



Exploration & Production

GENERAL SPECIFICATION

LOGISTICS AND OPERATIONAL SUPPORT

GS EP LSO 306

Selection and Operation of Dynamically Positioned Vessels
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01	01/2011	Update definitions
00	10/2009	First Issue
Rev.	Date	Notes

Owner: EP/TDO/LSO	Managing entity: EP/TDO/LSO
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1. Scope

This General Specification defines the types of equipment and minimum performance levels required to conduct operations safely on board a dynamically positioned (DP) vessels. This General Specification shall be used for the initial selection and subsequent operation of a DP vessels for activities where DP is used as a means of station keeping.

DP vessels operated or chartered by an affiliate shall comply with this General Specification. Additionally, project-specific operational guidelines shall be established for each project and implemented during the execution of the work.

The requirements in this General Specification are applicable to the following activities:

- routine offshore operations
- offshore construction
- accommodation support
- DP offshore support vessels assisting in specific construction activities
- Vessels shall comply with all applicable Class and Flag State regulations.

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.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
IMCA M 103	Guidelines for the design and operation of dynamically positioned vessel
IMCA M 117	The training and experience of key DP personnel
IMCA M 185	International guidelines for the safe operation of dynamically positioned offshore supply vessel
IMO MSC Circular 645	Guidelines for vessel with Dynamic Positioning systems
IMO MSC Circular 738	Guidelines for Dynamic Positioning system (DP) Operator Training



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
Not applicable	

3. General

3.1 Philosophy

The philosophy of managing operations on a DP Vessel shall be based on gaining a clear understanding of the safest mode of operation for the vessel. A pre-contract verification process shall be initiated to gain this understanding. Upon final selection of the vessel and award of a contract, the Contractor shall develop Activity Specific Operational Guidelines or Well Specific Operational Guidelines which shall be used to execute DP operations safely. The Principal shall be engaged in the development/review and approval of this document. For critical operations, the safest mode of operation shall be decided in collaboration with the Contractor and shall be included in the Activity Specific Operational Guidelines or Well Specific Operational Guidelines.

The overriding philosophy shall be to:

- understand the worse case failure and significant single point failures (if any) of the DP system
- determine the configuration for the safest mode of operation
- undertake Defined Critical Activities with the vessel's DP system, configured for the safest mode of operation



- ensure that all key DP Personnel on the vessel are brought to the same level of understanding with regard to the Activity Specific Operational Guidelines / Well Specific Operational Guidelines
- have robust contingency plans in place.

3.2 Applicable Specifications

The following specifications shall be complied with by the Contractor unless specifically directed otherwise by the Affiliate or DGEP Technical Experts:

- **IMCA M 103** - Guidelines for the design and operation of dynamically positioned vessels
- **IMCA M 185** - International guidelines for the safe operation of dynamically positioned offshore supply vessels. (For Offshore Supply Vessels only)
- **IMO MSC Circular 645**
- **IMO MSC Circular 738**.

Note: Not every job requires the use of all the above specifications. An Affiliate shall supply the required specifications with the Invitation to Tender and Contract documentation.

3.3 DP CLASS

3.3.1 General

All vessels operating on DP shall comply with IMCA Guidelines with respect to DP Operations. A requirement to comply with IMCA Guidelines shall form part of any Charter Party or contract where a vessel may be required to operate on DP as part of the intended operations.

The DP equipment class required for a particular operation shall be based on a risk analysis of the consequences of a loss of position for the specific activity being considered. This DP Class shall not be less than the minimum DP Class required as shown in the table below. A Risk Assessment shall be carried out, with respect to the intended operations, by a risk assessment team that shall have at least one marine specialist as part of the team and, any recommendations arising from the risk assessment shall be implemented prior to the DP operations taking place.

In certain areas of operation the local government or Coastal State may dictate the minimum class required which may be higher than that required according to DGEP Rules.

3.3.2 DP Class Notation

Some Classification Societies use different notations compared to the ones given by IMO.

	IMO	Corresponding Class Notations			
Description	DP Class	ABS	LRS	DNV	
Manual position control and automatic heading control under specified maximum environmental conditions	-	DPS-0	DP (CM)	DNV-AUTS	DPS O
Automatic and manual position and heading control under specified maximum environmental conditions. A single fault may result in loss of position.	Class 1	DPS-1	DP (AM)	DNV-AUT	DPS 1
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault excluding loss of a compartment. Systems to be provided and configured such that a fault in any active component or system will not result in loss of position. (Two independent computer systems running and aligned)	Class 2	DPS-2	DP (AA)	DNV-AUT R	DPS 2
Automatic and manual position and heading control under specified maximum environmental conditions, during and following any single fault including loss of a compartment due to fire or flood. Systems to be provided and configured such that a fault in any active component or system will not result in loss of position. (At least two independent computer systems running and aligned with a separate back-up system separated by A60 class division).	Class 3	DPS-3	DP (AAA)	DNV-AUT RO	DPS 3

3.3.3 Minimum required DP Class levels according to type of operation

Table 1 shows the minimum DP Class level required when conducting particular types of operations. Each type of operation should be risk assessed and, where the assessment shows that a higher DP Class is required than that shown in the table, watercraft with the higher DP Class shall be used.



DGEP Technical Experts shall be consulted regarding the DP Class of Operation required for any watercraft for those types of operation not listed in **Table 1**.

Table 1 - Minimum DP Class Requirements

Type of operation	Location	DP Class of Operation*
Drilling	World-wide	3
Production	World-wide	3
Works and wireline operations to sub-sea wells	World-wide	3
Underwater operations where divers are required to enter an enclosed or confined space, e.g. wellhead, subsea manifold, wreck, or inside the anchor pattern of moored watercraft such as a MODU or FU.	World-wide	3
Accommodation operations hotel / living quarters.	World-wide Gangway in place	2
Underwater operations with saturation or surface supplied diving.	World-wide	2
Manned underwater operations such as submarine, atmospheric suit.	World-wide	2
Marine operations such as pipeline and cable laying, covering, burying, well stimulation (platform and satellite wells)	World-wide	2
Marine heavy lift operations such as lifting and piling.	World-wide	3
Operations requiring watercraft and/or ROV to be directly connected to a subsea system via wire, rope, pipe, hose or other means.	World-wide	2
ROV, ROT, AUV operations	Less than 300 m from an installation	2
ROV, ROT, AUV operations	More than 300 m from an installation	1
Acoustic, Seismic or VSP vessels	Less than 300 m from an installation	2
Acoustic, Seismic or VSP vessels	More than 300 m from an installation	1
Bow loading	Loading location (buoy, etc)	1



Type of operation	Location	DP Class of Operation*
Bow loading	FPSO/FSO	2
Supply vessel / AHTS (Anchor Handling Tug Supply vessel) if DP mode is required.	World-wide	1
Fire Fighting (FiFi) if DP mode is required	World-wide	1

*in accordance with IMO notation

3.4 Technical Capability

Contractors shall provide necessary documentation for assessment of the technical capability of the DP Vessel being proposed. Documentation and evidence shall also be provided to help assess the competence of the Contractor's operational management and personnel.

4. Verification Process

4.1 General

The Contractor shall provide the documentation listed in Table A and Table B, for the purposes of:

- validating the technical suitability of the vessel for the activity
- identifying the vessel's configuration for the safest mode of operation
- understanding the vessel's station keeping capabilities following the worst case failure
- understanding the general level of compliance with:
 - IMCA M 103
 - IMCA M 185
 - IMO MSC Circular 645
 - relevant DP class requirements
 - any relevant mandatory standards and guidelines applicable in the particular Coastal State
 - IMO MSC Circular 738 (which refers to IMCA M 117 as an acceptable standard).

Project-specific requirements may be more stringent than the IMCA and IMO guidelines.

A formal submittal of the following shall be required as part of the Contractor's proposal. Documents specified in Table A shall be subjected to a review. The outcome of this review, along with the submittals specified in Table B, shall be used in audits.

The Affiliate or Project Group shall determine what documentation is required according to the intended duty and role of the Vessel.



4.2 Documentation For Detailed Review

Table A -Documentation for Detailed Review

No.	Document	Remarks
1	Vessel's Class Notation and Copy of Certificate	
2	FMEA of DP System	FMEA requirements in Section 3.1. FMEA shall have clear statement on Vessel's Safest Mode of Operation in DP (Power Generation/Power Distribution/Auxiliaries)
3	FMEA Proving Trials Results	Status of any actions arising from the trial to be verified.
4	DP Annual Trial Results	Status of any actions arising from the trial to be verified.
5	Power System discrimination and selectivity study, protective device calibration/testing documentation and vessel's bus tie philosophy	Power System Study shall be sufficiently detailed and provide a clear understanding of the safe mode configuration for the vessel. The Principal may accept closed bus tie operations if this Study shows this to be a safe mode. The Principal reserves the right to specify Open Bus for critical operations.
6	DP Capability Plots	Capability plots shall include the condition following worst-case failure. Capability plots should include current conditions of 1.0 knot, 1.5 knots and 2.0 knots.
7	Results of Capability proving tests for intact condition and worst case failure	Procedure in Appendix 1
8	Results of tests that show generators and thrusters can produce full power upon worst case failure	Procedure in Appendix 1
9	Philosophy for carrying out critical DP operations in proximity of sub sea or surface hazards	Includes methodology for risk assessments and contingency planning (examples to be provided)
10	Service reports concerning the DP system (last three years)	
11	Details of any DP related modifications since last FMEA	
12	Details of any acoustic noise tests conducted on the vessel	For determination of suitability of Acoustic Position Reference System
13	Audit Results (last three years) of Vessel and DP inspection	Include close-out reports



No.	Document	Remarks
14	DP Operations Manual	Vessel Specific DP Operations Manual, not the Manufacturer's DP manual
15	DP Incident reports (last three years) including close-out reports	Advisory, yellow alert and red alert levels
16	Details of spare capacity and interface for additional position reference sensors	
17	Details of Logging/Data Capture Capability	
18	Examples of Activity Specific Operational Guidelines or Well Specific Operational Guidelines that the vessel has used in the past	Example in Appendix 2
19	Details of Software QA methodology and modification management for key systems e.g. DP control system, power management system, variable frequency drives etc	
20	HPR Calibration report	
21	For vessels performing lifts on DP – details of DP control system proportional gains for fore/aft, port/starboard and heading along with description and settings for any heavy lift modes	Instability of the DP control system can be caused when the load is restrained by the setting guides. Procedures and or DP control system features need to be in place to avoid this.

Guidance Note 1 – when this General Specification is used for DP Drilling Vessels, the riser analysis will be required for detailed review.

4.3 Documentation Required As Basis For Audit

Table B - Documentation Required for Basis for Audit

No.	Document	Remarks
1	Field Arrival/mobilization Trials Procedures	
2	DP watch keeping check lists	DP control position and ECR
3	Details of DP related emergency drills (black-out recovery, and any others as identified in FMEA)	
4	Maintenance schedules covering operational period of equipment such as diesels, generators, auxiliaries and thrusters	
5	DP/ECR manning and operator shift pattern. Clear depiction of roles and responsibilities and tasks that are to be carried out by DP Operators	
6	Résumés of all key DP personnel on the vessel	To include copies of relevant certification and record of DP hours
7	Examples of lessons learned workshop or tool box talks pertaining to DP operations	Alternative means may be used to disseminate information and provide ongoing training

5. Requirements

5.1 FMEA / Proving Trials and Annual Trials

- FMEA/proving trials and Annual Trials submitted shall comply with the following minimum requirements:
 - FMEA shall define the safest mode of operation, the worse case failures and significant single-point failures in the summary.
 - FMEA shall be updated after any major modifications and proving trials have been conducted.
 - FMEA's shall have been reviewed and updated once every five years (even if no major modifications have been carried out). Proving trials (if necessary) or comprehensive Annual trials shall be conducted following this review. This review shall incorporate lessons learned within the industry and from failures and incidents on board the vessel (see Guidance Note 2).
 - FMEA Proving Trials shall address all known and identified failure modes.
 - Periodic FMEA testing shall be scheduled for high-risk FMEA issues (e.g. black-out recovery).



- Annual trials are adequate and have been conducted in the past 15 months and were witnessed by an independent party (see Guidance Note 3).
- Action items from FMEA, proving trials, annual trials, audits and incidents have been or are in the process of being closed out. Closing out of action items shall be well documented and auditable.
- FMEA Documents shall have vessel-specific:
 - details of governor failure modes
 - details of AVR failure modes
 - details of main switchboard control power failure modes
 - details of position reference system processing provided by the DP control system
 - details of DP control system's consequence analysis feature
 - DP control system Input/Output Schedule
 - details of Networks
 - single-line diagram for satellite based position references
 - single-line diagram for hydro-acoustic position references
 - single-line diagram(s) for other position reference systems (e.g. Taut Wire, Laser based etc.)
 - details of communications and alerting systems provided for the DP operator and their redundancy (systems and power supply).

Some FMEAs may not contain all the above information. In such cases the requested information shall be supplied as separate documents in sufficient detail with clear identification of the content.

Guidance Note 2– it is recognised that some companies monitor and manage changes through a structured management of change process. It is expected that such process will trigger review of FMEA if warranted. Due diligence dictates, that a process be established within the contractor's organisation to ensure that the FMEAs are reviewed. The review needs to be carried out:

- When changes are implemented
- Once every five years

Where no changes are implemented it is expected that the review still be undertaken to verify:

- No changes have occurred that would warrant a review/revision of the FMEA
- Known incidents within industry or from the vessel cannot manifest themselves.

Evidence of this review shall be provided by a competent person accountable for DP operations within the contractor's organisation.

Guidance Note 3 – trials performed on a continual basis for MODU's, per IMCA guidelines, may be considered as an alternate to annual trials.



5.2 Position Reference Systems

A suitable suite of position reference systems shall be agreed between the Affiliate and Contractor. The following points shall be considered and evaluated:

- Number of independent position reference systems required.
- Choice of Reference Systems including absolute and/or relative.
- Water depth of operation (for acoustics and taut wire).
- Area of operation (e.g. sensitivity of GPS to scintillation).
- Multiple DGPS of the same type shall not be considered as redundant. Redundancy of multiple DGPS systems shall be achieved by diversity (for example using different DGPS suppliers). The vessel's DP system should be capable of accepting raw GPS signals without the differential update. The DP operator should be able to have information on the nature of the signal (E.g.: Warning when using natural GPS signal instead of differential signal)
- Multiple acoustics shall not be considered as redundant unless they operate on different principles and cause no interference with each other.
- Acoustic systems shall be suited for the water depth in which operations are carried out and shall be capable of being used in conjunction with other position reference systems.
- For critical operations involving coupled body motions, both absolute and relative position reference systems may be required. Field conditions will normally dictate which systems are used. In general a mix of absolute and relative systems shall not be used for coupled body motions unless:
 - the DP system has a Relative Positioning Mode
 - field conditions and trials prove that the vessel is capable of maintaining position in this mode and carrying out the intended work
 - the intended operation is of short duration when the vessels are coupled (not exceeding 1 hour).

Each position reference system shall use its standard interface to connect the DP control system. 'Pseudo' interfacing and/or any intermediate processor(s) shall not normally be used, unless there are special project requirements. In that case an FMEA and test procedure shall be provided for the particular set-up.

Additionally, the DP Controller shall have at least one free spare interface to connect project specific position reference system(s).

The following are the minimum requirements for Position Reference Systems (PRS) according to the vessel's IMO DP Class.

IMO DP Class	Minimum Number of PRS
DP Class 1	2
DP Class 2	3
DP Class 3	3



5.3 Open and Closed Bus Tie Operations

The vessel shall normally be operated with one or more open bus ties.

Closed bus tie operations may be considered for non-critical operations if it can be demonstrated that closed bus tie operation is capable of preventing a black-out under the following fault conditions:

- any single generator or Voltage Regulator (AVR) fault
- any single equipment failure or fault
- any single diesel or diesel speed control fault
- any single switchboard or electrical buss fault
- any single shared systems fault (e.g. control power or fuel)

and if

- closed bus tie operation is inherently safer.

5.4 Data Logging, Alarms and Screen Capture

Vessel shall be provided with a separate data logging system.

The purpose of such a system is to aid in understanding the real causes of failures and provide faster diagnosis and recovery following a failure.

The system shall at least have:

- the ability to capture and store in electronic media key parameters of a DP system (including key power plant data) for a minimum period of 30 days
- a means of analyzing data and depicting it in a usable format (graphs/reports)
- a means of providing hard copies in colour
- the capability to read logged data using off-the-shelf commercially available software and in the Windows environment
- a data logger processor connected to a UPS
- the capability to print DP control system screens to a colour printer connected to a UPS
- alarm printers for hard copying alarms for the DP control system computers (the printing of these alarms should not require any operator intervention).

5.5 Status Alarm System and Communications

The status alarm system and DP related communications shall have:

- visual and audible status alarm indication for yellow and red alarms at DP control position, ECR, the work area and the area where the work is controlled. (See Guidance Note 4)
- alarms manually initiated from the DP console (see Guidance Note 5)
- alarms logged on the DP alarm printers
- alarms operational in a black-out



- alarms recorded on the data logging computers
- accessible redundant means of direct communications between the DP console and ECR, work area and the area where work is controlled from.

One means of communication for the above shall be hands-free and still be operational during a black-out.

Guidance Note 4 – It is recognised that some vessels operating on DP Class 1 do not have a requirement for yellow and red status alarms, e.g. DP Supply vessels. The requirement for these alarms shall be reviewed on a case by case basis for DP Class 1 vessels.

Guidance Note 5 – it is recognised that some contractors have implemented automatic initiation of these alarms, notwithstanding the above it is expected that the vessel will have manual means of initiation of status alarms.

5.6 Documentation

Documentation submitted in accordance with Table A and Table B shall be reviewed in order to gain an understanding of:

- effective incident reporting, investigation and close-out
- adequacy of DP related drills conducted on board the Vessel
- accuracy of Vessel's capability plots and proving tests
- assessment of system reliability and outstanding issues from the service reports
- confirmation that the capability plots cover the worse case failure(s) identified
- confirmation that the consequence analysis feature covers the worse case failure(s) identified; (see Guidance Note 6)
- suitability of position reference system processing
- suitability of data logging and screen printing features for post-incident investigation
- suitability of communication and alerting systems
- adequate manning of DP operation
- DP operator shift pattern and DP/ECR manning.

Guidance Note 6 – Consequence analysis is a requirement of class however certain Class Societies do not specify that it needs to cover worse case failure.

5.6.1 Manufacturer's Manuals

Copies of the Manufacturers' Manuals should be on the bridge and the engine control room. These should include, but not limited to, the following:

- DP system operating manual
- DP system maintenance manual
- DP system fault finding chart
- DP sensor operation and maintenance manual
- Power management system



- UPS system operation and maintenance manual.
- DP installation manual.

6. Operational Guidelines

An extract from a typical Activity Specific Operational Guideline or Well Specific Operational Guideline is given in Appendix 2.

Activity Specific Operational Guidelines or Well Specific Operational Guidelines shall be developed for the intended operations. This document is considered as a key document and an important tool for effectively managing DP operations. This document shall include:

- a review of the documents
- the results of proving/field specific trials
- risk analyses
- the specific nature of the intended operations.

The Vessel's operational personnel shall be engaged in risk identification and assessment practices. Operational personnel assigned to a given vessel shall have a key role in the development of the Activity Specific Operational Guidelines or Well Specific Operational Guidelines and shall own the document. This document shall be signed by the OIM and provided to the Principal for acceptance.

The Activity Specific Operational Guidelines or Well Specific Operational Guidelines may be modified in the field, subject to the explicit consent of the on-board representative of the Principal and the vessel's OIM (Master).

Nothing in Activity Specific Operational Guidelines or Well Specific Operational Guidelines shall relieve the operational personnel of the vessel of their responsibility to take the necessary actions in order to stabilize the vessel's position in the event of:

- the threat of an imminent DP incident
- or the onset of an unplanned/unforeseen DP incident

An Activity Specific Operational Guidelines that summarizes the potential DP incidents, the appropriate contingency plans and the alerting of personnel on board the vessel shall be prepared as an appendix to the installation procedures. If the Activity Specific Operational Guidelines is in conflict with the DP Operations Manual of the vessel, the Activity Specific Operational Guidelines shall prevail.

7. Training

Training and Certification of DP Operators (DPO) following a formal process developed by the Nautical Institute. Training consists of two or more of the following:

- Formal shore based training courses
- On board training and experience
- Manufacturer's training ashore and on board



Training on board depends upon:

- The type of vessel
- The consequences of the position loss during their work (e.g. DP class).

Experience and training on board must be filled in the DP operator's log book and signed by the Master.

This log book is normally provided by the Nautical Institute but other Institutes or Associations (e.g. IMCA) versions are acceptable providing they record the correct level of training and experience.

7.1 DPO Training

DPO Training is carried out in four stages.

1st Stage:

DP Induction course to gain an understanding of how DP systems and their associated reference system function and includes operating a typical type of DP system.

2nd Stage:

DP Vessel based experience: During this stage actual shipboard experience is gained under the supervision of a DPO. Training is documented in a log book. The DP Trainee is not permitted to take charge of a DP Watch.

3rd Stage:

DP simulator course based at an appropriate college or at a DP Manufacturer's facility will provide training in the use of DP systems including simulator exercises and emergency situations.

4th Stage:

A minimum of documented **6 months DP experience of supervised DP watch-keeping**. This must be recorded in the DP log book and signed by the Master of the vessel. The DP Trainee is not permitted to take charge of a DP Watch. Until this period of training has been completed. On completion of this period of training, a DPO certificate from the Nautical Institute or equivalent recognised institute or Association will be issued.

The Certificate then permits unsupervised operation of DP systems.

Where a DPO trainee has only operated on a **IMO DP Class 1** vessel he may be issued with a restricted DPO Certificate. Additional training on a **IMO DP Class 2** vessel is required before an unrestricted DPO Certificate will be issued.

DP operators who have gained DP experience on **IMO DP Class 1** vessels and have not completed Stage 1 of the training process, may, after a period of 6 months documented DP operations, get an exemption from Stage 1 of the training requirements.



8. Additional Equipment

Additional equipment and features may be decided upon between the Affiliate and the Contractor as required for the particular activity. The following are examples of additional equipment or features which may be considered:

- force feed forward feature
- heavy lift mode
- relative positioning modes
- position reference sensors.

9. Pre-Field Arrival Requirements

The pre-field arrival process is designed to ensure that all DP related equipment is set up correctly, fully operational and fit for purpose. Special attention shall be given to the performance of certain systems for the given location and the particular operation to be conducted.

Prior to the vessel arriving at the field the agreed Activity Specific Operational Guidelines or Well Specific Operational Guidelines shall be discussed in detail on board the vessel with all key DP personnel.

Pre-field arrival trials shall be carried out while in the safest mode of operation - in particular relating to the power management system and load sharing functionality and shall include:

- vessel's own standard field arrival tests
 - correct functioning of all manual thrusters and propulsion controls
 - additional tests required as a result of the review of the FMEA(s)
 - functioning of additional equipment, special features or special modes of operation
- and may include the following:
- key drills (vessel specific e.g. black-out drills).

- repeat of capability test for worse case failure condition (if requested by the Principal)
- generator and thruster maximums and step load transfer on worse case failure

The table below is a guide to the actions required and status when a DP Vessel is making an approach to its final position in a Restricted Navigation Zone

Position		Control Mode	DP Status	Action	Document / Form
Before entering Restricted Navigation Zone		Main Engine/Thruster Control	Manual Control at main manoeuvring position	Pre-job meeting / Tool Box Talk	JSA/JSC permit to Work Contact with Engineer on Duty
				Bridge: On manual control of thrusters Check and confirm thruster / propeller / rudder operation and feedback	Restricted Navigation Zone DP entry checklist Engine Room DP checklist
		DP Standby Control	DP Standby Mode to DP Manual Mode	Check and select : Sensors Thrusters Gyros Position Reference Systems	
		Joystick	Progressive Auto Mode	Select : Rotation point Gain Allocation mode Carry out relevant checks	Bridge DP Checklist
		Joystick	Semi Automatic Mode		
Approach	Safe distance to installation or site (300 metres or 3 x ship length, whichever is the greater)	Joystick DP Auto position	"Semi Automatic" mode DP Auto Position	Hold vessel in position. Change over to DP Auto mode. Monitor vessel capability and power consumption Remain at this position for at least 10 minutes to allow DP Model to build up.	Status checklist Change over checklist Footprint
	Move to final position close to installation or site.	DP Auto position	DP Auto Position	Approach by using position offset buttons at low speed	
At required position		DP Auto Position	DP Auto Position	DP Watchkeeping routines	Status checklist Footprint



10. Reporting

Reporting shall mainly be dictated by the Activity Specific Operational Guidelines or Well Specific Operational Guidelines, however:

- records shall be maintained for both field arrival and watch keeping checklists
- the daily report shall include a section on DP equipment status, planned maintenance and any DP related incidents.

11. Simulator Training

At the Affiliates' discretion and expense, the Contractor may be required to carry out Project Specific Simulator Training. This training shall be conducted at a suitable training facility and, as far as practicable, shall be carried out on equipment similar to that on board the vessel. The training shall include theoretical instruction and practical simulation. The intent of the training shall be to communicate:

- an overview of the project
- the criticality of the specific operation(s) to be carried out
- the DP and contingency planning required
- worst case failure and significant single point failures of the DP system
- the configuration for the safest mode of operation
- development and practical use of the Activity Specific Operational Guidelines or Well Specific Operational Guidelines.

The Course content developed for the training shall be submitted to the Principal.

The following personnel shall attend training:

- Master(s)
- Chief Mate(s)
- DPO(s)
- Chief Electricians

Contractors may choose to use such training as part of their competency assurance process.

12. Definitions

Item	Definition
Adverse Weather:	Adverse weather includes, snow, ice, fog, hail, lightning, heavy rain, high winds, wind chill, high or low air temperatures, low cloud base, poor visibility, severe sea states and strong river or tidal currents. In certain circumstances low or no wind can also be adverse weather. Weather conditions can change quickly and the effects of short term variations such as wind gusts or rip tides shall be considered.
Affiliate:	A Total E&P subsidiary, Group Project (GPI) or other entity carrying out oil exploration and production activities on behalf of or for DGEP. It does not include non-operated assets.
Anomaly:	Any unsafe situation or act that has the potential to contribute to an incident.
Capability Plot:	A theoretical polar plot of the vessel's capability for particular conditions of wind, waves and current from different directions.
Contractor:	Any person or an organization who is directly involved in execution of prescribed work under a contract with the reporting to COMPANY or COMPANY representative.
Deficiency:	A deficiency is an item or condition that is considered sub-standard or below minimum expectations, such as those mandated by either Company Rules, Specifications or drawings.
DP:	Dynamic Positioning: automatic control by means of a computer of a vessel's position and heading by the use of thrusters with respect to one or more position references. Position reference sensors, combined with wind sensors, motion sensors and gyro compasses, provide information to the computer pertaining to the vessel's position and the magnitude and direction of environmental forces affecting its position. Dynamic positioning may either be absolute in that the position is locked to a fixed point over the bottom, or relative to a moving object like another watercraft or an underwater vehicle. One may also position the vessel at a favourable angle towards wind, waves and current, called weathervaning. May also be used to mean dynamically positioned.
DPO:	Dynamic Positioning Operator: A person who by means of training and competence operates a Dynamic Positioning system
Flag State:	Flag State refers to the authority under which a country exercises regulatory control over a commercial vessel which is registered under its flag. This involves the inspection, certification, and issuance of safety and pollution prevention documents.



Item	Definition
FME(C)A:	Failure Modes Effects (Cause) Analysis: a systematic process for identifying potential design and process failures before they occur, with the intent to eliminate them or minimise the risk associated with them It is carried out according to recognized standards.
Footprint:	A graphic illustration of a set of real observations of a vessel's DP station keeping ability in particular environmental conditions.
Incident:	An incident is any event or a chain of events which has caused and could have caused any or all of the following consequences : injury or fatality, damage to the environment, material / production loss, loss of image (as additional consequence).
Inspection:	An inspection is defined as a methodical physical examination of a watercraft or equipment to verify that it is suitable for its intended purpose and its conformity with its specifications and contractual prescriptions.
Inspector/Auditor:	The person (or persons) auditing or inspecting the watercraft. The technical knowledge and experience of the person (or persons) performing the audit or inspection should be appropriate to the type of watercraft under review.
Integrity:	Definition 1 – watercraft, equipment and systems The state of a watercraft, equipment or system where it is performing its intended functions without being degraded or impaired by changes or disruptions in its internal or external environments. Definition 2 – management and business methods Strict adherence to an acceptable business code, reflected in transparent honesty and complete harmony in what the company thinks, says, and does.
Marine Operations:	Marine Operations are those operations, or works, carried out on, through or under water at all offshore, coastal, inland waters or river sites in a DGEP Affiliate.
Offshore site:	The term offshore site is a generic term that applies to a geographical location in which one or more offshore installations undertake oil-related activities and designate any construction, floating or otherwise, designed and built to be installed at an offshore, coastal or inland waters site including oil and gas terminals.
Offshore Support Vessel:	A watercraft used to support any offshore, coastal site and inland water or river oil exploration or production activity.

Item	Definition
Offshore installation:	A generic term applied to all units, whether floating or not, which are designed and constructed to be installed on offshore, coastal, inland waters or river sites. These are marine structures carrying drilling, production, processing, storage and hydrocarbon transfer installations. They include: • Permanent fixed installations: metal or concrete structures resting or permanently fixed to the seabed for their full lifetime • Semi-permanent floating installations: dynamically positioned structures or structures anchored to the seabed for the full period of their operation (this definition includes FU's) • Mobile floating installations: dynamically positioned structures or structures anchored to the seabed for a specifically-defined operation (this definition includes Mobile Offshore Units). Note: Semi-permanent or mobile floating installations are watercraft.
OIM:	Offshore Installation Manager
Restricted Navigation Zone:	The area or zone around an offshore installation, normally marked on charts, maps or advised in Notices to Mariners, in which navigation by watercraft is controlled or restricted. Access to the Zone is controlled by the Person in Charge of the Zone (RSES) or his nominated deputy. IMO rules (Geneva Convention 1958 Section 5, paragraphs 2 and 3) require a safety zone of 500 metres radius around offshore installations, within which navigation is restricted. This radius may be increased if required by local regulations or issues specific to the installations concerned (International Convention on the Law of the Sea concluded at Montego Bay, 1982, Clauses 60, 80 and 81).
Simultaneous Operations (SIMOPS):	The simultaneous execution of two or more operations. A term used when two or more operations, such as, but not limited to, drilling, production, construction, diving, heavy lift, slickline unit or heavy marine unit moving alongside are performed concurrently. Simultaneous operations generally have an impact on the installation safety procedures and contingency planning processes.



Item	Definition
Technical Expert:	A Technical Expert is a person assigned to a DGEP Technical Division, who by virtue of training, education, profession, publication or experience, has extensive knowledge or ability in a particular area of study and is mandated to give sound advice or information in a technical profession. Technical Divisions include: • Logistics and Operational Support (TDO/LSO) • Drilling and Wells (TDO/FP) • Health Safety and Environment (HSE) • Technology Division (TDO/TEC) • Field Operations Division (TDO/EXP) • Contracts and Procurement Division (TDO/CA)
Vessel:	This term applies to a watercraft capable of moving under its own power, and is registered, has a nationality and can be used at sea (i.e. it can move under its own power at sea and in those waters where it is required to work: estuaries, harbours, etc.)
Watercraft:	The term watercraft includes every description of self propelled, propulsion assist or non-propelled craft, including displacement and non-displacement craft, floating unit, seaplanes and other aircraft when waterborne, vessel, boat, crewboat, barge, mobile offshore (drilling) units (MO(D)U), F(P)SO, FU, buoy, oil and gas tankers, seaplanes, submarines and Remotely Operated Vehicles (ROV), irrespective of their purpose or design, used or capable of being used as a means of transportation or other purposes on, through or under water.



Appendix 1 Capability Assessment

TEST A DP System - Capability Assessment – Current - All Thrusters	
PURPOSE: To access the maximum beam current in which the vessel can operate and to check to one point on the vessel's capability plots when all thrusters are available.	
METHOD: Step 1 Estimate of Surface Current This is best performed when there is low wind and waves. On other vessels valid results are obtained when wind speed is between 5 kn and 8 kn. • Vessel stable on DP (period exceeding 30 min). • Note DP current, wind speed and direction, vessel's heading, total resultant thrusters force used and resultant direction, turning moment. • Go out of auto position (both heading and position). • Monitor drift of vessel (DGPS, vessel's position) at 1 min intervals (speed and distance from initial point). • Allow vessel to drift for 10 min. • Record results as above and estimate current. Step 2 Stabilize vessel on DP • Ensure sufficient number of engines are on the board to be able to cope with 100 % load on thrusters (this test may be done with a closed bus). • Adopt heading where resultant environmental forces are on the beam. • Observe and record station-keeping abilities. • Note DP current, wind speed and direction, vessel's heading, total thrusters force used and resultant direction, turning moment. Note direction of resultant thrusters force. • Leave heading control on but come out of auto position. • Use full joy stick to thrusters vessel sideways to starboard (100 % thrust on thrusters). • Record speed of vessel (until steady state speed is reached. Not necessary to go beyond 5 minutes once 100 % thrust is achieved). Record heading holding ability. • Reduce thrust, slow down and stop vessel. • Repeat test thrusting to port. • Record results as above. Step 3: • Average out results from above. • Note maximum steady-state speed achieved. • Use capability plot associated with current equal to this speed and assess co-relation. • Record conclusions.	
RESULTS: Record results in separate spreadsheet – to be provided.	
COMMENTS:	
WITNESSED BY:	DATE:



TEST B DP System - Capability Assessment – Current - Worse Case Failure

PURPOSE:

To access the maximum beam current in which the vessel can operate and to check one point on the vessel's capability plots for the worse case failure.

METHOD:

- Repeat Test A steps 1, 2 and 3 with those thrusters that would remain after the vessel's worst case design failure.
- Record Results.

Use Capability plot associated with worst design case failure and assess co-relation.

RESULTS:

Record results in separate spreadsheet – to be provided.

COMMENTS:

WITNESSED BY:

DATE:

TEST C DP System – Capability Assessment – Combined Weather - Worse Case Failure

PURPOSE:

To access the maximum beam weather in which the vessel can operate and to check one point on the vessel's capability plots for the worse case failure.

METHOD:

- On DP heading into heavy weather with those thrusters that would remain after the vessel's worst case design failure.
- Note DP current, wind speed and direction, vessel's heading, total thrusters force used and resultant direction, turning moment.
- Change heading 5 degrees at a time until the vessel can no longer maintain station.
- Record Results.

Use Capability plot associated with worst design case failure and assess co-relation.

RESULTS:

Record results here on separate spreadsheet – to be provided.

COMMENTS:

WITNESSED BY:

DATE:



Appendix 2 Example of a Typical Well Specific Operating Guideline

MODE :				
SITE :				
ALERT LEVEL DEFINITIONS				
CONDITION	GREEN	BLUE	YELLOW	RED
Notify RSES OIM, Master and Operator/Client Immediately	Normal communications	Yes	Yes	Yes
Action	Continue normal operations	Informative/ consultative status	Sound yellow alarm rig floor cease drilling operations. Hang off. initiate EDS preparation (do not shear)	Sound emergency disconnect alarm, immediately clear drill floor and moonpool areas of personnel, disconnect and move away from well
The watch circles are dynamic. Two sets are calculated. One set for wind speed less than 13m/s and the other for wind speed greater than 13m/s. these wind limitations should be kept in mind while analysing watch circle values at all times.				
Heading Changes to be done at Medium or High Gains				



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INTACT DP SYSTEM				
CONDITION	GREEN	BLUE	YELLOW	RED
Weather related excursion (Wind <13m/sec)	< 10m	10 m	> 21 m	42 m excursion
Weather related excursion (Wind >13m/sec)	< 5m	5m	> 11 m	23.8 m excursion
Heading Excursion	<3 degrees	3-5 degrees	5 Degrees. If threat to Position	
Lower Flex Joint	<2 Degrees	2 Degrees	> 2 Deg	>5 deg
Wind up Choke and Kill Limits/Riser Twist	+ / - 180° from BOP landout	150° when vessel heading cannot be rewound	> 150° when vessel heading cannot be rewound	



<u>Operating Cases</u>				
CONDITION	GREEN	BLUE	YELLOW	RED
Impending collision with vessels not supporting the field operations	Not Applicable	If a minimum Closed Point of Approach is less than 500m	Possibility of collision	If collision is otherwise unavoidable
Fire in an engine room, SWBD, bow thruster room & transformer room	Not Applicable	Any fire alarm in an engine	Fire Confirmed	Loss of position
Full black out	Not Applicable	Not Applicable	Full blackout	Loss of position
Partial black out due to loss of 1 bus	Not Applicable	Not Applicable	Partial Blackout	Loss of position
Drive off				Yes
Seawater Cooling	Not Applicable	Loss of 1 or 2 Seawater Pumps	Loss of 3 Seawater pumps	Loss of all 4 sea water pumps & loss of Station Keeping Capabilities.
Freshwater Cooling	Not Applicable	Loss of any of Loops 1, 2 or 3	Loss of any two of the cooling loops 1 ,2 or 3	(Loss of Loop 4 or loss of all three loops 1, 2 & 3) & Loss of Station Keeping Capabilities



<u>Operating Cases</u>				
CONDITION	GREEN	BLUE	YELLOW	RED
Dill floor and ECR Communications	Two voice, one VHF and alert lights	Loss of one system	One voice system remaining	
Generators on line	Two each side	Not symmetric except for the start/sync time of a set	Loss of a generator and unable to start another generator	
"Clean" Supply	From Motor Generator set	Motor Generator set failure	Loss of "Clean" Supply	
Fuel	Boiler and day tanks enough fuel	low level alarm	Operation of three or more diesels on boiler tank	
Switchboard 110V control voltage failure	Not Applicable	One charger failed	Both on batteries	
Switchboard 24V control failure	Not Applicable	One charger failed	Both on batteries	
PMS Control Processor Failure	Not Applicable	Single processor failure	Loss of Primary & Secondary PMS CPU	
VMS/PMS Control Net failure	Not Applicable	Multiple network alarms	One or both network fails	



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<u>Operating Cases</u>				
CONDITION	GREEN	BLUE	YELLOW	RED
VMS UPS's	Not Applicable	Any VMS UPS alarm		
Loss of air conditioning swbd room	Air Conditioning System Operational	SYSTEM FAILURE/High temp alarm		
Loss of Air Conditioning in ECR	Air Conditioning System Operational	SYSTEM FAILURE/High temp alarm		
Loss of air conditioning to transformer room	Both air conditioning systems operational	Single system/High temp alarm		
Variable Frequency Drive UPS's	Not Applicable	Any VFD UPS on Battery alarm		
Azimuth control system back up supply	Not Applicable	Failure of main or back up supply		
Emergency Generator Test	Not Applicable	Yes	Not Applicable	



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<u>Operating Cases</u>				
CONDITION	GREEN	BLUE	YELLOW	RED
Generators 1 or 6 reassigned to other bus	Not Applicable	Yes	Not Applicable	
Loss of ventilation or fresh water cooling to engines	Not Applicable	Yes	Not Applicable	
Loss of thruster ventilation, Air Handling Unit or fresh water cooling	Not Applicable	Yes	Not Applicable	
Diesel Start Air	Sufficient pressure and connection HP Air open	Low air pressure alarm	Not Applicable	



<u>DP CONTROL SYSTEM</u>				
CONDITION	GREEN	BLUE	YELLOW	RED
Position Reference Systems Available	3 Systems (2 DGPS and RS925)	Loss of 1 DGPS or 1 RS925 or all differential updates to one DGPS	Only one position reference available	Loss of position
DP Control Systems	3 operational	Two Operational	One Operational	Loss of all three
DP SPU's	Three SPU operational	Two Operational	One Operational	Loss of all three
SPU control nets	Two operational	Not Applicable	Loss of one network	Loss of both networks
Heading sensors (Gyro)	3 operational	Two Operational	One Operational	Loss of all three
Wind Sensors	3 operational	Loss of 2	Loss of 3 and Gusty conditions	
DP UPS	Three DP UPSs operational and none on bypass	Any UPS fails or any operational UPS on bypass	Not Applicable	
MRU and VRU	2 MRU's and 1 VRU and RS925's set up on different MRU	Loss of one MRU or both 925's using same MRU	Not Applicable	