

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 702

Requirements for design and installation of skirted foundations and suction anchors
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1. Scope

1.1 Objective

This document gives the minimum requirements applicable to the design and installation of skirted foundations or suction anchors, and covers:

- Suction anchors used in permanent moorings for production structures (e.g. FPSO/FSO, TLP, semi-submersible FPU, or other floating units such as the SPAR)
- Suction anchors used in temporary moorings for exploration drilling rigs (MODUs)
- Skirted foundations for riser towers or single risers
- Skirted foundations for manifolds or subsea production structures
- Steel skirted caisson foundations for fixed jacket structures or gravity-based structures.

This General Specification applies to:

- Acquisition and interpretation of soil data
- Geotechnical design requirements
- Requirements for monitoring of the installation behaviour.

Deviations from any of the requirements defined herein shall be treated as non-conformances in accordance with Company procedures.

1.2 Abbreviations

The following abbreviations are used:

- **CPTU** Cone Penetration Test with pore pressure measurement
- **FPSO/FSO** Floating Production Storage & Off-loading / Floating Storage & Off-loading
- **FPU** Floating Production Unit
- **GBS** Gravity-Based Structure
- **MODU** MOBILE Drilling Unit
- **MSCL** Multi Sensor Core Logging
- **REB** Reverse End Bearing
- **ROV** Remotely Operated Vehicle
- **SPS** Subsea Production Structure
- **TLP** Tension Leg Platform

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published at the effective date of this document.

Reference	Title
AISC Manual of Steel Construction	Allowable Stress Design, 9 th Edition
API Bull 2U	Bulletin on Stability Design of Cylindrical Shells
API RP 2A-WSD	Planning, Designing, and Constructing Fixed Offshore Platforms-Working Stress Design
API RP 2GEO	Geotechnical and Foundation Design Considerations
API RP 2SK	Design and Analysis of Stationkeeping Systems for Floating Structures
API RP 2T	Planning, Designing, and Constructing Tension Leg Platforms
DNV-RP-E303	Geotechnical design and installation of suction anchors in clay
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 19901-7	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 19902	Petroleum and Natural Gas Industries - Fixed Steel Offshore Structures
ISO 19903	Petroleum and Natural Gas Industries - Fixed Concrete Offshore Structures

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Reference	Title
GS EP GEO 101	Offshore Geotechnical Survey
GS EP GEO 201	Offshore Geophysical Site Investigation
GS EP SPS 001	Subsea Production Systems General Design Requirements
GS EP SPS 002	Design of Subsea Stations
GS EP STR 101	Design of offshore jacket and subsea structures
GS EP STR 433	Structural design of skirted foundations and suction anchors
GS EP STR 661	FPSO - Design requirements for mooring and anchoring systems

3. Requirements for site and soil investigation

The general offshore site and soil investigation equipment and procedures shall be in agreement with:

- [GS EP GEO 201](#) for geophysical site surveys
- [ISO 19901-8](#) and [GS EP GEO 101](#) for procedures and equipment for in-situ testing, soil sampling and laboratory testing, as well as data interpretation and reporting.

The scope of the site and soil investigation, which will depend on the soil type and site variability, shall be submitted to Company for approval. The survey methods shall focus on the detailed determination of the characteristics of the first 20-40 m of sediments corresponding to the anticipated skirt height plus two foundation widths or diameters. Possible obstacles or detrimental features, such as boulders, sand layers or cemented units, should be paid particular attention.

The soil investigation shall combine in-situ testing (e.g. CPTU, T-bar, Ball or vane) and high quality sampling. Equipment and procedures allowing continuous profiling and sampling should be preferred. Correlations used for determining the soil characteristics and strength from in-situ testing shall be calibrated on site specific data or local experience (to be documented in the soil investigation report).

The requirements about depth accuracy classes and application/quality classes of soil investigation equipments and results (to be defined in the Project specifications) shall be in agreement with [ISO 19901-8](#).

The quality of the soil samples shall be determined on the basis of e.g. MSCL logging, X-ray logging, or change in void ratio under reconsolidation to in-situ stresses (see Table 6 of [ISO 19901-8](#)). Advanced laboratory testing, such as direct simple shear, soil-steel interface ring shear, oedometer, and static or cyclic triaxial testing, shall be performed on highest quality samples. Classification tests, as well as tests on remoulded soil for simulating the situation during skirt penetration, can be performed on lower quality samples. The onshore laboratory testing program shall be submitted to Company for approval.