

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 202

Geophysical Survey for the Installation and/or the Inspection of Offshore Structures and Pipelines

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1. Scope

This General Specification describes the surveys activities to be carried out in relation with the development of offshore oil & gas field including pre-lay survey of pipeline route, flexible lines and umbilicals, mooring legs of production floating structure, subsea structures installation, as-laid and as-built of all infield system pipeline, flexible lines and umbilicals, mooring legs of fixed floating structure, subsea structures, export lines. When sea lines (pipeline, flexible, umbilical, cable) require to be dug into a trench and/or covered by dumped material, additional surveys are required.

This General Specification describes the procedures to be used in order to successfully carry out surveys and inspections, in full accordance with the state of the art practice, of the requirements of the Statutory Authorities and to the satisfaction of the Company.

This General Specification outlines the minimum requirements for the support vessel, survey equipment and ROV. It defines the content and summary of Survey reports.

This specification mainly applies to:

- The Hazard survey of conditions in any area at sea or near structures, prior to the start of the installation operations
- Accurate monitoring of the touchdown point while laying umbilicals at sea within the lay corridor, including curves, and at the required distance from existing lines and structures
- Visual inspection, accurate positioning and mapping of all installed lines, umbilicals and structures to be issued immediately after laying / installation is complete
- Final inspection, positioning and mapping of all installed lines, umbilicals, risers and moored subsea structures, after all connections and remedial work have been performed
- Cathodic Protection (CP) survey may be required at the same time.

Each operation must be covered by a separate report which will therefore be prepared and issued as a preliminary report onboard Survey vessel, then issued as final reports, within a month. This applies to:

- Pre-operation survey
- Permanent Structure installation
- Lines and umbilical laying including Inline structures
- Mooring legs of large floating structures installation
- Mooring of large floating structures FPSO, FSO, FPU, OOB, etc.
- Export line installation
- Riser installation
- Cathodic Protection Inspection.

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And in specific cases, to:

- Trenching (when required)
- Backfilling or material dumping (when required).

Finally, after completion of all installation works, after tie-in and remedial works have been completed, an "as-built" report shall be issued, comprising all positioning and survey results. It will provide the basis of the reference document to be used for later inspection.

This General Specification shall be read in conjunction with the particular Specification valid for the project.

All positioning aspects are detailed in Company specification **GS EP POS 001** and **GS EP POS 002**.

Pre-engineering survey, which is carried out as a basis for Front End Engineering Design (FEED) is covered by Company specification **GS EP GEO 201** referenced in section 3.

2. Reference documents

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

In addition, applicable codes and Standards which are to be used in conjunction with this specification will be listed in the Particular Specification.

The order of precedence of the applicable documents shall be:

- The Particular Specification
- The present General Specification
- The Codes and Standards in reference.

Where this specification states no overriding requirements, the referenced Codes and Standards shall apply in full. Standards equivalent to those referenced herein shall not be substituted without written approval from the Company.

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
IAGC	Marine Geophysical Operations Safety Manual 7 th edition, 1991
BS EN 14161	Petroleum and natural gas industries — Pipeline transportation systems
DNV	Rules for Submarine Pipeline Systems December 1996
ISO 13623	Petroleum and Natural Gas Industries - Pipeline Transportation Systems
Nederlands Normalisatie Instituut	Requirements for steel pipeline transportation systems

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Reference	Title
UKOOA guidelines	Guidelines for the Conduct of site Surveys for Mobile Drilling Rigs, 1995 Guidelines on the use of differential global systems in offshore surveying, 1994
ISO 9001	Quality management systems - Requirements
ISO 9000	Quality Management Systems - Fundamentals and Vocabulary

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 COR 502	Control by electrical measurements of cathodic protection of submerged pipelines
GS EP GEO 110	Requirements to Offshore Survey Vessels
GS EP GEO 201	Offshore geophysical surveys
GS EP GEO 203	Geophysical survey for offshore pipeline inspection
GS EP POS 001	Offshore surface positioning works
GS EP POS 002	Subsea positioning works

3. Scope of Work

3.1 Shallow water requirement

In water depth shallower than 50 m, Survey requirement shall be simplified. Due to shallow water depth, Interim survey shall not be required, as TDP can easily and accurately be extrapolated from surface position.

3.1.1 Pre-lay survey

Not earlier than one month before the start of the laying operation, a survey using multi-beam echo sounder side scan sonar, sub-bottom profiler shall be performed along the intended routes, in order to determine precisely the position and dimensions of any obstacle, buried or unburied, natural or man-made obstruction (wrecks, debris, depressions, rock outcrops, etc.) within the laying corridor.

In addition, Kullenberg coring may be performed to confirm the nature of the seabed and sub-surface soils.

When buried pipes or power cable are present, high resolution magnetometer shall be used in order to provide a good cartography of their position.

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When an anchored laying barge is involved in operation, an additional Side scan sonar survey shall be carried out over the areas of interaction of Barge anchors and anchor wire with the seabed.

3.1.2 As-laid survey

As-laid Survey shall be carried out using Multi-beam Echosounder and Side scan sonar.

Free spans shall be identified using Side Scan Sonar technique. Side scan sonar fish shall be positioned using an USBL system.

3.2 Standard Requirement

At each step of the field installation, surveys shall be carried out with a survey vessel and/or an Inspection/ Work ROV, fully equipped with required survey sensors and positioned with an USBL system, or with an LBL array.

3.2.1 Pre-lay survey

Pre-lay survey shall be carried-out with a ROV equipped with High definition sonar, Dual Head Scanning Sonar (DHSS), bathy-system, pipe tracker and positioning from Survey Vessel. The pre-lay survey is to be done not earlier than one month before the start of the laying operation,

The speed of the ROV shall be maintained below 1 knot in order to obtain the best possible recording quality. The requirements include, but are not limited to the following:

- Continuous sonar and visual inspection, production of commented color video recording of the sealine route as per latest revision of alignment sheets
- Visual inspection and commented color video recording of any subsea structure
- Visual identification and positioning of any obstacle or obstruction, located close to the installation areas, identified during pre-engineering survey, any sonar target or structure detected during the actual survey
- Buried lines and/or obstacles detection with pipetracker
- Visual inspection and positioning of any existing sealine electrical cable, or umbilical
- Selected still photographs or good quality video-grabs in areas of interest
- Trench profiling along the route
- Cartography of the ROV survey.

The video recordings and video-grabs shall include at least the following overlaid information: identification, date, time, UTM co-ordinates, KP, heading, depth.

In areas where permanent poor visibility does not allow to carry out a visual inspection, the video recording shall include sequences with Obstacle Avoidance Sonar recording and Side Scan Sonar.

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3.2.2 Interim survey

During laying operations, a ROV shall monitor continuously, the sealine touchdown position in order to ascertain engineering parameters are satisfied, maintain a minimum distance from existing structures, perform crossing monitoring, laying over mattresses, etc.

This task shall be performed either directly from the installation vessel, or from the Survey vessel and video transmitted to Installation vessel.

Offset from existing structures shall be measured, directly by ROV positioning system or using the Obstacle Avoidance Sonar. If an existing sealine is buried, it shall be relocated at regular intervals, using the pipe tracker, in order to keep the required minimum distance from the sealine being laid.

3.2.3 As-laid survey

As-laid survey shall be carried-out with ROV equipped with High-Resolution sonar, dual-head scanning sonar (DHSS), Bathy-System, dual boom cameras, pipe tracker (if required) and USBL positioned from Survey Vessel immediately after the completion of the installation of each sea line.

The speed of the ROV shall be maintained below 1 knot in order to obtain the best possible recording quality.

The aim of this survey is to provide the following information:

- Integrity of the coating (and strapping if sea lines are laid in bundles)
- Integrity, functioning and X, Y position of all anodes
- Evidence of any anomaly such as damage to coating, anodes, obstructions or obstacles within the corridor
- The Attitude, orientation and X, Y, Z position of any specific feature such as: T-piece, SDU, ILT, PLET, crossing, etc.
- The X, Y, Z position of the sealine
- The relative position of the sealine to the seabed, buried sections, free spans
- An accurate identification, visual inspection and metrology of free spans (KP, length, max height, profile). This inspection shall be repeated after remedial work has been carried out.

3.2.4 Final as-built Survey

In water depth up to 200 meters, as-built survey shall be limited to the results of as-laid/ as installed survey and the inspection data of all areas where remedial work has been carried out.

For deep-water field development, the as-built survey shall comprise the survey of all structures installed, including fixed structures, sea lines, umbilicals, risers, export lines, mooring lines of permanent floating structures (FPSO, FPU, OOB, etc., final position of permanent floating structures.

In the case of permanent floating structures, the following procedure shall be followed out once final positioning and tensioning adjustments have been performed:

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As-built of all permanent systems, export lines, mooring lines and related tensioning data, environmental data (wind, waves, currents) should be part of a single document. The document should also comprise the following:

- Position and heading of each permanent floating structure
- LBL position attitude, orientation of each anchor
- LBL position of the mooring lines TDP
- XYZ of each mooring line including accurate position fixing at mid-depth
- Position and depth of any export line, any float, when applicable.

3.2.5 CP survey

If required, CP survey shall be carried out, in accordance with **GS EP COR 502**, as part of the final As-built Dossier.

3.3 Specific Requirements

In some specific areas additional surveys can be required when trenching and backfilling are performed.

3.3.1 Pre-trenching survey

A pre-trenching survey shall be performed prior to trenching operations if a long period of time (more than one month) has elapsed or if other works have been performed since the "as laid" survey.

The goal is to spot any anomaly appeared since the end of laying. During this ROV inspection (with continuous video recording), special attention shall be paid to:

- Any damage to coatings (and strapping if sea lines are laid in bundles)
- Possible debris on the sealine or within the laying corridor that may endanger the trenching machine.

Trench profiler data (typical distance between scans: 25 m) shall be used as a reference for the post trenching survey.

3.3.2 Post-trenching survey

The aim of this survey is to check that the top of the trenched-in sealine is at the required depth of burial below the mean undisturbed seabed level, as defined in the job specification, and to detect any free span, exposure or debris, etc.

In order to measure the depth of burial, the ROV shall be equipped with a TV, a trench profiler and a pipe tracker.

Measurements shall be taken (ROV) static every 10 m or less if required.

3.3.3 Out of Straightness survey

If the pipe is expected to be subject to Upheaval Buckling, Contractor shall perform a specific Out Of Straightness survey (OOS). Contractor shall give accurate variations of elevation of the

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pipeline using relevant equipment (odometer, digital depth sensor, etc.). From this acquired detailed Bathymetry and pressure gauge data, a comprehensive assessment of the OOS survey shall be submitted to Company under the form of tables and graphs.

In the event of buried pipe sections, a pipe tracker shall be used.

Prior to any section of as-trenched or as-backfilled being ROV surveyed, and at intervals of no greater than two hours, the pipe tracker shall be compensated for Manufacturers quoted "field strengths" based on pipeline diameters. All such compensation checks shall be recorded on video tape and shall form an integral part of the ROV dive.

Should the ROV mounted Pipe Tracker fail to provide the relevant depth of burial and OOS information, Contractor shall propose alternative solutions. The alternative methodology and instrumentation should have sufficient accuracy in order to match the UHB prevention factors as defined from the engineering study.

Processed data from the as-trenched survey and as-backfilled survey, including depth of burial and selected trench profiles, shall be incorporated in-the as-built report.

3.3.4 Pre-backfilling or dumping survey

If a long period of time (more than one month) has elapsed or if other works have been performed since the post-trenching survey, a pre-dumping survey shall be performed prior to backfilling or dumping.

This survey shall be carried out using the same equipment and procedures as as-laid survey.

3.3.5 Post-backfilling or dumping survey

The aim of this survey is to ascertain that the sealine has been covered according to job Specification.

This survey shall be carried out using the same equipment as listed in paragraph 3.3.1. Cross profile measurements shall be taken with the ROV static and correlated with pre-dump survey measurements (± 1 m longitudinal position) to be to provide:

- The thickness of material coverage over the top of the sealine
- The lateral extension of the berm.