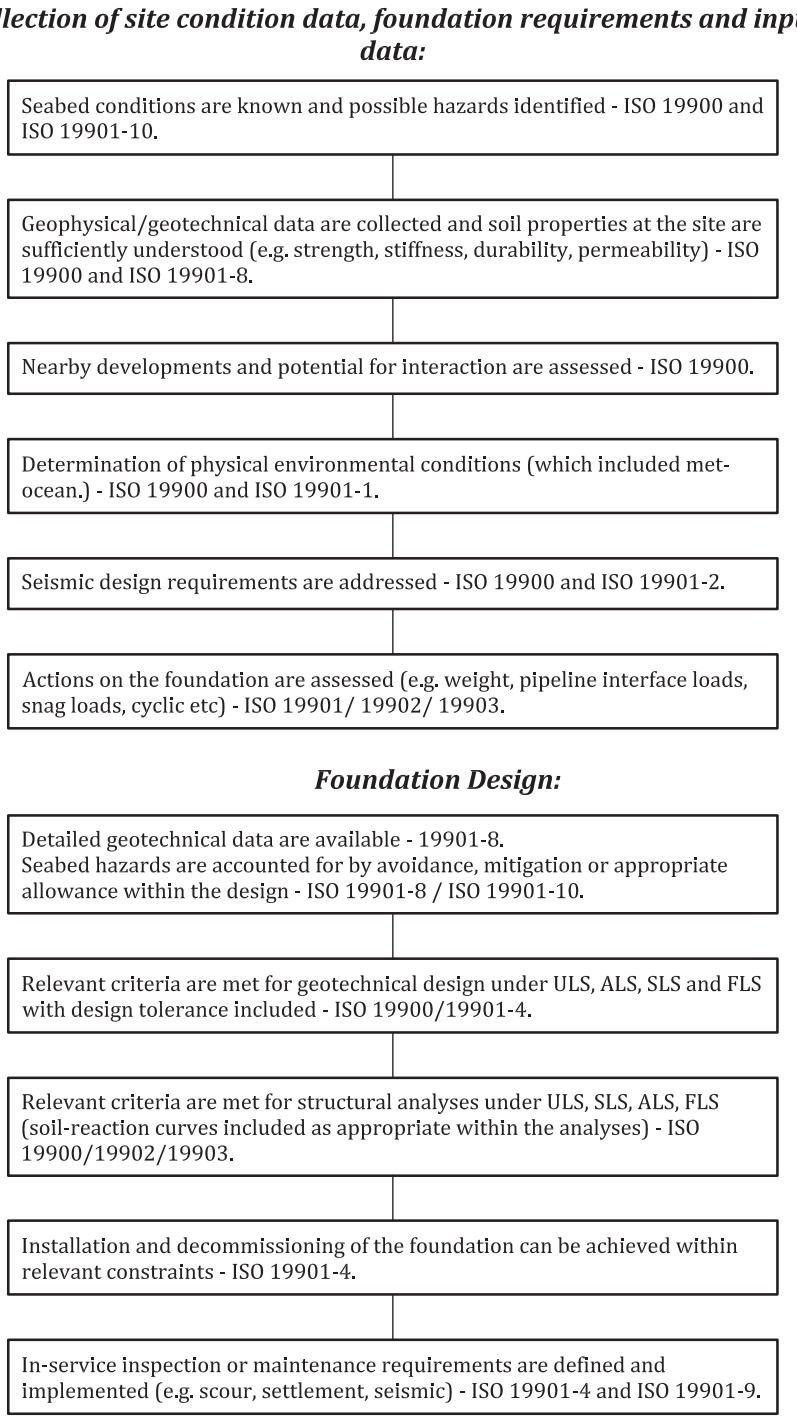
The International Standards on offshore structures prepared by TC 67 are intended to provide wide latitude in the choice of structural configurations, materials and techniques without hindering innovation. Geotechnical design practice for offshore structures has proved to be an innovative and evolving process over the years. This evolution is expected to continue and is encouraged. Therefore, circumstances can arise when the procedures described in this document or the International Standards on offshore structures prepared by TC 67 (or elsewhere) are insufficient on their own to ensure that a safe and economical design is achieved.

Seabed soils vary. Experience gained at one location is not necessarily applicable at another. Extra caution is necessary when dealing with unconventional soils or unfamiliar foundation concepts. Sound engineering judgment is therefore necessary in the use of this document.

Some background to and guidance on the use of this document is provided in Annex A.

ISO 19905 provides requirements and detailed guidance on foundations for mobile offshore units.

Figure 1 set outs a typical workflow for design of offshore foundations with reference to other relevant International Standards.



NOTE Specific design and installation constraints can apply for structures in arctic regions (see ISO 19906), for mobile offshore units, especially for jack-ups (see ISO 19905) and for anchors for floating units (see ISO 19901-7 Design can be an iterative process from concept (initial feasibility and applicability study), basic to final design. Different level of details and objectives are required in the various design stages.

Figure 1 — Flowchart showing typical design process for offshore foundations

International Standard **ISO 19901-4:2025(en)**

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

Part 4: Geotechnical design considerations

1 Scope

This document contains provisions for geotechnical engineering design that are applicable to a broad range of offshore structures, rather than to a particular structure type. This document outlines methods developed for the design of shallow foundations with an embedded length (L) to diameter (D) ratio L/D < 0,5, intermediate foundations, which typically have 0,5 ≤ L/D ≤ 10 (see Clause 7), and long and flexible pile foundations with L/D > 10 (see Clauses 8 and 9).

This document also provides guidance on soil-structure interaction aspects for flowlines, risers and conductors (see Clause 10) and anchors for floating facilities (see Clause 11). This document contains brief guidance on site and soil characterization, and identification of hazards (see Clause 6).

This document can be applied for foundation design for offshore structures used in the lower carbon energy industry.

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 19901-7, *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*

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

ISO 19901-9, *Oil and gas industries including lower carbon energy — 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: Ship-shaped, semi-submersible, spar and shallow-draught cylindrical structures*

ISO 19905 (all parts), *Oil and gas industries including lower carbon energy — Site-specific assessment of mobile offshore units*

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

DNV-RP-F110, *Global buckling of submarine pipelines*

DNV-RP-F114, *Pipe-soil interaction for submarine pipelines*