

GENERAL SPECIFICATION

SURVEYS

GS EP GEO 110

Requirements for Offshore Survey Vessels

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1. Scope

1.1 Objective

The present General Specification defines the basic requirements for vessels performing offshore survey or construction support works under direct Contract for the Company, or under the responsibility of a Sub-Contractor working for the Company, irrespective of flag or ownership. The objective is to reduce the hazards and risks which may affect survey vessels and their crew under normal operations, and to specify the minimum standard for communication, equipment and work space dedicated to survey operations.

The scope of the document covers both survey construction support vessels, geophysical survey vessels and geotechnical coring vessels, for both dedicated purposely built and permanently converted survey vessels, or for temporarily used vessels.

Other offshore service vessels, e.g. supply vessels, standby vessels, towing vessels, personnel transfer vessels, anchor handling vessels, construction crane vessels, diving support vessels, etc., are covered by other documents.

1.2 Abbreviations

- AHTS Anchor Handling Supply Vessel
- CCTV Closed Circuit TeleVision
- CP Cathodic Protection
- CPT Cone Penetration Test
- DP Dynamic Positioning
- ERP Emergency Response Procedure/Plan
- IMO International Maritime Organization
- ISM International Safety Management
- LBL Long Base Line
- LEL Lower Explosion Level
- MOB Man Over Board
- MPSV Multi-purpose – Platform Supply Vessel
- MRU Motion Reference Unit
- OCIMF Oil Company International Marine Forum
- OIM Offshore Installation Manager
- OVID Offshore Vessel Information Database
- PFD Personnel Flotation Device
- PPE Personnel Protective Equipment

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- PSV Platform Supply Vessel
- QHSE Quality Health Safety & Environment
- RA / JHA Risk Analysis / Job Hazard Assessment
- ROV Remotely Operated Vehicle
- RSES Responsible for Safety and Environment on Site
- SIT Silicone Intensified Target
- SWL Safe Working Load
- TMS Tether Management System
- USBL Ultra Short Base Line
- VHF / UHF Very High Frequency / Ultra High Frequency

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
API RP 7G	Recommended Practice for Drill Stem Design and Operating Limits
API Spec. 13A	Specification for Drilling-Fluid Materials
API Spec. 4F	Specification for Drilling and Well Servicing Structures
IMO - ISM	International Safety Management
IMO - ISPS	International Ship and Port Facility Security Code
IMO - MARPOL	International Convention for the Prevention of Pollution from Ships
IMO - MODU	Mobil Offshore Drilling Unit
IMO – SOLAS 74	International Conventions for the Safety of Life at Sea
IMO – STCW-95	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers Guidelines for vessels with dynamic positioning systems
IMO A.481 (XII)	Principles of Safe Manning
IMO A.538 (13)	Maritime Safety Training of Personnel on Mobile Offshore Units
IMO A.680 (17)	Guidelines on Management for the Safe Operation of Ships and for Pollution Prevention

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Reference	Title
IMO MSC Circ. 645	Guidelines for Vessels with Dynamic Positioning Systems
ISO 10407	Petroleum and Natural Gas Industries - Drilling and Production Equipment - Drill Stem Design and Operating Limits
ISO 11961	Petroleum and Natural Gas Industries - Steel Pipes for Use as Drill Pipe - Specification
ISO 13500	Petroleum and Natural Gas Industries - Drilling Fluid Materials - Specifications and Tests
ISO 15546	Petroleum and Natural Gas Industries - Aluminium Alloy Drill Pipe
NORSOK J-003	Marine Operations
OGP and AIGC	All reference documents and safety manuals

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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 GEO 101	Offshore Geotechnical Soil Survey
GS EP GEO 201	Offshore geophysical surveys
GS EP GEO 202	Geophysical Survey for the Installation and/or the Inspection of Offshore Structures and Pipelines
GS EP LSO 202	Personnel transfer between watercrafts and between watercrafts and offshore structures
GS EP LSO 207	Notices to mariners and restricted navigation zone
GS EP LSO 306	Selection and Operation of Dynamically Positioned Vessels
GS EP POS 001	Offshore surface positioning works
GS EP POS 002	Subsea positioning works
GS EP STR 402	Anchorage for support vessel on an offshore site

3. General requirements

3.1 Safety requirements

3.1.1 Safety and quality management

In order to enhance safety of marine operations, Company applies a strict marine operations control system. This system is fully described in Company's rules and procedures.

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Contractor will have to comply with this system, and particularly with the following control steps:

3.1.1.1 Contractor qualification for marine services

Company selects Contractors that are entitled to provide marine services through a pre qualification system.

Marine services are those performed using vessel(s) including, but not limited to, PSV, AHTS, TUG, CREWBOATS, MPSV, DSV, FLOTEL, WORKBARGE charter.

The qualification evaluation is based on a documentary review, linked with a standard questionnaire. It includes 3 parts: Technical/QHSE, Financial situation, Compliance.

The Technical/QHSE part is mainly based on IMO's ISM code, technical and personnel management evaluation.

As part of the execution of the contract, all contractors operating marine units (contract holder or sub-contractor as applicable) will have to be qualified by Company for marine services.

Should a marine operator fail to be qualified, even for the contract holder, Contractor will have to nominate an alternate qualified operator for the related marine operation.

Potential marine operators therefore need to be nominated in due time so that their actual status can be confirmed, and to launch a qualification process if necessary (2 to 3 months are necessary).

It should be noted that there is a similar (but independent) qualification system for diving and ROV services contractors.

3.1.1.2 Vessels selection

All vessels that will be nominated within the contract's Marine Support Services will have to be inspected and accepted by Company.

Inspections will be based on the OCIMF's OVID system. Vessel owner/operator will be responsible of registering his vessel(s) into the OVID electronic database, to fill in and update the online particulars questionnaire, and to review/comment on-line the inspection report after the inspection.

Should a vessel not be accepted after inspection evaluation, Contractor will have to nominate an alternate vessel.

- **There is no age limit for surface support vessels built initially as geophysical survey vessel, geotechnical survey vessel, and survey assistance vessels - vessels older than 20 years need to be inspected annually and maintenance and dry docking records will be required for evaluation**
- **For geophysical survey vessels, geotechnical survey vessels and survey assistance vessels who had initially another function but have been converted into survey or survey assistance vessels the age limitation is 20 years.**

3.1.1.3 Procedure control

All marine operation procedures (including but not limited to towing, moving, mooring...) will have to be submitted to Company for approval before being implemented. Any rejected procedure will have to be re issued and re submitted to Company.

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The full compliance with the approved procedures will be checked by Company by any appropriate way, including the attendance of Company man onboard vessels during the operations. Company will be entitled to stop the operations if the procedure is not fully applied or if vessels condition or environment conditions justifies it.

3.1.1.4 Complementary measures

In addition to the above, Contractor agrees that Company proceeds to formal and/or informal inspections on board chartered vessels upon request.

Contractor also agrees that Headquarters or Affiliates of nominated marine operators (contract holder or sub contractor) are audited by Company's marine specialists upon request.

3.1.2 Risk analysis and job hazard assessment

Risk analysis and job hazard assessment (RA/JHA) documents covering all operations and activities on the survey vessel shall be established. Project specific risk analyses and hazard assessments may be required on certain projects, for example for a geotechnical survey vessel drilling in a suspected shallow gas area (see section 6.2).

Further, the vessel Owner/Manager shall have established emergency response procedures (ERP) to ensure that any emergency can be handled safely, including any potential emergency situations that may arise in conjunction with survey operations on the vessel, which are likely to represent a danger to personnel, environment or equipment.

All accidents and incidents occurring on board a survey vessel under Contract shall be reported to the Company as soon as reasonably practicable in addition to any Contractor, vessel Owner/Manager, or flag state reporting requirements.

All incidents with the potential to cause pollution, or which have already resulted in such, must be reported to the Company and to the appropriate Regulatory Bodies.

Master of the vessel must ensure that all wastes are properly stowed, secured and segregated. All wastes shall be properly declared, packaged and marked in accordance with legislation prior to their transfer to a quayside facility. Waste disposal records shall be provided to Company.

Maintenance records shall be as per qualification requirements.

3.1.3 Safety zones and offshore responsibilities

Vessels are prohibited from entering inside the 500-metre safety zone around an offshore installation, or a temporary limited area corresponding to a safety zone, without formal approval issued by the Company Representative (refer to the General Specification [GS EP LSO 207](#)).

Vessels operating inside the safety zone are under the responsibility of the Company Offshore Installation Manager (OIM), acting as Responsible for Safety and Environment on Site (RSES). Masters should co-operate with OIM/RSES in carrying out their responsibilities, for example, OIM/RSES can modify or terminate any survey vessel activity which they regard as hazardous with respect to other operations which may be in progress. In particular, any hot work permit approved by the Master shall also be approved and counter-signed by the OIM/RSES, and the Master shall ensure that the OIM/RSES is advised when the work/permit is complete.

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Prior to entering the 500-metre safety zone surrounding a floating structure, and prior to manoeuvring close to the structure, the Master shall ascertain the following as part of the pre-approach checks:

- Vessel propulsion systems
- Motion characteristics of the floater
- Number and type of thrusters running on the floater (if any)
- Floater mooring system characteristics and position of the mooring lines (if applicable)
- Sea height and its effect on the vessel's position keeping capability
- Wind and current characteristics at the site
- Weather conditions and risk of weather deterioration.

Should equipment failure or a problem occur with the survey vessel's machinery/control systems, the Master must inform the OIM/RSES immediately and leave the 500-metre safety zone as soon as practicable. The vessel will not be allowed to re-enter until remedial action has been taken and that the Master and OIM/RSES are satisfied that the vessel is fully operational.

For a survey vessel operating in open seas outside safety zones, the Company Representative on board the vessel acts as RSES, in particular for liaison between the Master and the Company facilities offshore and/or onshore.

Fishing within the 500-metre safety zone is strictly prohibited.

3.1.4 Vessel classification

All survey vessels shall maintain valid class with a recognised Classification Society.

The classification should include all systems of importance to the safety of the operations, i.e. mooring systems, dynamic positioning (DP) systems, helicopter landing systems (if any), cargo handling systems, crane or lifting systems (e.g. A-frame, etc.), diving systems or sub-sea operations systems (e.g. ROV, if applicable), etc.

3.1.5 Communications and liaison between the Contracted vessel and the Company

A direct line of communication shall be established between the Master of the survey vessel and the Company facilities offshore and/or onshore, using VHF/UHF channel, satellite phone/fax, or mobile cell phone. Contacts from all parties shall be clearly identified for this purpose.

This direct communication line should not replace the first offshore communication between the Master of the survey vessel and the OIM/RSES but should complement it by ensuring that any on-going safety issues or other urgent concerns can be resolved efficiently.

Vessel shall maintain a continuous listening watch on the nominated working VHF/UHF channels. The survey vessel must also monitor the international marine emergency VHF channel at all times.

Effective communication shall be maintained between the bridge, engine room and deck crew at all times.

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Weather forecast information for the intended survey work locations should be obtained on a daily basis as a minimum.

3.1.6 Personnel

All personnel participating in marine operations shall have valid safety training and medical fit certificates, including specialist survey personnel working temporarily on vessels. The vessel Owner/Manager has the responsibility to ensure that the Master and crew are adequately trained, experienced, certificated and familiarised for the survey tasks they will undertake.

Vessel crews shall participate in regular safety drills, exercises and safety meetings, and shall have time allowed to carry out certain mandatory health and safety requirements.

All personnel shall be qualified for their assigned work. Qualifications requirements shall be specified for job categories of significance to safety and security.

The Master is responsible for ensuring that specialist survey personnel temporarily joining the vessel receives a safety induction briefing at time of joining the vessel or as soon as practicable thereafter. As a minimum, such briefing shall include but not be limited to the following:

- Emergency alarms and actions to be taken on hearing alarms
- Position of muster stations
- Position and use of life jackets and survival suits
- Vessel familiarisation tour
- Abandon ship routine
- Substance abuse policy
- Specific survey working practices (if applicable).

Appropriate personnel protective equipment (PPE) shall be worn at all times by all crew and survey personnel outside accommodation.

In specific survey operations area (e.g. back deck of a geophysical survey vessel carrying streamers and seismic source winches, or drill deck of a geotechnical drilling vessel), personnel not involved directly with operations must keep clear of the work area at all times.

Survey equipment temporarily loaded on the vessel shall not obstruct escape ways which shall be clear of any objects at all times.

Any use of alcohol, drugs or narcotics is prohibited. Procedures shall be established for personnel who need medication for due medical reasons.

Key personnel participating in marine operations shall be able to speak English correctly for ensuring good communication between the crew and the specialist survey personnel.

Unless otherwise indicated, the survey vessel shall be adequately manned to work on the basis of 24 hours per day. When determining the crew level and working practices, the specialised nature, hazards and risks associated with survey operations must be taken into account. If necessary, the Master and the OIM/RSES should discuss the intended operation so as to minimise, as far as possible, the problem of fatigue and to ensure the crew and survey personnel have adequate rest periods.

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3.1.7 Personnel transfer offshore

Direct transfers between watercraft and/or installations are not allowed. Transfer of personnel offshore from the survey vessel to a fixed platform or another vessel shall be made following Company approved procedures using approved equipment, e.g., by surfer/boat landing, personnel basket, pilot ladders or swing ropes (refer to the General Specification [GS EP LSO 202](#)).

Personnel transfer by basket should be limited to emergency situations, or only used when other solutions are not possible or unsafe. Master shall be aware of Contractor's and Company's instructions with regard to personnel basket transfer, but as a minimum:

- Master, OIM/RSES, crane driver and passengers shall be in agreement that it is safe to proceed with the transfer
- There must be a clear deck space with a minimum diameter of 6 meter for the safe landing of the basket plus an area around the landing circle of minimum 2 meters available to allow a safe transfer. There shall be no obstructions within these areas
- Standby boats (if any) shall be informed and shall be on close standby with fast rescue craft made ready
- All personnel involved are to be briefed on safety procedures and be supplied with appropriate safety equipment
- Cranes used shall be certified for manriding.

Transfer by MOB or rescue boat should only be used in case of emergency (refer to the General Specification [GS EP LSO 202](#)).

3.1.8 Verification of compliance

Before a vessel enters into service for Company under Contract, the Contractor shall confirm that the requirements outlined in this document are complied with. Any non-compliance with regard to these requirements shall be identified and reported. Necessary corrective actions must be proposed, and reasons shall be stated for those non-conformances which are proposed for acceptance.

To ensure the observance of good practice and compliance with relevant requirements, audits or inspections of vessels (suitability inspections), equipment, safety and quality management systems and documents may at any time be performed by Company.

As a minimum, inspection and audits of survey vessels shall include:

- Vessel classification certificates
- Certification of safety equipment on board the vessel
- In some cases, the survey of vessel's structure, main and auxiliary engines
- Manning and certification of crews
- Last quarterly status report on board
- Arrangements on vessel for dealing with the prevention of pollution

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- Crew accommodation and related matters (e.g. galley, mess room, recreation room, food stores, etc.)
- Operational arrangements for the survey work.

Any non-conformance revealed during such audits or inspections shall be promptly corrected and re-inspected for acceptance by Company.

3.2 Position keeping requirements

3.2.1 Moorings and anchors

The mooring system and anchors shall be verified by a competent specialist or institution, and the mooring wires and ancillary equipment such as shackles, swivels and others shall be certified. The mooring system should be verified to have the required capacity for the proposed seabed, environmental conditions, water depth and survey work.

A survey vessel without dynamic positioning shall have at least 2 propellers and bow thrusters. Geotechnical vessel shall be equipped with 4-point mooring systems, and shall be able to lay her anchors alone. The vessel specifications shall clearly state the water depth limitations for self-mooring capability as well for mooring with assistance of anchor handling tugs.

When assistance is required from anchor handling tugs, the Master of the survey vessel shall have the responsibility for ensuring that anchor handling tugs, together with their equipment, are fit for purpose and adequately manned by competent personnel with the relevant experience. If possible, Masters and key personnel in charge of anchor handling should be briefed prior to leaving port or, failing that, on location prior to anchoring operations. Full procedures for anchors installation and/or retrieval should be agreed by Masters and key personnel involved. In addition, each Master should hold a pre-job meeting with his own crew to ensure that his anchor handling procedures are fully understood and in agreement with his own safety procedures. There should be agreement on to the responsibility for providing additional mooring equipment (e.g. piggy-back anchors, buoys, pennant wires, etc.) and agreement as to the amount and specification of such equipment.

If required, a mooring analysis shall be performed by qualified personnel using an approved computer programme, to verify compliance with minimum safety factors under the applicable weather conditions.

3.2.2 Dynamic positioning

DP vessels shall be designed, equipped and operated in accordance with [IMO MSC Circ. 645](#) and Company General Specification [GS EP LSO 306](#).

The minimum DP class requirements shall be as lined out in Company Specification [GS EP LSO 306](#).

Voice intercommunication shall be available to enable necessary information between DP operators and all other parties directly involved in or responsible for survey operations. All essential communication systems should be provided with 100% redundancy.

Audio-visual alarms shall be connected to the DP system to draw the attention of personnel responsible for survey operations whose safety is dependent upon the vessel's position keeping to an indication of degraded status.

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For DP vessels using a sub-sea positioning system in the 500-metre safety zone or in the area surrounding ongoing sub-sea construction works, it shall be checked that the vessel's positioning system does not interfere with acoustic frequencies utilised for other sub-sea works which may be in progress (refer to the General Specification **GS EP POS 002**). When available, the frequency allocation plan shall be checked against DP selected frequencies.

Use of manual positioning for certain types operations is not excluded, provided that Contractor can demonstrate that the required survey work can be performed safely and in compliance with the Company requirements.

3.2.3 Pipelines and sub-sea obstructions/structures

All relevant parties involved must have full details regarding the location of pipelines and sub-sea obstructions/structures relating to the whole survey work.

The vessel and its mooring lines and anchors shall be located at a safe distance from any sub-sea or sea surface obstructions/structures, including pipelines, cables, wellheads, risers, fixed or floating platforms, mooring buoys, navigation marks, etc. Safe distance shall be defined prior to starting offshore survey operations, paying due consideration to site and work conditions, and be included in the project operations procedure. In all cases, it shall never be less than 200 m or 400 m when an anchor line crosses a pipeline (refer to the General Specification **GS EP STR 402**).

When it is known that anchor handling operations will be conducted near to pipelines or sub-sea obstructions/structures, then full written procedures shall be agreed by all parties and shall not proceed before formal approval has been given by the Company Representative.

Prior to anchoring or performing survey work near any pipelines or sub-sea obstructions/structures, detailed check of the positioning equipment of the vessel shall be performed and agreed by all parties (refer to the General Specification **GS EP POS 001**). If necessary, equipment to verify the exact location of the obstructions/structures on the seabed (e.g. side scan sonar, ROV, etc.) should be available.

3.2.4 Weather conditions

The Master has responsibility for the safety of the vessel and crew. If requested to work on deteriorating weather conditions, the Master should assess all potential risks on the basis of his knowledge of the vessel's behaviour. Such a risk assessment should include but not be limited to:

- Experience of Master
- Sea height and its effect on the vessel's position keeping
- Prevailing wind speed and direction
- Weather forecast
- Vessel's power management configuration and confidence in the reliability of power generation equipment and propulsion units.

Based on the Master's experience, vessel environmental limitations for safe marine operations shall be established, including, but not limited to, maximum wave height, current and wind speed.

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When deteriorating weather conditions may affect the results of the survey work, specific limitations for safe offshore survey operations shall be established in co-operation with the Company Representative.

In the event of any conflict of requirements between the Master of the survey vessel and the Company Representative, the final decision shall rest with the Master.

3.3 Electrical and welding equipments, and handling of gases and chemicals

3.3.1 Electrical equipment and wiring

The OGP schedules refer to the IAGC Safety Manual for electrical equipment and wiring. Assuming the vessel has been built to an accepted standard, concerns can be limited to the general condition of electrical equipment and wiring, the safety of any modifications, the arrangements for the use of portable electrical tools, and the general practises adopted for electrical installation and repair. The extent of the redundancy of electrical power generation should also be checked.

3.3.2 Welding equipment

a) Electric arc welding

- Direct current welding preferred
- Electrode holders to have completely insulated heads
- Cable lugs to be insulated
- Cables to be free of damage and no mechanical joints permitted.

b) Gas welding/cutting

- Gas hoses to be identified by distinctive colours, in general red for fuel and blue for oxygen
- Hoses to be protected from damage and from kinking
- Hoses to be frequently inspected for leaks, wear and loose connections
- Flashback arrestor to be fitted on fuel line immediately after the regulator.

c) Industrial compressed gas cylinders

- Top valve assemblies to be protected by guards or caps
- Be maintained in good condition and clearly show the date of manufacture and the last hydrostatic test
- The name of the gas in the cylinder to be clearly stencilled on the cylinder body.

3.3.3 Chemicals

- All chemicals to be packed and labelled with contents and stored in accordance with internationally recognised standards
- Contractor to be familiar with the hazards of all chemicals used

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- Personal protective equipment to be provided if required
- All necessary precautionary measures to be taken including availability for fire extinguisher, first aid kit, and eye wash
- Eye wash to be available when handling chemicals and adjacent to battery charging areas
- Chemical spillages to be contained and cleared up
- Waste and containers to be disposed of in an environmentally sound manner
- Freon should not be used as a general solvent and general cleaning agent.

In the US and Europe there are regulations concerning the ready availability of information in the work place about potentially harmful chemicals that may be in use. This information is often in the form of "HAZCHEM" sheets and covers the safe transport, safe storage, and safe use of the substance. Information is also provided on the actions to be taken in the event of ingestion, inhalation or splashing. Although not in the OGP schedules, the ready availability of this advice should be confirmed.

3.3.4 Lifting equipment

A register of lifting equipment and shackles is to be kept:

- Inspection certificates to be available (if requested by Client) for annual surveys (inspections) of all cranes, side booms and lifting slings and shackles
- Tests and inspections requested by Company Representative also to be carried out
- Safe Working loads (SWL) and radius charts to be available for all lifting equipment and to be marked on equipment.

3.3.5 Pressurised systems

Pressure systems to be properly maintained and regularly inspected:

- Where necessary inspected by a competent person in accordance with a written scheme prepared by the Contractor
- The interval between inspections to be specified by competent national authority, and in any case not more than five years.

4. Technical requirements for survey construction support vessels (deep water operations)

4.1 General

The survey construction support vessel shall be fitted with a DP class system as lined out in Company General Specification **GS EP LSO 306**, equipped with a min 100HP work ROV for deep water surveying, and fast winch.

The vessel shall fully comply with the requirements of **GS EP POS 001** surface positioning specification and **GS EP POS 002** subsea positioning specification.

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Survey vessel shall be equipped with built-in, high accuracy USBL system, interfaced to DP system, with retractable built-in pole for transducer, providing an accuracy around 0.5% of slant range (95% confidence level) for deepwater survey.

In order to use vessel USBL system for survey purpose, Contractor shall verify and provide evidence that the sensors associated to USBL system are compatible with the level of accuracy required. In particular, gyrocompass and MRU shall be survey grade equipment, lately serviced and checked and fully calibrated.

The minimum requirements for a survey vessel are:

- Two high accuracy surface positioning systems interfaced to DP system
- High accuracy subsea positioning interfaced to DP system (DP2 or above)
- A 100 HP work ROV for deep water equipped with TMS and minimum 250m long tether
- CCTV system with ROV video channels
- Close loop local network for data transfer between ROV control room, survey room, processing and mapping office
- Intercom system between, ROV control room, survey, deck and bridge, with VHF working on a dedicated channel for contingency
- Data and video transmission to other surface unit
- Data processing and mapping facility installed in a dedicated reporting office
- Video review and analysis facility
- A min 15 T crane for stand deployment (when required) and large deck space.

Construction support vessels shall comply with vessel specification detailed in section 5 dedicated to geophysical survey vessels.

4.2 Communication & internet access

Full communication capability, including telecom and high speed internet access in the Client office for Client dedicated computer, plus an internet hub allowing Company computer connection to internet (alternatively a WIFI network).

4.3 Survey dedicated areas specification

Various offices shall be available for technical personnel, fully equipped with air conditioning, computers, printers, storage, plotters, satellite telecom, network connection, internet connection, CCTV access, intercom, VHF communication, and in particular:

- Survey room office
- ROV control room
- Survey reporting and mapping office
- Client office.

Client dedicated computer shall be provided with the latest update of the following softwares: Office suite, Autocad, Win project.

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4.4 ROV dedicated specification

The ROV shall have sufficient power (min 100 HP) to progress in currents up to 3.0 knot from any direction and be equipped with a tether management system (TMS).

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

The umbilical capacity and multiplexer system shall be sufficient to supply all the required power and control to the ROV and to transmit all video and sensor signals, with no mutual interference.

4.4.1 ROV system

The ROV system shall be made of the following:

- Vehicle
- Launch and recovery system
- Umbilical winch
- Tether management system (TMS) equipped with min 250 m tether
- Control cabin
- Workshop cabin
- CCTV system
- Intercom system
- Spare tether for ROV
- 250 kVA power supply.

Power shall be supplied to ROV system by an independent power generator. The capability to connect ROV system directly to vessel power network shall be only considered as a back-up.

4.4.2 ROV tools

Survey construction support ROV shall be equipped with the following tools and sensors:

- 5-function manipulator (grabber)
- 7-function manipulator
- Cable cutter (1.5 / 3" diameter), softline cutter
- ROV undercarriage system with rollers adjustable to pipe diameter
- Zip pump, docking tool, hot stabs.

4.4.3 ROV survey sensors

- High definition sonar
- High resolution cameras (1 x replacement SIT and 2 x colour)
- Underwater lightning system

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- CCTV including all video visualisation, recording and capture required
- Survey-grade underwater gyrocompass
- Video overlay unit interfaced to navigation system
- Bathy- system suite with echo-sounder and digiquartz depth sensor
- Trench profiler or multi-beam sonar with pitch/roll correction from the ROV MRU
- Dual boom cameras system and associated video visualisation suite
- State of the art cable/ pipe tracker
- CP system for continuous remote CP readings and stab for direct readings
- Acoustic transponder/responder (USBL system compatible with survey vessel acoustic system)
- LBL acoustic transceiver (for positioning ROV inside a LBL array).

4.5 Lifting Equipment

- Min 15-Ton crane is required, depending on scope of work, up 50 Tons.
- Fast winch with 2000m range capability.

5. Technical requirements for geophysical survey vessels

5.1 General

Every work shall start with a safety start up audit of the geophysical equipment.

Plant, tools and equipment shall be maintained in an operable condition. Periodic formal inspections of workshop and related equipment (with associated documentation) shall be routinely done by Contractor. Reports of these inspections shall be made available to COMPANY representative.

All authorised users of plant tools and equipment are to be adequately trained, experienced and where necessary, licensed and certified. Arrangements for job and skill training and details of any tools or equipment which are restricted to named individuals/ranks shall be made available to Company Representative.

5.2 Air guns and compressors

The air gun is the system component that requires the most handling and maintenance, and consequently presents the greatest danger to personnel.

Air guns shall not be operated in the vicinity of diving operations.

Non essential personnel should be clear of the area.

To minimize risks associated with compressed air, all vessel specific procedures and work instructions should be followed, but at a minimum observe the following:

- Never put your hands in front of the jet air or any pressurized discharge port. A poster warning of the hazards associated with compressed air should be prominently posted.

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- Only qualified persons should operate the air guns, the handling equipment and the air compressors. All other personnel should stay clear of equipment, including lines, rigging and booms while deploying, retrieving and working on air gun systems.
- All personnel in areas where there is a risk of sudden release of air should wear ear and eye protection while the system is operating.
- An eye wash station should be located in the airgun area.
- The storage tanks, pipes, lines and fittings used to carry and control this high pressure are specialized equipment and must receive special attention.
- Never handle, tighten or loosen bolts or fittings or hammer any part of a high pressure system while pressure is applied.
- Pressure-relieving valves and other safety devices should never be removed or modified, except for repair or adjustment by qualified personnel.
- Any block valves installed upstream or downstream of a relief valve should be locked in the open position.
- It is recommended that high-pressure manifolds and all associated assemblies are housed behind a protective screen or cage in a secure space and not in the gun control room.

Another danger of compressed air is the possibility of explosion, when high pressure air reacts with combustible fluids in the piping or other system components. Explosions can also occur when high temperatures are created by sudden compression in the dead end (compression ignition) or when a gauge valve is opened to a vented gauge containing oil. Even a thin film of lubricating or hydraulic oil in the system piping may explode. These risks must be minimized.

When the airguns are being handled, the main switches for disabling/enabling, triggering and pressure control must be controlled and operated from the deck by the crew working on the guns, not from a remote location.

A flashing warning light and audible alarm will operate whenever any pressure is applied to the system when the guns are on deck. Such warning equipment should be provided at each entrance to the gun deck accompanied by a sign explaining the purpose of the warning.

If a person is exposed to the risk of falling overboard during the deployment or retrieval of guns, a personal flotation device (PFD) must be worn and it is recommended that an attached safety harness be worn.

Air gun operations involve high-pressure air hoses, electrical lines and towing cables. Care should be taken to prevent personnel from becoming entangled in or tripping over lines. Handle the high pressure hose and electrical cables carefully to prevent excessive bending, abrasion, or undue strain on the recovering.

5.3 Coring

5.3.1 Technical requirements

Coring equipment shall be regularly inspected (min. once a year). In particular winches and wires shall be certified by a third party and certificates shall be available on board.

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The coring equipment (wire length, beacon, etc.) shall be suitable to operate in the specified water depth + 25% extra. 100% spare parts shall be available on board in case of need.

On the vessel deck, the sample recovery shall be performed in a sufficiently large area, clear of any obstacle. At the very minimum, this area shall have a length of twice the core barrel length and a 2m width.

The sample cutting shall be made using dedicated equipment (saw, etc.) in a template preventing the movement of cores (in case of significant swell).

The sample analysis shall be made in a dedicated place, properly vented (in case H₂S rich soils), including tables, chairs, water supply, oven, geotechnical equipment. The sample analysis area shall be of at least 6 m². Air conditioning is mandatory in warm areas.

The geotechnical equipment shall be properly calibrated (min. once a year) and calibration certificates shall be available on board. Reference is made to **GS EP GEO 101** for geotechnical laboratory testing.

Sample storage shall be done in dedicated containers / boxes in a safe place.

5.3.2 HSE requirements

Coring operations shall be covered by a dedicated and comprehensive Job Hazard Assessment (JHA), which shall be well-known by the personnel involved. Only qualified personnel shall be authorized to operate the coring equipment.

A dedicated supervisor shall be in charge of coordinating the personnel involved in order to ensure proper and safe coring operations.

Before starting the coring operation, the dedicated supervisor shall ensure that the equipment is fully operational (at least by visual inspection). A restricted area shall be clearly defined around the coring equipment and the supervisor shall ensure this restricted area is respected.

Personnel involved in the coring operation shall wear full PPE (hard hat, gloves, coverall, and safety boots) at all time. In particular, safety harness and Personal Flotation Device (PFD) shall be worn when working over the side of the vessel.

5.4 Small boat and shore operations

The mission of the small boat should be compatible with the boat's size, propulsion system, impending weather and time of day.

Small boat operations should consider such hazards as predators (sharks, snakes, alligators), floating debris, low hanging limbs, shallow water, currents, tides, tidal bores, flash floods and any hazardous to the boat and its passengers.

Boats should be at least equipped with the following:

- Approved flotation device (PFD) for each person and a life ring
- Fire extinguisher
- Extra line or rope
- Paddles
- First aid kit

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- Ample fuel
- Waterproof radio.

Night operations shall be restricted to the minimum.

When working in transition zone actual methods and procedures for deployment and retrieval of units should be determined in accordance with Company procedures with absolute reference to safe and efficient personnel operations.

5.5 Streamers and towed bodies deployment and recovery

Length, type, way of deployment and number of streamers and tow bodies are different and continually evolving. Each vessel crew must devise a safe system of work that suits their operation. This procedure should be written and regularly reviewed. A clear procedure must be understood by all concerned before deploying or recovering trailing equipment. Prior to deploying any trailing gear, the ship's officers should be informed on the type of equipment to be deployed. During deployment and recovery, there must be close cooperation between the marine and geophysical crew.

A check on the expected weather conditions, water depth, and vessel traffic (including fishing boats) should be made before commencing any marine or geophysical operation.

The officer on watch must monitor all vessel traffic in the area and warn the back deck personnel of any situation that might involve a course change or other evasive manoeuvre.

The operation and condition of all components of the streamers and towed bodies shall be checked before starting work. A high voltage hazard exists on some towed bodies. Be certain that proper procedures are followed.

Communications and video equipment between the back deck and the bridge and recording room should be checked. Never begin deployment without adequate communication between back deck personnel and helmsman.

Safety harness and anchor points must be provided on the stern of the vessel. Harnesses should be worn where conditions dictate, or at the direction of the person in charge.

The correct personal protective gear (PPE) shall be worn including life jacket, non slip safety shoes, wet weather gear, gloves, or any other equipment that may be necessary.

6. Technical requirements for geotechnical drilling vessels

6.1 Drilling equipment and personnel

The geotechnical drilling equipment specifications and operation procedures shall be vessel specific. However, some ISO and API technical specifications for drilling equipment for the oil drilling industry may be used as reference documents for the equipment operated on board geotechnical survey vessels, with some modifications where appropriate, in particular:

- [API Spec. 4F](#) for the derrick and substructure
- [ISO 11961](#) and [ISO 15546](#) for drill pipes

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- [ISO 10407](#) and [API RP 7G](#) for the rotary drilling equipment
- [ISO 13500](#) and [API Spec. 13A](#) for the drilling fluid materials.

Specific geotechnical drilling equipment shall be subject to systematic maintenance, including:

- Drill bits, drill collars and pipes (steel or aluminium pipes)
- Power swivel
- Mud preparation and circulation system
- Seabed frame
- Heave motion compensator, for both the seabed frame and the drill string
- Associated draw works, engines/power generators and heavy lift winches.

In addition to indicating the extent and frequency of controls, the maintenance programme of the drilling systems shall also record equipment failures and replacements. The vessel Owner/Manager with the Master, the chief engineer and the drilling supervisor, have the responsibility to ensure that maintenance, repairs and/or modifications are carried out in such a way that an adequate level of safety is maintained.

The vessel should be equipped with a remote controlled pipe handling system, to be used for storing, connecting/disconnecting and suspension of drill string and collars under the power swivel, and transport of drill pipes, etc., from storage location to the drill floor and vice versa.

Access in connection with drilling operations and maintenance of equipment shall be catered for by suitable and safe access from deck or installed work platforms. In particular, guiding of geotechnical tools through the power swivel shall be made from a fixed work platform or by means of a remote controlled system.

The vessel shall have the capability of mixing both normal drilling mud (i.e. specific gravity of up to 1.05), as well as heavy mud to be used as barrier against shallow gas hazard (i.e. specific gravity of up to 1.30). The vessel shall have sufficient dry mud storage capacity in order to have both normal drilling mud and heavy mud available on board. In addition, two or more surge tanks for mud preparation and mixing are required.

For vessels being temporarily used as geotechnical drilling vessels, with set-up of all required drilling equipment on board (e.g. over the side or over a moon-pool), the vessel Owner/Manager is responsible for ensuring that appropriate arrangements are made to conduct the requested drilling operations with an adequate level of safety. Moreover, the stability of the vessel must be verified under all conditions, and the vessel Owner/Manager shall confirm that the modifications made to the vessel do not invalidate any of the vessel's certificates. If necessary, the derrick and all heavy load equipments shall be properly load-tested and certified by an appropriate Regulatory Body. After Contractor has confirmed that all requirements outlined in this document are complied with, acceptance of the vessel remains subject to satisfactory inspection by Company. Acceptance of the vessel by Company does not prejudice the Master's responsibility for the safety of the vessel and its crew.

Personnel engaged in drilling operations shall have the necessary qualifications. Before participating to any drilling operation on board a geotechnical survey vessel, drillers and assistants shall carry out any necessary training programme under the supervision of

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experienced personnel. Full records of training received/given should be recorded on board of the vessel in addition to any training log carried by the individual.

Special care shall be paid to geotechnical drilling operations with the objective to minimise soil disturbance close to the drill bit. It is then recommended that all drillers have been through a theoretical course with emphasis on specific geotechnical drilling techniques, including open-hole drilling, mud mixing, well control and handling of shallow gas kicks.

6.2 Drilling operations in suspected shallow gas area

6.2.1 Background

Shallow gas hazard in geotechnical drilling operations can be divided in four categories:

- Gas kick resulting in toxic gas on the vessel deck, for example hydrogen sulphide H₂S
- Gas kick with risk of combustion or hydrocarbons
- Blow out with survey equipment related hazard, i.e. geotechnical down-hole tool expelled from the drill string and falling on deck
- Blow out with serious or catastrophic loss of vessel buoyancy.

Shallow gas hazard may be identified from a high resolution geophysical survey and/or previous drilling at the proposed geotechnical survey site. In certain suspected shallow gas areas, a review of the geophysical survey report for the drilling location may not reveal the presence of a shallow gas hazard but, due to the inherent uncertainties related to seismic data interpretation, the possibility of encountering a gas pocket of limited extent can not be entirely discounted.

In such cases, specific procedures shall be defined to establish safe drilling operations down to the target penetration of the boreholes at the proposed geotechnical drilling locations.

After completion of the drilling operations, the geotechnical boreholes should be grouted or filled with heavy mud, in agreement with the requirements of the Particular Technical Specification.

6.2.2 Requirements related to barriers against shallow gas

For geotechnical drilling operations in suspected shallow gas area, two independent barriers shall be available as a minimum. The first barrier shall be the use of heavy mud with a minimum specific gravity of 1.15 and up to 1.30.

The second barrier against shallow gas shall be within the following or a combination thereof:

- During drilling, use of a non-return valve in the heavy mud system
- When connecting/disconnecting and pulling pipes, use of a non-return valve in the bottom-hole assembly
- During down-hole wire-line sampling/CPT operations, use of a safety valve on the power swivel which can close around the umbilical of the tool and withstand a minimum of 40 bars excess pressure.

Considering that a gas kick may still occur, a gas diverter system shall be installed in the mud circulation system. Such a diverter should ensure safe evacuation of the gas to leeward through the drill string, and limit as far as possible gas escaping via the drilling annulus to the seabed and bubbling into water with a risk of losing vessel buoyancy.

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6.2.3 Specific procedures in suspected shallow gas area

Vessel specific procedures for handling shallow gas hazard shall be established.

Such procedures shall include but not be limited to a combination of the following:

- Position the vessel optimally with respect to wind and current to minimise accumulation of gas on deck
- Use the vessel echo-sounder to detect gas bubbles in the water column
- Perform pilot holes to depth in excess of the target geotechnical survey holes
- **Note:** Pilot holes may be drilled without any indication of shallow gas presence, but gas blowing out can be stimulated by the swabbing action when pulling-out the drill string.
- During drilling, after each stand of pipe is drilled down, circulate with heavy mud to stabilise the borehole and to maintain maximum hydrostatic pressure in the drill string
- Pull-out down-hole tools slowly from soil with drill string to avoid swabbing
- **Note:** Special care to be exercised when an interface between clay and sand layers is indicated by drilling parameters since shallow gas would preferably accumulate in more permeable sandy formations.
- Prior to pulling the drill string at completion of drilling, circulate with heavy mud to stabilise the borehole; pull-out pipe slowly to avoid swabbing; when the drill string is disconnected, monitor for any backflow from the drill string bore; if any backflow is observed, reconnect the power swivel and circulate with heavy mud to stabilise the borehole.

When the risk to encounter shallow gas is considered as particularly severe, additional precautions may be taken, including:

- Installation of shear rams on the seabed frame
- Installation of a sub-sea camera on the seabed frame to detect gas bubbles at seabed level
- Offset the vessel with respect to borehole position to avoid gas on deck; when penetrating suspected layers with shallow gas, normal drilling operations can be carried out with a deviation of about 10% of the water depth
- Installation of fixed gas detectors at critical locations (e.g. moon-pool, driller's console, drill deck, engine room, etc.), and portable gas detectors; in case of possible toxic gas (e.g. H₂S), breathing apparatus shall be made available for all personnel on board the drilling vessel
- **Note:** The type of gas detectors and the alarm levels should depend on the type of gas likely to be encountered, e.g. 10% and 20% of lower explosion level (LEL) for flammable gas, and 10 and 20ppm for H₂S
- Use of spark-proof engines and lighting on deck
- Use of a standby boat with fire fighting equipment ready for use.

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Crew and survey personnel awareness on safety procedures against shallow gas hazard shall be maintained at all times, with the following actions from the Master or Site Manager to be repeated at least daily or at each change of working shift:

- Ensure that crew and all personnel on board is briefed and that safety procedures are well understood; if necessary, enforce safety drills/exercises, in particular fire fighting and abandon ship exercises
- Perform active and passive drift-off tests with the vessel
- Conduct “bubble tests” to determine gas bubble zone area in the event of blow out; perform bubble watch
- Function test gas alarm systems and gas detectors
- Function test mud system and valves, in particular the valves for gas diverter/mud line
- Enforce no smoking and hot work ban on deck
- Maintain permanent bridge attendance
- Function test communication systems between bridge, engine room and drill floor
- Establish daily contact with OIM/RSES and/or onshore Company facilities
- Close ventilation ducts to/from open deck and engine room whichever not required for drilling operations; close watertight doors, windows and portholes during drilling
- Pressurise fire line on deck with a fire hose connected and open.

6.3 Geotechnical survey equipment

The geotechnical survey tools (e.g. sampling, CPT or vane testing tools, etc.) which are operated from the survey vessel are covered by the General Specification **GS EP GEO 101**.

The vessel shall be equipped with an offshore soil laboratory for early testing of the recovered soil samples. The requirements for offshore laboratory testing are covered by the General Specification **GS EP GEO 101**.

7. Other references

Following documents are applicable:

- External documents: **IMO – ISM, IMO – ISPS, IMO – MARPOL, IMO – MODU, IMO – SOLAS 74, IMO – STCW-95, IMO A.481 (XII), IMO A.538 (13), IMO A.680 (17) and NORSOK J-003.**
- Total General Specifications: **GS EP GEO 201** and **GS EP GEO 202**.