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GUIDELINES FOR VESSELS AND UNITS WITH DYNAMIC POSITIONING (DP) SYSTEMS

- 1 The Maritime Safety Committee, at its ninety-eighth session (7 to 16 June 2017), approved the *Guidelines for vessels and units with dynamic positioning (DP) systems*, as set out in the annex, prepared by the Sub-Committee on Ship Systems and Equipment, at its fourth session (20 to 24 March 2017).
- 2 Member States are invited to bring the annexed Guidelines to the attention of DP manufacturers, ship designers, shipyards, shipowners and other parties concerned.
- 3 Member States are also invited to apply the annexed Guidelines to vessels and units with dynamic positioning systems.
- 4 Furthermore, Member States are invited to use the model form of the Dynamic Positioning Verification Acceptance Document (DPVAD), as set out in the appendix to the Guidelines.

ANNEX

**GUIDELINES FOR VESSELS AND UNITS WITH
DYNAMIC POSITIONING (DP) SYSTEMS**

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PREAMBLE

1 The *Guidelines for vessels with dynamic positioning systems* (MSC/Circ.645) were approved by MSC 63 in May 1994 to provide the industry with an international standard for dynamic positioning systems on all types of vessels. These Guidelines for new vessels and units with dynamic positioning systems have been developed to provide an amended standard reflecting the development in DP operation since 1994 and the current industry practice and DP technologies.

2 It is recommended that the present Guidelines be applied to vessels and units constructed on or after 9 June 2017. For vessels and units constructed on or after 1 July 1994 but before 9 June 2017, the previous version of the Guidelines (MSC/Circ.645) may continue to be applied, however it is recommended that section 4 of the present Guidelines be applied to all new and existing vessels and units, as appropriate.

3 Taking into account that dynamically positioned vessels are moved and operated internationally and recognizing that the design and operating criteria require special consideration, these Guidelines have been developed to facilitate international operation without having to document the dynamic positioning system in detail for every new area of operation.

4 Compliance with the Guidelines should be documented by means of a Dynamic Positioning Verification Acceptance Document (DPVAD) for the dynamic positioning system.

5 If the Administration exempts any vessel or unit which embodies features of a novel kind from any of the provisions of these Guidelines, the exemptions should be listed in the DPVAD.

6 If the Administration approves alternative design and arrangements for any particular provision of these Guidelines, pertinent technical information about the approval should be summarized and annexed to the DPVAD.

1 GENERAL

1.1 Purpose

The purpose of these Guidelines is to recommend the design criteria, equipment, operating provisions and testing as well as a documentation regime for dynamic positioning systems in order to reduce the risk to the personnel, the vessel, other vessels or structures, sub-sea installations and the environment, while performing operations under dynamic positioning control.

1.2 Definitions

For the purpose of these Guidelines, unless expressly provided otherwise, the terms used herein are defined hereunder:

1.2.1 *Activity-Specific Operating Guidelines (ASOG)* means guidelines on the operational, environmental and equipment performance limits for the location and specific activity. (For drilling operations, the ASOG may be known as the Well-Specific Operating Guidelines (WSOG)).

1.2.2 *Bus-tie breaker* means a device connecting/disconnecting switchboard sections ("closed bus-tie(s)" means connected).

1.2.3 *Company* means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all duties and responsibilities imposed by the International Safety Management Code.

1.2.4 *Computer system* means a system consisting of one or more computers and associated hardware, software and their interfaces.

1.2.5 *Consequence analysis* means a software function continuously verifying that the vessel will remain in position even if the worst-case failure occurs.

1.2.6 *Dynamic Positioning control station (DP control station)* means a workstation designated for DP operations, where necessary information sources, such as indicators, displays, alarm panels, control panels and internal communication systems are installed (this includes: DP control and independent joystick control operator stations, required position reference systems' Human Machine Interface (HMI), manual thruster levers, mode change systems, thruster emergency stops, internal communications).

1.2.7 *Dynamic Positioning operation (DP operation)* means using the DP system to control at least two degrees of freedom in the horizontal plane automatically.

1.2.8 *Dynamic Positioning Verification Acceptance Document (DPVAD)* means the document issued by the Administration or its Recognized Organization to a DP vessel complying with these Guidelines. (See appendix for model form.)

1.2.9 *Dynamically positioned vessel (DP vessel)* means a unit or a vessel which automatically maintains its position and/or heading (fixed location, relative location or predetermined track) by means of thruster force.

1.2.10 *Dynamic Positioning control system (DP control system)* means all control components and systems, hardware and software necessary to dynamically position the vessel. The DP control system consists of the following:

- .1 computer system/joystick system;
- .2 sensor system(s);
- .3 control stations and display system (operator panels);
- .4 position reference system(s);
- .5 associated cabling and cable routing; and
- .6 networks.

1.2.11 *Dynamic Positioning system (DP system)* means the complete installation necessary for dynamically positioning a vessel comprising, but not limited to, the following sub-systems:

- .1 power system;
- .2 thruster system; and
- .3 DP control system.

1.2.12 *Failure* means an occurrence in a component or system that causes one or both of the following effects:

- .1 loss of component or system function; and/or
- .2 deterioration of functional capability to such an extent that the safety of the vessel, personnel or environment protection is significantly reduced.

1.2.13 *Failure Modes and Effects Analysis (FMEA)* means a systematic analysis of systems and sub-systems to a level of detail that identifies all potential failure modes down to the appropriate sub-system level and their consequences.

1.2.14 *FMEA proving trials* means the test program for verifying the FMEA.

1.2.15 *Hidden failure* means a failure that is not immediately evident to operations or maintenance personnel and has the potential for failure of equipment to perform an on-demand function, such as protective functions in power plants and switchboards, standby equipment, backup power supplies or lack of capacity or performance.

1.2.16 *Joystick system* means a system with centralized manual position control and manual or automatic heading control.

1.2.17 *Loss of position and/or heading* means that the vessel's position and/or heading is outside the limits set for carrying out the DP activity in progress.

1.2.18 *Position keeping* means maintaining a desired position and/or heading or track within the normal excursions of the control system and the defined environmental conditions (e.g. wind, waves, current, etc.).

1.2.19 *Power management system* means a system that ensures continuity of electrical supply under all operating conditions.

1.2.20 *Power system* means all components and systems necessary to supply the DP system with power. The power system includes but is not limited to:

- .1 prime movers with necessary auxiliary systems including piping, fuel, cooling, pre-lubrication and lubrication, hydraulic, pre-heating, and pneumatic systems;
- .2 generators;
- .3 switchboards;
- .4 distribution systems (cabling and cable routeing);
- .5 power supplies, including uninterruptible power supplies (UPS); and
- .6 power management system(s) (as appropriate).

1.2.21 *Redundancy* means the ability of a component or system to maintain or restore its function when a single failure has occurred. Redundancy can be achieved, for instance, by the installation of multiple components, systems or alternative means of performing a function.

1.2.22 *Time to safely terminate (operations)* means the amount of time required in an emergency to safely cease operations of the DP vessel.

1.2.23 *Thruster system* means all components and systems necessary to supply the DP system with thrust force and direction. The thruster system includes:

- .1 thrusters with drive units and necessary auxiliary systems including piping, cooling, hydraulic, and lubrication systems, etc.;
- .2 main propellers and rudders if these are under the control of the DP system;
- .3 thruster control system(s);
- .4 manual thruster controls; and
- .5 associated cabling and cable routeing.

1.2.24 *Worst-Case Failure Design Intent (WCFDI)* means the specified minimum DP system capabilities to be maintained following the worst-case failure. The worst-case failure design intent is used as the basis of the design. This usually relates to the number of thrusters and generators that can simultaneously fail.

1.2.25 *Worst-Case Failure (WCF)* means the identified single fault in the DP system resulting in maximum detrimental effect on DP capability as determined through the FMEA.

2 EQUIPMENT CLASSES

2.1 A DP system consists of components and systems acting together to achieve sufficiently reliable position keeping capability. The necessary redundancy level for components and systems is determined by the consequence of a loss of position and/or

heading keeping capability. To achieve this philosophy the requirements have been grouped into three equipment classes. For each equipment class, the associated worst-case failure should be defined as in paragraph 2.2 below. The equipment class of the vessel required for a particular operation should be agreed between the company and the customer based on a risk analysis of the consequence of a loss of position and/or heading. Otherwise, the Administration or coastal State may decide the equipment class for the particular operation.

2.2 The equipment classes are defined by their worst-case failure modes as follows:

- .1 For equipment class 1, a loss of position and/or heading may occur in the event of a single fault.
- .2 For equipment class 2, a loss of position and/or heading will not occur in the event of a single fault in any active component or system. Common static components may be accepted in systems which will not immediately affect position keeping capabilities upon failure (e.g. ventilation and seawater systems not directly cooling running machinery). Normally such static components will not be considered to fail where adequate protection from damage is demonstrated to the satisfaction of the Administration. Single failure criteria include, but are not limited to:
 - .1 any active component or system (generators, thrusters, switchboards, communication networks, remote-controlled valves, etc.); and
 - .2 any normally static component (cables, pipes, manual valves, etc.) that may immediately affect position keeping capabilities upon failure or is not properly documented with respect to protection.
- .3 For equipment class 3, a loss of position and/or heading will not occur in the event of a single fault or failure. A single failure includes:
 - .1 items listed above for class 2, and any normally static component assumed to fail;
 - .2 all components in any one watertight compartment, from fire or flooding; and
 - .3 all components in any one fire sub-division, from fire or flooding (for cables, see also paragraph 3.5.1).

2.3 For equipment classes 2 and 3, a single inadvertent act should be considered as a single fault if such an act is reasonably probable.

2.4 Based on the single failure criteria in paragraph 2.2, the worst-case failure should be determined and used as the criterion for the consequence analysis (see paragraph 3.4.2.4).

2.5 The Administration should assign the relevant equipment class to a DP vessel based on the criteria in paragraph 2.2 and state it in the DPVAD (see paragraph 5.2).

2.6 When a DP vessel is assigned an equipment class this means that the DP vessel is suitable for DP operations within the assigned and lower equipment classes.

2.7 It is a provision of the Guidelines that the DP vessel is operated in such a way that the worst-case failure, as determined in paragraph 2.2, can occur at any time without causing a breach of acceptable excursion criteria set for loss of position and/or heading for equipment classes 2 and 3.

3 FUNCTIONAL REQUIREMENTS

3.1 General

3.1.1 Insofar as is practicable, all components in a DP system should be designed, constructed and tested in accordance with international standards recognized by the Administration.

3.1.2 If external forces from mission-related systems (cable lay, pipe lay, mooring, etc.) have a direct impact on DP performance, the influence of these systems should be considered and factored into the DP system design. Where available from the DP system or equipment manufacturer, such data inputs should be provided automatically to the DP control system. Additionally, provisions should be made to provide such data inputs into the DP control system manually. These systems and the associated automatic inputs should be subject to surveys, testing and analysis specified in paragraph 5.1.

3.1.3 In order to meet the single failure criteria given in paragraph 2.2, redundancy of components will normally be necessary as follows:

- .1 for equipment class 2, redundancy of all active components; and
- .2 for equipment class 3, redundancy of all components and A-60 physical separation of the components.

3.1.4 For equipment class 3, full redundancy of the control systems may not be possible. (i.e. there may be a need for a single changeover system from the main computer system to the backup computer system). Such connections between otherwise redundant and separated systems may be accepted when these are operated so that they do not represent a possible failure propagation path during DP operations. Failure in one system should in no case be transferred to the other redundant system.

3.1.5 For equipment classes 2 and 3, connections between otherwise redundant and separated systems should be kept to a minimum and made to fail to the safest condition. Failure in one system should in no case be transferred to the other redundant system.

3.1.6 Redundant components and systems should be immediately available without needing manual intervention from the operators and with such capacity that the DP operation can be continued for such a period that the work in progress can be terminated safely. The transfer of control should be smooth and within acceptable limitations of the DP operation(s) for which the vessel is designed.

3.1.7 For equipment classes 2 and 3, hidden failure monitoring should be provided on all devices where the FMEA shows that a hidden failure will result in a loss of redundancy.

3.1.8 The DP control station should be arranged where the operator has a good view of the vessel's exterior limits and the surrounding area. Equipment that should be located at the DP control station includes, but is not limited to:

- .1 DP control and independent joystick control operator stations;

- .2 manual thruster levers;
- .3 mode change systems;
- .4 thruster emergency stops;
- .5 internal communications; and
- .6 position reference systems' HMI, when considered necessary.

3.2 Power system

3.2.1 The power system should have an adequate response time to changes in power demand.

3.2.2 For equipment class 1, the power system need not be redundant.

3.2.3 For equipment class 2, the power system should be divisible into two or more systems so that, in the event of failure of one sub-system, at least one other system will remain in operation and provide sufficient power for station keeping. The power system(s) may be run as one system during operation, but should be arranged by bus-tie breaker(s) to separate the systems automatically upon failures which could be transferred from one system to another, including, but not limited to, overloading and short circuits.

3.2.4 For equipment class 3, the power system should be divisible into two or more systems so that, in the event of failure of one system, at least one other system will remain in operation and provide sufficient power for station keeping. The divided power system should be located in different spaces separated by A-60 class divisions. Where the power systems are located below the operational waterline, the separation should also be watertight. Bus-tie breakers should be open during equipment class 3 operations unless equivalent integrity of power operation can be accepted according to paragraph 3.1.4.

3.2.5 For equipment classes 2 and 3, the power available for position keeping should be sufficient to maintain the vessel in position after worst-case failure according to paragraph 2.2.

3.2.6 For equipment classes 2 and 3, at least one automatic power management system (PMS) should be provided and should have redundancy according to the equipment class and a blackout prevention function.

3.2.7 Alternative energy storage (e.g. batteries and fly-wheels) may be used as sources of power to thrusters as long as all relevant redundancy, independency and separation requirements for the relevant notation are complied with. For equipment classes 2 and 3, the available energy from such sources may be included in the consequence analysis function required in paragraph 3.4.2.4 when reliable energy measurements can be provided for the calculations.

3.2.8 Sudden load changes resulting from single faults or equipment failures should not create a blackout.

3.3 Thruster system

3.3.1 Each thruster on a DP system should be capable of being remote-controlled individually, independently of the DP control system.

3.3.2 The thruster system should provide adequate thrust in longitudinal and lateral directions, and provide yawing moment for heading control.

3.3.3 For equipment classes 2 and 3, the thruster system should be connected to the power system in such a way that paragraph 3.3.2 can be complied with even after failure of one of the constituent power systems and the thrusters connected to that system.

3.3.4 The values of thruster force used in the consequence analysis (see paragraph 3.4.2.4) should be corrected for interference between thrusters and other effects which would reduce the effective force.

3.3.5 Failure of a thruster system including pitch, azimuth and/or speed control, should not cause an increase in thrust magnitude or change in thrust direction.

3.3.6 Individual thruster emergency stop systems should be arranged in the DP control station. For equipment classes 2 and 3, the thruster emergency stop system should have loop monitoring. For equipment class 3, the effects of fire and flooding should be considered.

3.4 DP control system

3.4.1 General

- .1 In general, the DP control system should be arranged in a DP control station where the operator has a good view of the vessel's exterior limits and the surrounding area.
- .2 The DP control station should display information from the power system, thruster system and DP control system to ensure that these systems are functioning correctly. Information necessary to safely operate the DP system should be visible at all times. Other information should be available upon the operator's request.
- .3 Display systems and the DP control station in particular should be based on sound ergonomic principles which promote proper operation of the system. The DP control system should provide for easy accessibility of the control mode, i.e. manual joystick, or automatic DP control of thrusters, propellers and rudders, if part of the thruster system. The active control mode should be clearly displayed.
- .4 For equipment classes 2 and 3, operator controls should be designed so that no single inadvertent act on the operator's panel can lead to a loss of position and/or heading.
- .5 Alarms and warnings for failures in all systems interfaced to and/or controlled by the DP control system should be audible and visual. A record of their occurrence and of status changes should be provided together with any necessary explanations.
- .6 The DP control system should prevent failures being transferred from one system to another. The redundant components should be so arranged that any failed component or components may be easily isolated so that the other component(s) can take over smoothly with no loss of position and/or heading.

- .7 It should be possible to control the thrusters manually, by individual levers and by an independent joystick, in the event of failure of the DP control system. If an independent joystick is provided with sensor inputs, failure of the main DP control system should not affect the integrity of the inputs to the independent joystick.
- .8 A dedicated UPS should be provided for each DP control system (i.e. minimum one UPS for equipment class 1, two UPSs for equipment class 2 and three UPSs for equipment class 3) to ensure that any power failure will not affect more than one computer system and its associated components. The reference systems and sensors should be distributed on the UPSs in the same manner as the control systems they serve, so that any power failure will not cause loss of position keeping ability. An alarm should be initiated in case of loss of charge power. UPS battery capacity should provide a minimum of 30 minutes operation following a main supply failure. For equipment classes 2 and 3, the charge power for the UPSs supplying the main control system should originate from different power systems.
- .9 The software should be produced in accordance with an appropriate international quality standard recognized by the Administration.

3.4.2 Computers

- .1 For equipment class 1, the DP control system need not be redundant.
- .2 For equipment class 2, the DP control system should consist of at least two computer systems so that, in case of any single failure, automatic position keeping ability will be maintained. Common facilities such as self-checking routines, alignment facilities, data transfer arrangements and plant interfaces should not be capable of causing failure of more than one computer system. An alarm should be initiated if any computer fails or is not ready to take control.
- .3 For equipment class 3, the main DP control system should consist of at least two computer systems arranged so that, in case of any single failure, automatic position keeping ability will be maintained. Common facilities such as self-checking routines, alignment facilities, data transfer arrangements and plant interfaces should not be capable of causing failure of more than one computer system. The two or more computer systems mentioned above do not include the backup computer system; thus, in addition, one separate backup DP control system should be arranged, see paragraph 3.4.2.6. An alarm should be initiated if any computer fails or is not ready to take control.
- .4 For equipment classes 2 and 3, the DP control system should include a software function, normally known as "consequence analysis", which continuously verifies that the vessel will remain in position even if the worst-case failure occurs. This analysis should verify that the thrusters, propellers and rudders (if included under DP control) that remain in operation after the worst-case failure can generate the same resultant thruster force and moment as required before the failure. The consequence analysis should provide an alarm if the occurrence of a worst-case failure were to lead to a loss of position and/or heading due to insufficient thrust for the prevailing environmental conditions (e.g. wind, waves, current, etc.). For operations which will take a long time to safely terminate, the consequence analysis should include a function which simulates the remaining thrust and power after the worst-case failure, based on input of the environmental conditions.

- .5 Redundant computer systems should be arranged with automatic transfer of control after a detected failure in one of the computer systems. The automatic transfer of control from one computer system to another should be smooth with no loss of position and/or heading.
- .6 For equipment class 3, the backup DP control system should be in a room separated by an A-60 class division from the main DP control station. During DP operation, this backup control system should be continuously updated by input from at least one of the required sets of sensors, position reference system, thruster feedback, etc. and be ready to take over control. The switchover of control to the backup system should be manual, situated on the backup computer, and should not be affected by a failure of the main DP control system. Main and backup DP control systems should be so arranged that at least one system will be able to perform automatic position keeping after any single failure.
- .7 Each DP computer system should be isolated from other on-board computer systems and communications systems to ensure the integrity of the DP system and command interfaces. This isolation may be effected via hardware and/or software systems and physical separation of cabling and communication lines. Robustness of the isolation should be verified by analysis and proven by testing. Specific safeguards should be implemented to ensure the integrity of the DP computer system and prevent the connection of unauthorized or unapproved devices or systems.

3.4.3 Position reference systems

- .1 Position reference systems should be selected with due consideration to operational requirements, both with regard to restrictions caused by the manner of deployment and expected performance in working situations.
- .2 For equipment class 1, at least two independent position reference systems should be installed and simultaneously available to the DP control system during operation.
- .3 For equipment classes 2 and 3, at least three independent position reference systems should be installed and simultaneously available to the DP control system during operation.
- .4 When two or more position reference systems are required, they should not all be of the same type, but based on different principles and suitable for the operating conditions.
- .5 The position reference systems should produce data with adequate accuracy and repeatability for the intended DP operation.
- .6 The performance of position reference systems should be monitored and warnings should be provided when the signals from the position reference systems are either incorrect or substantially degraded.
- .7 For equipment class 3, at least one of the position reference systems should be connected directly to the backup control system and separated by an A-60 class division from the other position reference systems.

3.4.4 Vessel sensors

- .1 Vessel sensors should at least measure vessel heading, vessel motions and wind speed and direction.
- .2 When an equipment class 2 or 3 DP control system is fully dependent on correct signals from vessel sensors, these signals should be based on three systems serving the same purpose (i.e. this will result in at least three heading reference sensors being installed).
- .3 Sensors for the same purpose which are connected to redundant systems should be arranged independently so that failure of one will not affect the others.
- .4 For equipment class 3, one of each type of sensor should be connected directly to the backup DP control system, and should be separated by an A-60 class division from the other sensors. If the data from these sensors is passed to the main DP control system for their use, this system should be arranged so that a failure in the main DP control system cannot affect the integrity of the signals to the backup DP control system.

3.5 Cables and piping systems

3.5.1 For equipment class 3, cables for redundant equipment or systems should not be routed together through the same compartments. Where this is unavoidable, such cables may run together in cable ducts of A-60 class, the termination of the ducts included, which are effectively protected from all fire hazards except that represented by the cables themselves. Cable connection boxes may not be provided within such ducts.

3.5.2 For equipment class 2, piping systems for fuel, lubrication, hydraulic oil, cooling water and cables should be located with due regard to fire hazards and mechanical damage.

3.5.3 For equipment class 3, redundant piping systems (e.g. piping for fuel, cooling water, lubrication oil, hydraulic oil, etc.) should not be routed together through the same compartments. Where this is unavoidable, such pipes may run together in ducts of A-60 class, the termination of the ducts included, which are effectively protected from all fire hazards except that represented by the pipes themselves.

3.6 Requirements for essential non-DP systems

For equipment classes 2 and 3, systems not directly part of the DP system, but which in the event of failure could cause failure of the DP system (e.g. common fire suppression systems, engine ventilation, heating, ventilation and air conditioning (HVAC) systems, shutdown systems, etc.), should also comply with relevant requirements of these Guidelines.

3.7 Independent joystick system

3.7.1 A joystick system independent of the automatic DP control system should be arranged. The power supply for the independent joystick system (IJS) is to be independent of the DP control system UPSs. An alarm should be initiated upon failure of the IJS.

3.7.2 The IJS should have automatic heading control.

4 OPERATIONAL REQUIREMENTS

4.1 Before every DP operation, the DP system should be checked according to applicable vessel specific location checklist(s) and other decision support tools such as ASOG in order to make sure that the DP system is functioning correctly and that the system has been set up for the appropriate mode of operation.

4.2 During DP operations, the system should be checked at regular intervals according to the applicable vessel-specific watchkeeping checklist.

4.3 DP operations necessitating equipment class 2 or 3 should be terminated when the environmental conditions (e.g. wind, waves, current, etc.) are such that the DP vessel will no longer be able to keep position if the single failure criterion applicable to the equipment class should occur. In this context, deterioration of environmental conditions and the necessary time to safely terminate the operation should also be taken into consideration. This should be checked by way of environmental envelopes if operating in equipment class 1 and by way of an automatic means (e.g. consequence analysis) if operating in equipment class 2 or 3.

4.4 The necessary operating instructions should be kept on board.

4.5 DP capability polar plots should be produced to demonstrate position keeping capacity for fully operational and post worst-case single failure conditions. The capability plots should represent the environmental conditions in the area of operation and the mission-specific operational condition of the vessel.

4.6 The following checklists, test procedures, trials and instructions should be incorporated into the vessel-specific DP operations manuals:

- .1 location checklist (see paragraph 4.1);
- .2 watchkeeping checklist (see paragraph 4.2);
- .3 DP operating instructions (see paragraph 4.4);
- .4 annual tests and procedures (see paragraph 5.1.1.3);
- .5 initial and periodical (5-year) tests and procedures (see paragraphs 5.1.1.1 and 5.1.1.2);
- .6 examples of tests and procedures after modifications and non-conformities (see paragraph 5.1.1.4);
- .7 blackout recovery procedure;
- .8 list of critical components;
- .9 examples of operating modes;
- .10 decision support tools such as ASOG; and
- .11 capability plots (see paragraph 4.5).

5 SURVEYS, TESTING AND DYNAMIC POSITIONING VERIFICATION ACCEPTANCE DOCUMENT (DPVAD)

5.1 Surveys and testing

5.1.1 Each DP vessel to which the Guidelines apply should be subject to the surveys and testing specified below:

- .1 an initial survey which should include a complete survey of the DP system and FMEA proving trials for DP classes 2 and 3 to ensure full compliance with the applicable parts of the Guidelines. Furthermore it should include a complete test of all systems and components and the ability to keep position after single failures associated with the assigned equipment class. The type of tests carried out and results should be recorded and kept on board;
- .2 a periodical testing at intervals not exceeding five years to ensure full compliance with the applicable parts of the Guidelines. A complete test should be carried out as required in paragraph 5.1.1.1. The type of tests carried out and results should be recorded and kept on board;
- .3 an annual survey should be carried out within three months before or after each anniversary date of the Dynamic Positioning Verification Acceptance Document¹. The annual survey should ensure that the DP system has been maintained in accordance with applicable parts of the Guidelines and is in good working order. The annual test of all important systems and components should be carried out to document the ability of the DP vessel to keep position after single failures associated with the assigned equipment class and validate the FMEA and operations manual. The type of tests carried out and results should be recorded and kept on board; and
- .4 a survey, either general or partial according to circumstances, should be carried out every time a defect is discovered and corrected or an accident occurs which affects the safety of the DP vessel, or whenever any significant repairs or alterations are made. After such a survey, necessary tests should be carried out to demonstrate full compliance with the applicable provisions of the Guidelines. The type of tests carried out and results should be recorded and kept on board.

5.1.2 For equipment classes 2 and 3, an FMEA should be carried out. This is a systematic analysis of the systems to the level of detail required to demonstrate that no single failure will cause a loss of position or heading and should verify worst-case failure design intent. This analysis should then be confirmed by FMEA proving trials. The FMEA and FMEA proving trials result should be kept on board and the FMEA should be kept updated so that it remains current.

5.1.3 These surveys and tests should be witnessed by officers of the Administration. The Administration may, however, entrust the surveys and testing either to surveyors nominated for the purpose or to organizations recognized by it. In every case, the Administration concerned should guarantee the completeness and efficiency of the surveys and testing. The Administration may entrust the company of the vessel to carry out annual and minor repair surveys according to a test programme accepted by the Administration.

¹ If a Dynamic Positioning Verification Acceptance Document is not available, the anniversary date of the initial survey should be used to determine the date of the annual survey.

5.1.4 After any survey and testing has been completed, no significant change should be made to the DP system without the sanction of the Administration, except the direct replacement of equipment and fittings for the purpose of repair or maintenance.

5.2 Dynamic Positioning Verification Acceptance Document (DPVAD)

5.2.1 Compliance with these Guidelines should be verified by a DPVAD issued by or on behalf of the Administration.

5.2.2 A DPVAD should be issued, after survey and testing in accordance with these Guidelines, by the Administration or an organization recognized by it.

5.2.3 The DPVAD should be drawn up in the official language of the issuing country and in the form given in the appendix to the Guidelines. If the language used is neither English nor French, the text should include a translation into one of these languages.

5.2.4 The DPVAD is issued for a period not exceeding five years, or for a period specified by the Administration.

5.2.5 The DPVAD should cease to be valid if significant alterations have been made in the DP system equipment, fittings, arrangements, etc. specified in the Guidelines without the sanction of the Administration, except the direct replacement of such equipment or fittings for the purpose of repair or maintenance.

5.2.6 The DPVAD issued to a DP vessel should cease to be valid upon transfer of such a vessel to the flag of another country.

5.2.7 The privileges of the DPVAD may not be claimed in favour of any DP vessel unless the DPVAD is valid.

5.2.8 Results of the DPVAD tests should be readily available on board for reference.

6 TRAINING

Personnel engaged in operating a DP system should have received relevant training and practical experience in accordance with the provisions of the 1978 STCW Convention, as amended, the STCW Code, as amended, and the *Guidelines for Dynamic Positioning System (DP) Operator Training* (MSC/Circ.738, as amended).

APPENDIX

Model Form of Dynamic Positioning Verification Acceptance Document

Dynamic Positioning Verification Acceptance Document

(Official seal)

(State)

Issued under the provisions of the

Guidelines for vessels with
 dynamic positioning systems
 (MSC.1/Circ.[...])

under the authority of the Government of

(full designation of the State)

by _____
 (full official designation of the competent person or organization authorized by the Administration)

Distinctive identification (Name or number)	Type	Port of registry	IMO number

Date on which keel was laid or vessel was at similar stage of construction* or on which major conversion was commenced*

THIS IS TO CERTIFY that the above-mentioned vessel has been duly documented, surveyed and tested in accordance with the Guidelines for vessels with dynamic positioning systems (MSC.1/Circ.[...]) and found to comply with the Guidelines.

The vessel is allowed to operate in DP Equipment Class and in lower equipment classes.

This document is valid until unless terminated by the Administration, provided that the vessel is operated, tested and surveyed according to the provisions in the Guidelines and the results are properly recorded.

Issued at
 (Place of issue of document)

.....
 (Date of issue)

.....
 (Signature of authorized official issuing the certificate)

.....
 (Seal or stamp of the issuing authority, as appropriate)

* Delete as appropriate.

LIST OF EXEMPTIONS AND EQUIVALENTS

(refer to paragraphs 5 and 6 of the preamble of the Guidelines)

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-
-

LIST OF MAIN SYSTEMS AND COMPONENTS COVERED BY DPVAD²

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-
-
-
-
-
-

² All main systems and components comprising the dynamic positioning system should be recorded to account for overall system composition and design. Such records should readily facilitate cross-referencing to drawings, schematics, and/or other system diagrams. System and component updates introduced after the date of DPVAD issuance should be recorded only after proper testing/validation has been verified and found acceptable to the designated authority.

Record of annual survey reports, and periodic (5-year) testing reports

Date	Test type	Remarks	Report Reference Date/Number³	Sign. of appointed surveyor (if required)⁴	Sign. of Master/ Unit Manager

³ All reports should be filed together with this DPVAD for use during later testing and inspections by nominated surveyors, flag State surveyors, etc.

⁴ Refer to item 5.1.3.