MSC PLAN REVIEW GUIDELINE (PRG)

REVIEW OF DYNAMIC POSITIONING SYSTEMS

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Purpose

This Plan Review Guideline (PRG) explains the requirements for plan submittal for Dynamic Positioning (DP) systems in accordance with the references below. This PRG should be used as a guide when DP system plans are submitted to the Marine Safety Center for review.

Contact Information

If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by e-mail or phone. Please refer to Procedure Number E2-24.

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1. Applicability

This Plan Review Guideline (PRG) is applicable to installations of Dynamic Positioning Systems on all U.S. flagged inspected vessels and any Mobile Offshore Drilling Unit operating on the U.S. Outer Continental Shelf (OCS). This review consists of verifying DP equipment classes 1, 2, and 3 to applicable regulations and policies. See MTN 2-11 for further detail on Dynamic Positioning Systems.

2. References

(a) IMO MSC.1/Circ. 1580, "Guidelines for Vessels and Units with Dynamic Positioning Systems," dated June 16, 2017
(b) Title 46 CFR Subchapter F, Marine Engineering
(c) Title 46 CFR Subchapter J, Electrical Engineering
(d) Navigation and Inspection Circular (NVIC) 2-89, "Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units"
(e) MTN 02-11, CH 1, "Marine Safety Center Guidance for Vital System Automation and Dynamic Positioning System Plans"
(f) MSC Plan Review Guideline, E2-18, Qualitative Failure Analysis
(g) MSC Plan Review Guideline, E2-05, Design Verification Test Procedures
(h) MSC Plan Review Guideline, E2-17, Periodic Safety Test Procedures
(i) DP Committee of the Marine Technology Society

3. Definitions

a. *DP Class 1* a loss of position and/or heading may occur in the event of a single fault.

b. *DP 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.

c. *DP 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

d. *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.

4. General Guidance

a. DP systems are propulsion control systems and are considered vital systems, see Reference (a) (Section 1.2.11) and 46 CFR 62.10-1(a).

b. Automated systems, including DP systems, include a wide array of individual components which are in many cases independently designed. Integration and testing of these components as a system remains a significant challenge. A single point of contact should be provided for vessel automation systems to avoid significant gaps in integration that may be left unaddressed until onboard testing is conducted. It is also recommended that the DP system installation be discussed with the Marine Safety Center early in the project design phase.

c. The following DP system plans should be submitted as a minimum:

(1) DP system block diagram showing all components necessary to demonstrate compliance with DP system equipment class requirements. For equipment Class 3 (as defined in section 3), the necessary segregation of redundant components by fire and flooding boundaries should be indicated on the block diagram.

(2) A general arrangement plan showing the location of thrusters and control system components. For equipment Class 3, this plan should show the necessary segregation of redundant components by fire and flooding boundaries.

(3) Thruster design data and thruster remote control systems, including thruster manual joystick controls and thruster emergency stops.

(4) Thruster force calculations and DP capability plots. These should include calculations and DP capability plots for the worst case failure.

(5) Environmental force calculations and design safe operating envelope.

(6) DP system interconnections with the electrical power generation and distribution and power management systems. Please see requirements in 46 CFR Subchapter J, Electrical Engineering.

(7) DP control power system(s), including backup UPS system(s), provided.

(8) Details of the dynamic positioning alarm system and any interconnections to other vessel vital automations systems (e.g., centralized machinery monitoring

and control system). Please see requirements in 46 CFR Subchapter F, Marine Engineering.

(9) Details of the position reference systems provided.

(10) Details of the environmental monitoring systems provided.

(11) Interior and exterior communication systems provided.

(12) A detailed description of the consequence analyzer software including all parameters monitored, environmental data input, and all alarms provided.

(13) DP Operations Manual.

(14) Failure Mode and Effects Analysis (FMEA). The FMEA should be similar in content and detail to the Qualitative Failure Analysis (QFA) delineated in 46 CFR 62.20. Please see 46 CFR 50.20-5.

(15) Design Verification Test Procedure (DVTP) or DP FMEA Proving Trial Test Document. The Marine Safety Center will make a recommendation to the cognizant OCMI with regards to approval. Final approval from the Marine Safety Center or the OCMI should not be issued until after the completion of satisfactory testing. Any changes to the test procedures should be resubmitted to MSC for review.

(16) Periodic Safety Test Procedure (PSTP) or DP Annual Proving Trial Test Document. The Marine Safety Center will make a recommendation to the cognizant OCMI with regards to approval. Final approval from the Marine Safety Center or the OCMI should not be issued until after the completion of satisfactory testing. Any changes to the test procedures should be resubmitted to MSC for review.

Class 2 and 3 DP Systems

a. Sufficient detail should be provided to evaluate the following systems for redundancy:

(1) Fuel supply, including remote and automatic valve closures.

(2) Lubricating oil.

(3) Seawater cooling, including sea chests.

(4) Fresh water cooling.

(5) Control air.

(6) Engine air supply.

(7) Engine starting systems, such as starting air and batteries.

b. Adequate detail should be provided to evaluate the following systems for potential impact on system redundancy:

(1) Fire and Gas detection and alarm and associated automatic shutdowns.

(2) Fixed fire extinguishing systems and agent release-activated shutdowns.

(3) Machinery, electrical and electronics space ventilation and related ducting, dampers, closures and remote and automatic shutdowns.

Class 3 DP Systems

a. Sufficient detail should be provided to evaluate fire and flooding segregation. Evaluation should include:

(1) Failure of all components in any one watertight compartment (from fire or flooding

(2) Failure of all components in any one fire subdivision (from fire or flooding).

(3) Fire or flooding in a switchboard or transformer room.

(4) Fire or flooding along a common cable route.

(5) Fire or flooding in the emergency switchboard room.

(6) Fire or flooding in a main or auxiliary machinery space.

(7) Fire or flooding in the engine control room.

(8) Fire boundaries provided (e.g., A.60 class division).

Closed Bus Operation

An open bus configuration is the preferred mode of operation. If the vessel intends to operate closed bus, then additional review is needed, following the Marine Technology Society (MTS) guidelines and Technical and Operational Guidance Notes (TECHOPs). At a minimum a vessel's FMEA and DP FMEA Proving Trials should address the common failure modes listed in paragraphs 4.2, 4.3 and Figure 1 of TECHOP_GEN_01. These documents can be found in reference (i) under DOCUMENTS and applied as needed depending on the configuration of the vessel. The DP documents should provide robust analysis and testing to prove fault ride-through capability and blackout prevention.

Further Guidance

The following Marine Safety Center guidelines listed in the references for plan review may be useful in developing the DP test documents noted above: E2-18 Qualitative Failure Analysis, E2-05 Design Verification Test Procedures, and E2-17 Periodic Safety Test Procedures.

5. Disclaimer

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact MSC, the unit responsible for implementing this guidance.