

Group Practice



GP 65 - 50

Station Keeping - Design of Dynamic Positioning Systems

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Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 65-50.

This Group Practice (GP) is not based on any previous heritage documents from merged BP companies.

This GP relates to industry guidelines and best practice and indicates BP requirements for the design and construction of dynamic positioning equipment and associated systems used for station keeping on new-build, conversion and/or BP long-term leased vessels and floating facilities.

1. Scope

- a. This GP is applicable to the engineering and design standards for dynamic positioning (DP) equipment and systems installed on all types of DP vessels and offshore floating production facilities (FPF) that incorporate DP.
- b. This GP establishes key industry references and standards required or recommended by BP for use in the design and engineering of DP equipment and systems.
- c. This GP is applicable to equipment that directly and indirectly affects the DP capability of the vessel/facility.
- d. This GP covers three (3) basic DP subsystems:
 1. References (environmental, motions, and position).
 2. Control.
 3. Power supply (thrusters and controls).

DP systems are also supported by several auxiliary marine systems, including but not limited to; fuel oil, lubricating oil, cooling water, hydraulics, and compressed air. The criticality of the interfaces between these subsystems can not be overstated, regardless of the in-built redundancy levels provided in individual systems.

- e. Interfaces between DP systems and auxiliary marine systems are covered in GP 65-40.

2. Normative references

The following referenced documents may, to the extent specified in subsequent clauses and normative annexes, be required for full compliance with this GP:

- For dated references, only the edition cited applies.
- For undated references, the latest edition (including any amendments) applies.

BP

GP 65-40	Design of Hull Marine Systems.
GP 65-55	Station Keeping - Design of Mooring Systems.

International Maritime Organization (IMO)

IMO MSC Circ. 645	Guidelines for Vessels with Dynamic Positioning Systems.
IMO MODU Code	Mobile Offshore Drilling Unit Code.

International Marine Contractors Association (IMCA)

IMCA M103	Guidelines for the Design and Operation of Dynamically Positioned Vessels.
IMCA M140	Specifications for DP Capability Plots.
IMCA M166	Guidance on Failures Modes & Effects Analysis (FMEAs).

3. Terms and definitions

For the purpose of this GP, the following terms and definitions apply:

Administration(s)

Shortened version of Flag State Administration, which is a national marine regulatory authority/body.

**Beacon**

Acoustic pulse generating device on the seabed or on a fixed structure whose signals are repeated at regular intervals, as used by hydro-acoustic position reference to establish the vessel's position.

Blackout

Loss of all main electrical power, including power to thrust motors or the DP control system.

Note: Loss of electrical power that specifically prevents the DP control system from operating is known as DP blackout.

Capability plot

A theoretical polar plot of the vessel's or facility's position-keeping capability for specified conditions of wind, waves and current.

Note 1: These can be determined for different thruster combinations and produced in accordance with IMCA M140.

Note 2: The plot may also be represented as a theoretical and limiting polar power plot for specified conditions of wind, waves and current.

Note 3: The plot is normally provided for shuttle tanker operations in which the acceptable operating zone is reduced from the normal 360°.

Dynamic positioning (DP)

Automatic control and maintaining of vessel/facility position and heading by the use of thrusters with respect to one or more position references.

Note: A vessel or facility can also be referred to as being 'dynamically positioned'.

DP control location

Permanently manned location(s) where the DP operator is able to both monitor the performance of the DP system and also operate the DP system, intervening as necessary.

DP control system

Part of the DP system that calculates vessel/facility relative position and provides correcting thruster commands.

DP incident

Loss of automatic station keeping control, or loss of vessel/facility position outside of allowable limits, or any incident which has resulted in or should have resulted in a red or yellow alert.

DP system

All equipment that supports automatic station keeping control.

Equipment class

Classification for the equipment capability of DP vessels defined by their worst case failure modes, as outlined in IMO MSC Circ. 645.

Independent joystick

Joystick that is independent of the DP control system.

Joystick

Positioning facility that uses a single lever for control of the vessel surge, sway and yaw motions, which may be selected either individually, or together.

Loss of position

Movement(s) of vessel or facility from the intended or targeted position envelope.

Manual control

The use of individual thruster controls or joystick with or without automatic heading control.

Operator

Any member of the vessel's complement involved with DP equipment.

Examples: DP Operator, Master, duty engineer, Chief Engineer, electrician, taut wire operator, radio operator.

Note: This can also mean the organisation which operates vessels on behalf of the owners.

Perfect reference

An industry recognised term for a specific fault condition.

Note: A 'perfect reference' occurs when a reference system, through an unintended action such as the dragging of a taut wire clump weight, does not register, record or display an actual change in vessel position, i.e., the reference provides 'perfect' positioning.

Redundancy

The ability of a component or system to maintain or restore its function when a single failure has occurred.

Examples: By installation of multiple components, machinery and/or systems, or by providing alternate means of performing a function, e.g., battery back-up to mains power supply.

Safe working limits

Environmental limits specified for safely working the vessel/facility on DP, taking into account specified equipment failures and limitations imposed by the current worksite.

Thruster

Any propulsion device controlled by the DP control system (including main propeller and rudder).

Thruster phase-back

Automated DP control system command that reduces the loading of the thruster, or group of thrusters, to prevent the power system reaching its maximum level.

Worst case failure

Failure condition used for the basis of design and proven by the FMECA and trials.

Note: This usually relates to a number of thrusters and generators that can simultaneously fail and should be considered in any consequence analysis.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

DGPS	Differential global positioning system.
DPO	Dynamic positioning operator.
FPF	Floating production facility.
FMEA	Failure mode and effects analysis.
FMECA	Failure mode and effects (criticality) analysis.
FSVAD	Flag state verification and acceptance document.
MSC	Maritime Safety Committee.
RCS	Recognised classification society.
ROV	Remote operated vehicle.
UPS	Uninterruptible power supply.
WSOG	Well specific operating guidelines.

5. General philosophy

- a. This GP adopts guidance and recommendations from IMO MSC Circ. 645.
- b. IMCA M103 should also be followed.

There are no internationally ratified regulations covering DP systems.

The IMO Maritime Safety Committee approved the “Guidelines for Vessels with Dynamic Positioning Systems” at the 36th session in May 1994 (IMO MSC Circ. 645).

The IMO Guidelines were developed by the Ship Design and Equipment Sub-Committee and are implemented under the provisions of the IMO 1989 MODU Code - paragraph 4.12 for new vessels.

IMCA has developed guidance around DP and its use on the basis of IMO MSC Circ. 645.

IMCA M103 provides for the practical implementation of the IMO principles and guidance.

6. Flag state rules and guidance

- a. FSVAD as defined in IMO MSC Circ. 645 shall be obtained for all new and converted DP vessels/facilities.
- b. Flag State Administrations (Administrations) may have specific requirements for vessels operating in their jurisdictions. Particular care shall be taken to include any specific requirements when considering a vessel that is intended to operate solely within a single jurisdiction such as: Norway, United States, etc.
- c. Applicable Administration regulations shall be consulted during the design phase.

Administrations have the express authority from IMO to allow the operation of any vessel whose dynamic positioning system is designed to a different standard than those specified in the relevant IMO guidance (IMO MSC Circ. 645).

7. Classification society rules

- a. As a minimum requirement, the design and construction of DP systems shall comply with the selected RCS rules.

As required by GP 65-20, Clause 5.4.1, RCS class the floating structure as an offshore installation during design and fabrication (or conversion) phases. RCS approval covers verification of design method, materials and equipment specified, and fabrication and installation methods.

The following classification societies are considered to have adequately developed DP system rules:

- *Lloyds Register (LR) (U.K.).*
- *American Bureau of Shipping (ABS) (U.S.).*
- *Det Norske Veritas (DNV) (Norway).*

Rules and requirements to achieve IMO DP equipment class equivalency vary between different class societies.

8. System capability

The capability of a DP system is not the same as the DP equipment class (see Clause 9).

The capability of a DP system identifies the maximum continuous operational station keeping performance. A fixed number or notation identifies the vessel's station keeping capability against specified environmental conditions.

- a. BP will specify the capability level required for the intended areas and nature of vessel operation taking into consideration any Administration requirements.
- b. The DP system capability shall be determined (usually by calculation), in accordance with both of the following:
1. IMCA M103, Section 1.4.
 2. IMCA M140.

Class societies now issue performance capability notations which are calculated and issued according to the rules defined here;

- *Lloyd's Register Rules and Regulations for the Classification of Ships, Other Ship Types and Systems, Dynamic Positioning, Section 6. (PCR Notation - used only in Lloyds as a factor that gauges the percentage of time the ship can remain on station when subjected to a set of standard environmental conditions with:*
 - *All thrusters inoperative, and*
 - *With the most effective thruster inoperative.*
- *Det Norske Veritas, Rules for Ships, Part 6, Special Equipment and Systems - Additional Class, Chapter 7, Section 6. (ERN Notation - Used only in DNV as a factor used to indicate the station keeping ability of the vessel with all thrusters operating, minimum effect of single thruster failure and maximum effect of single thruster failure).*
- *ABS does not currently provide a notation to cover this aspect of station keeping capability.*