



Exploration & Production

GENERAL SPECIFICATION

SURVEYS

GS GEO 202

Geophysical survey for offshore pipeline installation

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1. Scope

This General Specification describes the surveys required prior to sea line laying (pre-lay survey), during the laying operations (interim survey) and after the end of the sea line installation (as built survey).

If the sea line (pipeline, flexible, umbilical, cable) is subsequently lowered into a trench and/or covered by dumped material, the same series of survey is required.

This General Specification also describes the procedures to be used in order to carry out these controls successfully in accordance with requirements of the subsidiary and the Statutory Authorities.

These requirements mainly apply to:

- The pre-operation inventory of the sea line corridor and close structure conditions, so that any damage that may occur during the operations can be assigned unambiguously.
- Accurate monitoring of the touchdown point to keep the sea line within the lay down targets and the required distance from existing lines and structures.

The following may also be required:

- During current laying or curves, to make sure that the sea line is kept within the specified corridor.
- To avoid obstacles which could have been detected during the pre-lay or engineering survey.
- The depth of burial measurements where the sea line is "trenched".
- The cover thickness measurement where the sea line is covered with backfilled or dumped material.

This General Specification outlines the minimum requirements for the support vessel and survey equipment. It defines the form of the work report.

Each operation must be covered by a separate report which will therefore be prepared after:

- Pre-operation inspection
- Laying
- Trenching
- Backfilling or material dumping.

Finally, however preferably after tie-in, an "as built" report shall be issued reviewing all the different operations. It will provide the basis of the reference document to be used for later inspection.

One shall comply with this specification in carrying out the work, acquiring the data and producing the final report(s).

This General Specification should be used in conjunction with the Job Specification valid for the project.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

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.

Standards

Reference	Title
UKOOA guidelines	Guidelines for the Conduct of site Surveys for Mobile Drilling Rigs, 1995.
ISO 13623	Guidelines on the use of differential global systems in offshore surveying, 1994
IAGC	Petroleum and Natural Gas Industries – Pipeline Transportation Systems
E&P Forum	Marine Geophysical Operations Safety Manual 7 th edition, 1991
	Service Vessel Marine Safety Guidelines, Report no. 6.38/213 – December 1994
	Health, Safety, and Environmental Schedules for Marine Geophysical Operations, July 1995
	Guidelines on the use of Small Boats in Marine Geophysical Operations, July 1995
BS 8010, Part 3	Pipelines Subsea: Design, Construction and Installation
DNV	Rules for Submarine Pipeline Systems December 1996
Nederlands Normalisatie Instituut	Requirements for steel pipeline transportation systems

Professional Documents

Reference	Title
Not applicable	



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS GEO 201	Offshore geophysical surveys
GS GEO 203	Geophysical survey for offshore pipeline inspection
GS GEO 301	Offshore surface positioning works
GS GEO 302	Subsea positioning works
GS COR 502	Control by electrical measurements of cathodic protection of submerged pipelines

3. Units and abbreviations

3.1 Units

System of measurements: the SI system of units shall be used in all relevant measurements, processing and reporting.

3.2 Abbreviations

DGPS	Differential Global Positioning System
HPR	Hydroacoustic Positioning System
LBL	Long Base Line System
USBL	Ultra Short Baseline System
ROV	Remote Operated Vehicle
LAT	Lowest Astronomical Tide
CD	Chart Datum



MSL	Mean Sea Level
DCC	Distance Cross Course
TDS	Temperature Depth Salinity
VHF	Very High Frequency
WGS 84	World Geodetic System 1984
AC	Alternating current
UTM	Universal Transverse Mercator
KP	Kilometre Post

Additional terms and definitions utilized herein are defined elsewhere in the relevant contract documents.

4. Requirements and equipment

4.1 Requirements

4.1.1 Pre-lay survey

Not earlier than one month before the start of the laying operation, a side scan sonar, sub-bottom profiling (pinger) and echo sounder survey shall be performed along the intended route.

The vessel must be suitably equipped to determine precisely the position and dimensions of any buried or unburied, natural or man-made obstruction (wrecks, debris, depressions, rock outcrops, etc.) within the laying/trenching corridor.

4.1.2 ROV survey

The different controls performed at each step of the sea line installation shall be carried out using an appropriate ROV, positioned relative to its support vessel with ultra-short base line acoustics. The survey shall be carried out visually and quantitatively using the ROV survey equipment.

The requirements include (but are not limited to) the following:

- Continuous visual inspection and commented colour video recording over the center and of both sides of the sea line
- Selected still photographs or good quality videograbs in areas of interest
- Trench profiling along the route
- Continuous bathymetric profiling (multi-beam)
- Depth of burial measurements
- Cartography of the sea line.

The speed of the ROV shall be set to obtain the best possible recording quality. However, the maximum speed shall be 1 km/h.

The video recording shall be commented to describe and point out any objects or anomalies that might represent a potential problem.

The video recordings and videograb pictures must include at least the following information: identification, UTM co-ordinates, KP, date, time, depth, heading.

If the sea line is laid from the shore, the draught of the support vessel may make ROV inspection up to the landfall unfeasible. The remaining section will then be video recorded by diver. Videos and videograbs must bear the same information as here above.

In areas where permanent poor visibility does not allow visual inspection, the survey shall only be carried out by means of ROV survey equipment such as pipe tracker, trench profiler and Obstacle Avoidance Sonar.

4.1.2.1 Pre-lay survey

In addition to the side scan sonar pre-lay survey, an ROV pre-lay survey can also be performed if the theoretical layout of the sea line was not known accurately at the time of the geophysical/geotechnical corridor survey, and/or if bottom conditions were found so intricate as to require a visual investigation.

4.1.2.2 Interim survey

One of the main tasks of the ROV shall be to provide continuously, to the lay barge, the sea line touchdown X,Y position in order to keep it a minimum distance from existing structures, also, upon request, to check that it is kept on the required track or to carry out any other task such as: obstacle avoidance, crossing monitoring, etc.

Spacing from existing structures shall be measured, visually or using the Obstacle Avoidance Sonar. If an existing sea line is buried, it shall be repositioned at regular intervals, using the pipe tracker, in order to keep the required minimum distance from the sea line being laid.

4.1.2.3 As-laid survey

The as-laid survey shall take place immediately after installation of the sea line.

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

- The integrity of the coating (and strapping if sea lines are laid in bundles)
- The integrity and X, Y position of all CP anodes
- The integrity and X, Y position of any specific feature such as: T piece, crossing, etc.
- The X, Y position of the sea line
- The position of the sea line relative to the seabed
- Metrology of free spans
- Any anomalies such as damage, obstructions or obstacles within the corridor.

The above inspection shall be repeated when remedial work has been carried out.

Note: A side scan sonar survey can also be performed if there is any suspicion that damage (anchor dragging, equipment dropped, etc.) may have been caused by the resources used during the different operations.

4.1.2.4 Pre-trenching survey*

A pre-trenching survey shall be performed prior to the 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.

It shall demonstrate that no anomaly has 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 sea line or within the laying corridor that may endanger the trenching machine.

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

4.1.2.5 Post-trenching survey*

The aim of this survey is to check that the top of the trenched sea line 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.

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

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

4.1.2.6 Out of Straightness survey

If the pipe is expected to be subject to Up Heaval Buckling, CONTRACTOR shall perform a specific out of straightness survey. CONTRACTOR shall give an accurate data of the variation of elevation of the pipeline using relevant equipment (odometer, digital depth sensor, etc.). From this acquired detailed Bathymetry and pressure gauge data, a comprehensive assessment of the "out of straightness" shall be submitted to COMPANY in a form of tables and graphs.

The tables shall include:

- Listing of KP
- Target depth
- Depth of burial as indicated by each individual sensor
- Estimated top cover
- Preliminary assessment of out of straightness.

The graphs shall include:

- Plot of the natural sea bed profile
- Plot of the target depth profile (as defined at engineering stage)
- Plot of TOP profile showing progress pass after pass.

In the event that the pipe is not visible, a pipe tracker shall be used.

* If applicable



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 away from the influence of the pipeline, for MANUFACTURERS quoted "field strengths" of given 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 solution. The alternative methodology and instrumentation provided 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, to include depth of burial and selected trench profiles, shall be incorporated on the as-built.

4.1.2.7 CP survey*

CP survey shall be done in accordance with **GS COR 502** after the trenching (or after the laying if the trenching is not required)..

4.1.2.8 Pre-backfilling or dumping survey*

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

This survey shall be carried out using the same equipment and procedures as in 4.1.2.5.

4.1.2.9 Post-backfilling or dumping survey* (as-built survey)

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

This survey shall be carried out using the same equipment as in 4.1.2.5. Cross profile measurements shall be taken with the ROV stopped, and correlated with pre-dump survey measurements (± 1 m longitudinally) to provide:

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

4.2 Survey after remedial/Preventive works

Remedial/preventive works shall include but not be limited to the possible dumping of gravel over spool pieces and flanges, the installation of anti-scouring mats, the installation of free span correction devices and pre-lay pipeline route preparation works and straightness correction.

* If applicable

Should rock/gravel dumping be required for pre-lay route preparations or post-lay interventions, the survey Scope of Work shall comprise of close order DHSS and bathymetry profiles together with data from the pipe tracker.

- A longitudinal line along the centreline of the spool piece/pipeline by ROV obtaining data from the ROV echo sounder, DHSS (or Sea Bat) and pipe tracker
- Cross lines at 5 m intervals perpendicular to the spool piece/pipeline obtaining data from the ROV echo sounder, DHSS (or Sea Bat) and pipe tracker. Cross lines shall extend for a minimum of 10 m either side, and for the whole length, of the dump material
- Continuous video recordings of specific area of interest.

4.3 Equipment

4.3.1 Minimum accuracy

Installation tolerances shall be in accordance with relevant COMPANY's construction specification. These include but not be limited to, target areas, route corridors, facility orientation and parameters for trenching, backfilling and rockdumping.

- | | |
|---|----------------------------------|
| • Offshore primary and secondary surface positioning system | < ± 3 m absolute WGS 84 position |
| • Surface positioning accuracy near shore and platform area | 1.5 m within LOS |
| • Survey gyros
Repeatability < ± 0.25 degrees | Dynamic error < ± 0.7 degrees |
| • Sub-surface ultra short baseline positioning error relative to positioning vessel's transducer head | 1 % of slant range |
| • Sub-surface long baseline positioning error relative to positioning vessel's transducer head | < ± 1.5 m within the array |
| • Bathymetry (echo sounders) | < 0.1 % of water depth |
| • Digiquartz pressure sensor | ± 10 mm |
| • CTD device accuracy
0.02 % (temp)
0.5 % (depth range) | 0.005 % (salinity) |
| • ROV precision echo sounder accuracy | 0.5 % measured distance |
| • ROV pressure sensor accuracy | 0.01 % scale range |
| • ROV gyrocompass absolute direction accuracy | 1° (dynamic) |
| • ROV scanning profiler short range accuracy | 0.02 m |

The positioning system accuracy shall be adapted to achieve the tolerances of installation required in the Contract.

4.3.2 Survey datums

4.3.2.1 Geodetic parameters

The geodetic datum system for the performance of the work shall be defined in the Particular Specification.

All the co-ordinates shall be based on the single reference datum and using the UTM projection with the central meridian defined in the Particular Specification.

4.3.2.2 Tidal datums

All bathymetry measurements shall be referenced to Lowest Astronomical Tide (LAT) determined using standards recognised by the COMPANY and relating to the working area.

If accurate standards do not exist, the tidal level shall be established using observed tidal readings obtained from tide gauges offshore to be installed by CONTRACTOR.

4.3.3 Vessel

The vessel must be dedicated to ROV surveying with a dynamic positioning (DP) system with software capable of following an ROV fitted with acoustic transponder/responder, in the open sea, or close to offshore structures

The vessel shall be as per the requirements of section 6 of **GS GEO 201** specification.

In addition built-in acoustic positioning system, with retractable pole, with a tracking transducer with an accuracy in the order of 1 % of the slant distance

4.3.4 Positioning

4.3.4.1 Real time DGPS

The use of differential GPS for site investigation as a standalone positioning system is required. An absolute accuracy of ± 5 m is required for survey operations.

Refer to **GS GEO 301** for technical details concerning equipment and operational procedures.

4.3.4.2 Ultra Short Base Line (USBL) and Long Base Line (LBL) acoustic positioning

These systems shall be integrated in the primary positioning system in order to locate continuously the side scan sonar fish the other towed tools and the ROV, or to control the laying down of sea lines into initiation and/or abandonment targets.

Refer to **GS GEO 302** for technical details concerning equipment and operational procedures.

4.3.5 Integrated navigation system

Computer facilities (i.e PC) shall be interfaced to acquire the vessel's towed tools and ROV's positioning data in real time, including the data transmitted by the different sensors of the ROV. The data shall be stored, output to plotters/printers and visualised on monitors (at least two monitors shall be provided).

The available options in each navigation peripheral must include, but shall not be limited to:



4.3.5.1 Real time plot

- Antenna position
- Position of ROV corrected for lay-back or lateral offset (also when using side scan sonar)
- Scale.

4.3.5.2 Monitor

- Vessel's shape to scale
- Existing structures installed permanently, or temporary obstacles, related or unrelated to the sea line laying activities such as: acoustic beacon, dead weight, anchor line, etc.
- Display of sea line theoretical route
- Real time display of ROV (or side scan sonar) position
- Eastings and northings
- Latitude and longitude
- KP value of the ROV position
- Standard deviation
- Water depth
- Official time
- Distance cross course
- Speed
- Scale.

4.3.5.3 Printer

- Dive (or line) identification
- Fix number
- Official time
- Identification and co-ordinates of the stations used
- Gyro readings
- Eastings and Northings
- Latitude and longitude
- KP value
- Δx and Δy value between each positioning system's co-ordinates.

4.3.6 Survey equipment

4.3.6.1 Echo sounder and side scan sonar

Refer to **GS GEO 201** for technical details concerning equipment and operational procedures.

4.3.6.2 Magnetometer

A magnetometer with a sensitivity of 0.01 gamma should normally be used to relocate a buried pipeline or telephone cable in use. Relocation of power cable or disused telephone cable may require the use of a 3-axis magnetometer in some cases with low frequency AC signal injection.

The proposed system shall include the graphic recorder, sensors, winch and tow cable long enough to tow the sensor well outside the magnetic field of the vessel.

Typically, the magnetometer sensor is towed a couple of metres above the sea bottom. A depth sensor is therefore mandatory.

If available at the time of the pre-lay survey, the ROV pipe/cable tracker may also be used

4.3.6.3 Remote Operated submersible Vehicle (ROV)

The proposed ROV, its survey and acoustic positioning equipment must be adequate for the water depth and environmental conditions expected in the area (Deep water mandatorily entails the use of a tether monitor system).

The ROV must have sufficient power to progress in currents up to 1.0 knot from any direction and to overcome drag forces on the umbilical paid out, even if the touchdown (and drift from the touchdown to existing structures) is monitored from the lay barge.

The ROV must have sufficient payload to carry its basic equipment outfit and the survey equipment defined below:

- High frequency obstacle avoidance sonar
- Closed circuit colour television system (at least three (3) cameras)
- Compass
- Bathymetric survey suite comprising an echo sounder and depth sensors
- Trench profiler or multi-beam sonar with pitch/roll measurement of the ROV
- Pipe tracker
- Acoustic transponder/responder (USBL system compatible with survey vessel acoustic system)
- Acoustic transponder (for positioning the ROV inside the LBL array)
- Full function manipulator (at least five functions), wire cutters
- Trench profiler frame (if necessary) to allow visual and cross profile in one pass
- Rollers compatible with pipe diameter
- CP system for continuous and remote CP readings.

The umbilical capacity and multiplexer system must be sufficient to supply all the required power to control the ROV and its equipment and to transmit all the sensor signals, when used simultaneously, with no mutual interference.

4.3.6.3.1 Closed-circuit television system

The ROV shall be equipped with at least (depending on the sea line diameter) Three colour video cameras positioned on both sides and mounted on pan and tilt units.

Each camera shall be controlled from the surface control unit, and recorded on original video tapes with voice commenting and appropriate annotation (UTM, KP's, etc.) superimposed on the display. Good lighting is required to ensure high quality video data.

The surface control room shall include:

- The control console
- The navigation control monitor
- The colour TV monitors
- The data and video recording systems.

4.3.6.3.2 Video print facilities

Printing from the video tape shall be available upon request.

4.3.6.3.3 Compass

The ROV shall be equipped with a 'FOG Gyro-Compass' and its calibration shall be checked at regular intervals against the vessel's gyrocompass.

4.3.6.3.4 Bathymetric survey suite

In order to provide highly accurate depth measurements along the sea line and riser, the ROV shall be equipped with a high precision altimeter together with a high precision pressure sensor (0.1 % of the water depth).

Both sensors must be calibrated and the results compared with those of a vessel's hull mounted high precision echo sounder. Depth information shall be logged for further integration in the processing and drafting sequence (longitudinal profile of pipeline and seafloor).

The velocity through the water column shall be calculated using appropriate equipment.

Atmospheric pressure shall be taken into account.

4.3.6.3.5 Trench profiler

A trench profiler shall be provided in order to obtain the unburied sea line position in the vertical plane, relative to the undisturbed seabed.

In addition to the video display (to be recorded on tape), these scans shall also be recorded on disk, together with the ROV pitch/roll measurements and high accuracy depth data needed for further processing.

4.3.6.3.6 Pipe and cable tracking system

When the sea line is buried because of natural backfilling, self lowering or material dumping, the sea line position shall be obtained from a pipe and cable tracking system.

This equipment shall be mounted on the front of the ROV, within sight of the front cameras.

The configuration and size of the coils (minimum 3) shall be determined according to the size and nature of the sea line.

Vertical and horizontal range to target shall be obtained and depth of burial computed using information from a dedicated altimeter, along with the natural sea-bed level obtained simultaneously with the trench profiler.

Target representations and numeric indications shall be displayed on the surface console and recorded on video tapes.

All digital data shall be logged on disk for further processing and outputting the depth of burial profile.

4.3.6.3.7 Out of straightness measuring system

In the event of high pressure, high temperature fluid being carried through a small diameter pipeline (< 16 inch), it may be necessary to measure accurately the vertical undulations after trenching, in order to detect potential risk of heaving/buckling and therefore, to anticipate the nature and amount of remedial dumping material.

The basic system comprises two elements:

- High precision pressure sensor
- High precision odometer.

Data from both sensors must be digitized for further processing.

Tide variation recording is mandatory, during the out of straightness measurements.

5. Quality control and reporting

5.1 Quality control

5.1.1 Equipment quality control

All equipment must be installed and operated in accordance with the MANUFACTURER's specifications.

All items of equipment must be tested and calibrated in accordance with the operator's and MANUFACTURER's procedures, as often as required, in order to ensure that the equipment is providing consistent, reliable data during the course of the survey.

Laboratory calibration certificates must be available on board. Results of field calibrations must be submitted to the onboard representative for approval.

Copies of laboratory and field calibrations shall be included in the appendices of the final report.

Equipment provided must be of recent make. Maintenance certificates must be available on board.

5.1.2 Spare parts

All key equipment must be duplicated and all necessary spare parts supplied to avoid down time during the survey. A detailed list of the back-up equipment and of all spare parts must be documented in the tender documents and checked by the onboard representative(s) during the vessel's mobilisation safety audit and the key equipment functional tests.

The detailed technical manual of each item of equipment must be available on board.

5.2 Reporting

5.2.1 Field report

The sea line data base shall be delivered to the onboard representative before survey demobilisation. It shall include:

5.2.1.1 After sea line laying

- Date
- Time
- Field joint number
- KP
- UTM co-ordinates
- DCC
- Corresponding video tape number.

5.2.1.2 After sea line trenching

As 5.2.1.1. In addition, the depth below undisturbed seabed level shall be indicated (spacing 5 to 10 metres).

5.2.1.3 After material dumping

As 5.2.1.2. In addition, the thickness of the dumped material shall also be indicated at similar intervals.

In addition, the preliminary report must include separate event logs such as:

- Anode
- Damage
- Free span
- Natural self lowering
- Debris
- Other.

As for the sea line data base, these logs shall be presented in the form of event printouts comprising the following information:

- Date
- Time
- KP
- UTM co-ordinates
- Type of event
- Corresponding video tape number
- Corresponding still number^(*)



- Comments or description
- Dimensions^(*).

As mentioned in chapter 1, each operation shall be covered by a separate report. There will therefore be an "as laid", "as trenched" and "as dumped" ("as built") report. However, if the different operations are performed by the same CONTRACTOR within a one month period, only section 2 "Results" of the final report will differ.

This report shall be accompanied by a copy on CD disks of the raw UTM co-ordinates of the sea line (ASCII format).

5.2.2 Final report

A draft of each final report shall be submitted to the COMPANY supervisor for approval not later than 4 (four) weeks after survey completion.

It shall be entitled:

Company name
Block reference and location name
Type of sea line, diameter, start and end of line location
CONTRACTOR'S name
Start/end dates of offshore works
As laid Survey report or "as-trenched" or "as-built"

The first page of the report certification must specify the date of issue, the name and signature of issuing authority, Party Chief in charge of field works and all personnel involved in its preparation.

Date, relevant names and signatures should also be indicated on each chart.

The final report shall be written according to (but not limited to) the following guidelines:

Section 1: Introduction

Giving a brief description of the operation, date of survey, situation plan with existing structures, obstructions, etc. and the theoretical sea line data base.

Section 2: Results

This section shall provide an extensive summary of the sea line data base (every pipeline field joint 10 to 20 metres spacing for a cable or a flexible) and event logs already presented in the preliminary report:

- The undisturbed seabed level is the reference for any vertical measurement of the sea line top after laying, trenching or material dumping.
- The burial depth is the depth of sea line top relative to the natural seabed level.
- The coverage is the vertical distance from the top of the sea line to the surface of the overlaying material.
- After trenching or dumping, the lateral range of the trench profiler must allow unambiguous reading of the seabed level, outside the area affected by excavated soils or spreading of dumped material.

^(*) If applicable

- Of the scans performed after laying, trenching or material dumping, those selected for reporting shall have the same KP's and interval for comparison purposes.
- Any measurement related to the undisturbed seabed level must be corrected for tide variation.

Section 3: Procedures and statistics

This section shall review the work definition and technical specification and provide an extensive description of the resources used to perform the whole survey:

- Vessel and survey equipment including: side scan sonar, echo sounder, gyrocompasses, etc.
- Surface positioning systems
- Acoustic positioning systems
- ROV and ROV sensors such as altimeter and pressure sensor, gyrocompass, trench profiler, pipe-tracker
- ROV video equipment
- Video recording and display system.

Section 4: Quality control of results

This section shall provide an extensive description of the performances of the resources used as listed in chapter 4.3, together with all port and offshore calibration results, equipment layout data examples, etc.

Section 5: Cross profile catalogue

This section shall include the scans obtained from the trench profiler.

Each scan (typical spacing 5-10 metres) shall be displayed with a horizontal and vertical scale of 1 cm = 1 metre. The following information should be included:

- ROV dive number
- Scan number
- Date
- Time
- KP
- UTM co-ordinates
- Tide value at time of scan
- ROV depth, including trench profiler offset
- Natural seabed level left/right
- Natural seabed level mean
- Depth of sea line top
- Burial depth (positive value if above, negative value if buried)

- Depth of trench (or residual trench if sea line covered)
- Thickness of overlaying material (cover).

Section 6: Appendices

- Appendix 1: Reduction of all charts to A3 standard size
- Appendix 2: Summarized tidal data, tide curve and correlation to chart datum
- Appendix 3: Personnel involved
- Appendix 4: Diary of events
- Appendix 5: Survey station co-ordinates and description
- Appendix 6: Offset diagrams
- Appendix 7: Video tape index (ROV)
- Appendix 8: Video print-out log (ROV)
- Appendix 9: Sea line inspection sheets (ROV)
- Appendix 10: Listing of original records.

Section 7: Maps

Because of the reduction of all charts to A3 standard size, special attention must be paid to the printing quality.

All maps should show the geographical and grid co-ordinates, as well as the survey grid (in filigree) and a true North arrow.

All symbols used must be explained in a key.

The key map must be presented on a situation plan.

Each map should have an overlap of 10 cm approximately.

The match line must be clearly shown.

The personnel in charge, date of issue and revision number must be indicated on each map.

The scale of all alignment sheets and the horizontal scale of the cross-sections shall be as follows:

- 1/2,500 for a corridor length < 10,000 m
- 1/5,000 for a corridor length < 20,000 m
- 1/10,000 for a corridor length > 20,000 m

The following maps are required:

General situation map

Showing the intended sea line route, the existing platforms, cables, pipelines and, in general, all place names used in the report. This map must also appear in the text.

Separate drawings of initiation and lay-down or crossing areas

Scale 1/1000 with position of existing sea lines, LBL array, LBL beacons on sea line, theoretical target, final position of initiation or lay-down head, existing structures (theoretical and "as found" co-ordinates), theoretical and final heading, etc.

Alignment sheet

The results on the sea line route shall be presented in the form of alignment sheets having 4 (four) thematic "windows" in the following order:

1. Plan view of the sea line

In this box, the sea line actual position is overlaid with various sets of information obtained from the geophysical/geotechnical corridor survey and from the pre-lay survey:

- Bathymetric contours (0.5 m contour interval), reference LAT.
- Kilometric chaining along the sea line showing kilometre posts (with co-ordinates) and ticks every 100 metres.
- Theoretical sea line route, in filigree, together with the main geodetic points along the sea line (turning point, tangent point, curvature radius, etc.).
- Existing structures.
- Debris within the side scan sonar range (detected during the pre-lay survey or the as-built survey).

The information obtained from the ROV survey shall be added:

- Anomaly
- Free span
- Video tape change
- Damage
- Picture number.

All the above events shall be documented with corresponding KP and UTM co-ordinates.

2. Longitudinal profile of sea line and seabed

With representation of the top and bottom of the sea line relative to the natural seabed level.

The kilometric chaining (ticks every 100 m) must also be drawn and the main events listed above reported in same manner as in Box 1.

If the longitudinal profile follows a material dumping operation, the top of overlaying material must also be indicated.

3. Cross profiles

This must provide the most convenient representation (spacing 50-100 metres) of the cross profile extensively presented in the catalogue.

Selected profiles must illustrate, as far as practical, significant events such as free span, self lowering, exposures, etc.

4. Engineering information

This window should provide information not appropriate to the previous window(s) i.e.:

- KP with ticks every 100 metres
- Video tape index
- Video print index



- Joint
- Anode
- Free span
- Self lowering
- Damage
- Debris
- Other.

In the event of bundle laying, the following should also be included:

- Joint and anode of the attached sea line
- Saddle-block or clamp
- Damage to the sea line
- Clock face position when different from vertical.

6. Document delivery

6.1 Final report

When the final version of the survey report has been approved and amended accordingly, it shall be output and dispatched, together with a PC compatible CD ROM copy of the full report in Word for Windows format and in Adobe Acrobat.PDF format, according to the distribution list included in the job specification.

In addition, all charts shall be digitized and stored on CD ROM in DGN and DWG/ DXF format and the sea line database must be copied (ASCII format) for reading in Excel.

6.2 Video tapes

Tapes must be fully labelled, referenced and sent when and where required in the job specification.

6.3 Field data

All original records must be sent soon after the report has been delivered and must comply with following requirements:

- Each file and roll shall be assigned a number and recorded on the same listing. The detailed listing of original records, including the common reference numbers, shall be included in Appendix 10 (see section 6 of chapter 5.2.2). It will indicate, for each file roll:

The file or roll number

Profile numbers with, for each, the first and last fix numbers

The date of the recording

The location name.

- Data disclosure is not allowed without written approval.