

GENERAL SPECIFICATION

GEOMATICS

GS EP POS 001

Offshore surface positioning works

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1. Scope

The objective of this specification is to provide reliable three-dimensional positioning for offshore operations conducted by Contractor in compliance with Company requirements.

This specification is to be used in conjunction with the other documents referred to in section 2 as well as the Company project specification.

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 supplements, is the latest revision published at the effective date of this document.

Reference	Title
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organizations

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP POS 004	The use of Differential Global Navigation Satellite System

3. Scope of work

Contractor shall carry out all positioning tasks of the project, on a highly professional manner, in accordance with industry standard, current surveying practice and to the satisfaction of the Company.

3.1 Surface positioning systems

Contractor shall ensure that all specified navigation and positioning equipment including computer hardware and software are installed, fully calibrated and operational. The positioning work shall only commence with all systems approved by Company.

In all cases, **Contractor shall supply at the minimum, 2 fully independent positioning systems** each of which providing sufficient redundancy and quality control output in order to insure that positioning is made within the required accuracy. During period with high solar activity, dual frequency shall be a standard requirement as well as the use of additional HF/ radio-link correction delivery solutions.

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These positioning systems shall be each other fully independent, based on different correction system and will be designated as primary (typically the most accurate) and secondary systems. The delivery of the RTCM or global corrections shall be independent. All necessary spare parts, user and maintenance manuals shall be provided onboard the vessel.

The surface positioning system selected by Contractor, shall allow to continuously provide a position during the required period of time and within the specified 2-sigma accuracy (defined as corresponding to a 86% confidence level) anywhere in the desired area or zone of operations.

System accuracy (defined as the value corresponding to a 86% confidence level or 2-Sigma) **shall be better than a 1 meter for both primary and secondary**, after corrections for pitch, roll and heading.

Contractor shall measure all horizontal and vertical offsets prior to each operation, after each modification and at any other time on the request of the Company Representative. All 3-dimensional offsets to and from reference points on the vessel shall be physically measured using acceptable survey technique. All offsets and any changes shall be logged and displayed in the offset list forms and diagrams and updated in the navigation software.

For large structures (FPSO, FPU, RIG, Lay Barge, ...) a complete dimensional control shall be carried-out onboard, in order to provide 3D-offsets between main reference points of the structure (centre of the FPSO, moon pool, antenna mast, fairleads, etc...).

All reference point positions shall be calculated in real-time after application of corrections due to both heading and pitch & roll.

Performance of the positioning system shall be monitored in real time using state of the art positioning QC software.

Contractor shall ensure that all positioning tasks shall be covered by a specific Work Instruction or by the Project Quality Plan.

3.1.1 DGNSS, GcGNSS systems

Contractor shall follow the guidelines provided in the document itemized in section 3 as well as specification of **GS EP POS 004**.

3.1.2 RTK

Contractor shall follow the guidelines provided in the document itemized in section 3 as well as specification of **GS EP POS 004**.

3.1.3 RGNSS

Where a RGNSS system is provided for relative vector GNSS positioning, the RGNSS system shall form part of the simultaneous computation and where applicable adjustment of the surface positioning network.

The RGNSS data shall be computed at every update.

RGNSS telemetry shall be via radio link, and using more than one unique frequency per RGNSS unit used at one time.

It shall be ensured that the PDOP for the RGNSS positioning does not exceed 4. Where necessary, height aiding may be used providing that Contractor uses a geoid - ellipsoid

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separation model approved by Company. The maximum age of RGNSS data shall be 30 seconds. The minimum number of observed satellites shall be 5 or 4 with height aiding (see also **GS EP POS 004**).

3.1.4 Tug Management system

A Tug Management System (TMS) is required for all operation involving tugs (AHT) directed by a “tow master” during infield or mooring operations. TMS will allow monitoring and displaying all vessels working in conjunction with the positioning/mooring of a large floating structure. Such system is required for:

- FPSO/FPU final tow and mooring installation (TMS Master system)
- The tugs working under the instructions of a tow master (Remote TMS station)
- The support vessel for recovery and hook-up of mooring lines: FPSO, FPU (TMS Remote station)
- The support vessel of the recovery and hook-up of mooring lines: OOB (TMS Master station)
- The OOB (TMS Remote station)

The anchor laying vessels shall be positioned using DGNSS or RGNSS system and the positioning data shall be transferred to the unit and processed. The positioning data shall then be transferred in real time to the anchor laying vessels in the form of graphic screen displays.

The accuracy in positioning of the stern of the anchor laying vessel shall be better than 5 meters at 2-Sigma. The requested accuracy of each offset component between the antenna and the stern shall be 1m at 2-Sigma. The accuracy of the anchor laying vessel heading shall be better than 1 degree at 2-Sigma.

3.1.5 Laser tracking system

The laser tracking system may be required for all vessels operating within 500 m from any large surface structures:

- Riser installation vessel
- Support vessel of the riser installation vessel (if applicable)
- Umbilical installation vessel

In such case, the laser tracking system shall be interfaced to the DP of the vessel.

3.2 Complementary survey systems

If a complementary survey system is required, it shall provide sufficient redundancy and quality control output in order to insure that positioning is made within the required accuracy.

All necessary spare parts, user and maintenance manuals shall be provided on the vessel.

True orientation of the surface unit, shall be monitored in real-time, using a fully calibrated system.

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3.2.1 Survey grade gyrocompass

True orientation of surface unit may be derived from survey grade gyrocompass (North-seeking, Fiber Optic Gyro, etc...).

The accuracy of the equipment (typically better than 0.2 deg), shall be documented in survey procedures and approved by Company prior to the mobilisation.

Note that for tug management system, the use of fluxgate compass information may be approved based on global accuracy requirement.

3.2.2 GNSS Compass

True orientation of surface unit may be derived from GNSS Based Gyrocompass.

The accuracy of the equipment (typically better than 0.2 deg), shall be documented in survey procedures and approved by Company prior to the mobilisation.

Contractor shall follow the guidelines provided in the document itemised in section 3 as well as specification of **GS EP POS 004**.

3.2.3 VRU & MRU

Pitch & roll (and heave if needed) of the surface unit, may be monitored in real-time, using a fully calibrated survey grade VRU or MRU. The accuracy of the equipment (typically better than 0.05 deg), shall be documented in survey procedures and approved by Company prior to the mobilisation.

Corrections due to pitch & roll shall be calculated and applied in real-time by the navigation system.

3.2.4 Inertial Navigation System

The Inertial Navigation System (INS) may be required to monitor in real-time pitch & roll (and heave if needed) or 3-axis velocity of the surface unit.

INS may be required also to smooth vessel position at a higher output rate.

The accuracy of the equipment shall be documented in survey procedures and approved by Company prior to the mobilisation.

Corrections due to pitch & roll shall be calculated and applied in real-time by the navigation system.

3.3 Reference parameters

3.3.1 Table of Tolerance and accuracy

Installation tolerances shall be defined into the Particular Specification of the project. They shall be in accordance with relevant Company's construction specification. An example of typical installation tolerances is given in Appendix 1.