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Ships and marine technology — Specification for software-based planned maintenance systems

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National foreword

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**Ships and marine technology —
Specification for software-based
planned maintenance systems**

*Navires et technologie maritime — Spécification pour la gestion de
maintenance assistée par ordinateur*



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Contents		Page
Foreword		iv
Introduction		v
1 Scope		1
2 Normative references		1
3 Terms and definitions		1
4 SPMS functions		1
4.1 General.....		1
4.1.1 Language.....		1
4.1.2 Backup capability.....		2
4.1.3 Ship-shore communication.....		2
4.1.4 PMS code.....		2
4.1.5 Database.....		2
4.1.6 Authentication and authorization.....		2
4.1.7 Update.....		2
4.1.8 Failure recovery.....		2
4.1.9 Cyber security.....		3
4.1.10 Notifications.....		3
4.1.11 Queries and printout.....		3
4.2 Initialization function.....		3
4.2.1 Registration of machinery and parts.....		3
4.2.2 Initialization of the SPMS tasks.....		3
4.3 Maintenance process.....		4
4.3.1 Maintenance planning.....		4
4.3.2 Reporting.....		4
4.3.3 Approval.....		5
5 Optional functions		5
5.1 Spare parts management.....		5
5.2 Analysis and optimization.....		6
5.2.1 Maintenance plan.....		6
5.2.2 Spare parts.....		6
6 Control of internal and external SPMS documents		6
7 SPMS software and hardware requirement		7
Bibliography		8

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents shall be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 11, *Intermodal and Short Sea Shipping*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In its International Safety Management Code, the International Maritime Organization (IMO) defines a mandatory regulation on planned maintenance systems (PMS) for ships, for the purposes of promoting efficiency of maintenance and safe operation. Although PMS are regulated to be operated on paper or software, software-based PMS are preferred due to systematization and computerization of the shipping industry. Hence, software-based PMS have already been used to help implement ISM Code 2018 Part A/10. However, a standardized software-based PMS is needed to meet further demand in the era of e-navigation or maritime autonomous surface ships (MASS). In addition, even though shipping companies have been developing their own PMS software and equipping ships, this has been proving difficult for medium to small size shipping companies. This document will prove useful to shipping companies when developing the software program of PMS, by providing the method of inputting, planning, reporting and managing the data of maintenance of items and spare parts.

Ships and marine technology — Specification for software-based planned maintenance systems

1 Scope

This document specifies the minimum functions for software-based planned maintenance systems (SPMS) and related aspects, that shipping companies are intended to provide to ships. It includes requirements for planning and implementing a maintenance schedule, as well as for recording, reporting, analysing and optimizing the maintenance of onboard equipment and systems, in support of ISM Code 2018 Part A/10, which addresses maintenance, spare parts, procurement, personnel, and voyage planning; these aspects can be covered in one or more applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IACS E22, *On Board Use and Application of Computer based systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

planned maintenance system

PMS

system that supports efficient maintenance, such as planning, scheduling, implementing, recording and reporting of actions taken for onboard equipment and systems

3.2

software-based planned maintenance system

SPMS

planned maintenance system (3.1) that fulfils functionalities via software

4 SPMS functions

4.1 General

4.1.1 Language

The SPMS should be implemented in English, other languages may also be used.

4.1.9 Cyber security

The transmissions of data that are critical to the safety of the ship should be protected against unauthorized access.

Cyber security measures in accordance with MSC. 428(98) and related instruments shall be implemented to protect against cyber threats and to ensure data integrity.

4.1.10 Notifications

The SPMS shall:

- a) enable the user to set a pre-notification date for maintenance, before the planned maintenance date;
- b) notify the user when the notification date and planned maintenance date are due;
- c) enable the user to check all overdue or failed tasks according to the maintenance plan within a user-defined time window;
- d) notify the user when the tasks have been overdue, and propose a maintenance date for overdue tasks based on the existing maintenance plan;
- e) enable the user to provide a description of related reasons of overdue or failed tasks;
- g) notify the user in the case of self-malfunction, such as disk full, exceptional error, network malfunction, database management system (DBMS) failure, etc.

4.1.11 Queries and printout

The function of query and print out of history data shall be provided by the SPMS.

4.2 Initialization function

4.2.1 Registration of machinery and parts

When first installed, the SPMS shall at least include the following particulars for the equipment and systems of the ship:

- a) the machinery number;
- b) the machinery name;
- c) the manufacturer;
- d) the machinery type;
- e) the spare parts.

4.2.2 Initialization of the SPMS tasks

Maintenance details of each equipment or system shall be defined, according to the machine's characteristics, the manufacturer's recommendation and the maintenance policy of the company; at least it shall include the following:

- a) the task description;
- b) the maintenance frequency;
- c) the maintenance method;
- d) the person in charge;

- e) the last work date, or the date when the equipment or system was new;
- f) the total running hour as of the last work date.

The task period shall be determined by maintenance frequency, defined change in a component value or judgment of the person in charge, and the initial maintenance date and the initial value shall be set as the standard for maintenance.

4.3 Maintenance process

4.3.1 Maintenance planning

The running hours of the equipment or systems shall be updated by visual inspection or average running hours.

The SPMS shall enable the user to establish a maintenance plan for a period of time (e.g. for a given number of months) or for a voyage, based on manpower, scheduling and dependencies of the maintenance tasks, at least including:

- a) the machinery;
- b) the maintenance task and description;
- c) the planning method;
- d) the spare parts needed;
- e) the person in charge;
- f) the due date.

If the maintenance plan period is determined, the SPMS task times for the selected period shall be automatically listed up, so that the user can confirm the SPMS tasks to be performed during the period and establish the detailed implementation schedule.

The SPMS shall enable the user to establish unplanned and unexpected maintenance tasks as the need arises according to [4.2.2](#).

The SPMS shall enable the user to reschedule a due date before the calculated due date, and record the related reasons.

The SPMS shall provide a forecast for the material resources required for a set future period of time in a range of equipment and systems to be produced, based on the existing maintenance plans.

4.3.2 Reporting

When a maintenance task is completed, details on the maintenance task shall be reported, at least including:

- a) the maintenance date;
- b) the person in charge;
- c) the time used;
- d) the spare parts used;
- e) the quantity of spare parts used;
- f) a picture (if any);
- g) the related planned maintenance task;

h) comments (such as reason for overdue).

When the above data is inputted completely for one task, the subsequent plan date and other related information shall be generated, such as:

- a) the name of machinery, equipment;
- b) the SPMS task and description;
- c) the last maintenance date;
- d) the next maintenance date;
- e) the person in charge.

4.3.3 Approval

Supervision over input data shall be exercised through the SPMS, so that a user with supervisor's permissions can review and manage maintenance reports.

The approval shall be recorded, and the supervisor shall be capable of checking the list of tasks, categorized in terms of approved versus unapproved and planned versus completed.

5 Optional functions

5.1 Spare parts management

When first installed, at least the following particulars of spare parts shall be registered through the SPMS:

- a) machinery number;
- b) parts number;
- c) parts name;
- d) manufacturer;
- e) parts type;
- f) machinery related to the spare part;
- g) quantity in use;
- h) stock quantity;
- i) expected stock quantities: minimum, maximum;
- j) storage item location;
- k) expiry date (if necessary);
- l) critical item or statutory item.

The stock quantity shall be updated through the SPMS, based on the report of maintenance tasks and stock transactions, and a complete overview of current stock shall be provided.

A stock transaction record shall be kept, and stock in or stock out shall be registered automatically or manually. Details of stock transaction records shall include:

- a) purchased (the quantity is increased);

- b) used (the quantity is decreased);
- c) returned unused (the quantity is increased);
- d) lost (the quantity is decreased);
- e) found (the quantity is increased);
- f) sold (the quantity is decreased);
- g) transferred in (the quantity is increased);
- h) transferred out (the quantity is decreased);
- i) delivered back (the quantity is increased);
- j) lent out (the quantity is decreased);
- k) trashed (the quantity is decreased).

For the stock items marked as perishable, the SPMS shall notify the user when the stock item is beyond the warranty period.

5.2 Analysis and optimization

5.2.1 Maintenance plan

Analysis of the implementation history of maintenance plan should be achieved through the SPMS, and recommendations on amendments to the maintenance plan, such as optimized task sequence and task period, should be provided for more efficient maintenance. Once the recommendations are confirmed by the authorized person, the maintenance plan may be updated accordingly.

5.2.2 Spare parts

Stock forecasts for individual or multiple part numbers over a variable period of time may be established through the SPMS, and recommendations on the necessary minimum stock quantities should be provided to achieve a balance between cost of spare parts on hand and the predicted breakdown prevention. Once the recommendations are confirmed by the authorized person, the required level of spare parts may be updated accordingly.

6 Control of internal and external SPMS documents

The SPMS shall provide functionalities to:

- a) make relevant maintenance documents available at all points of use;
- b) approve PMS documents for adequacy by qualified personnel prior to use;
- c) review, update as necessary, and re-approve documents;
- d) control distribution of documents and their revisions;
- e) identify the changes and current document revision status;
- f) ensure the documents remain legible and readily identifiable;
- g) prevent obsolete documents from unintended use.

This includes, but is not limited to:

- a) manufacturer manuals;

- b) maintenance procedures and instructions;
- c) maintenance reporting and measurement forms;
- d) drawings and machinery documentation;
- e) spare parts lists, catalogues, order particulars;
- f) technical bulletins and manufacturer circulars related to the ship's equipment.

7 SPMS software and hardware requirement

Reference can be made to the following industry standards for the development of the SPMS, the latest edition of which (including any amendments) applies:

- a) ISM 2018 Part A, [ISO/IEC 12207](#), [ISO/IEC 25000](#), [ISO/IEC 25041](#), IEC 61511;
- b) the SPMS shall comply with IACS E22.

Bibliography

- [1] [ISO/IEC/IEEE 12207](#), *Systems and software engineering — Software life cycle processes*
- [2] [ISO/IEC 25000](#), *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*
- [3] [ISO/IEC 25041](#), *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Evaluation guide for developers, acquirers and independent evaluators*
- [4] IEC 61511, *Functional safety — Safety instrumented systems for the process industry sector*
- [5] ISM. 2018 Part A, International Safety Management Code

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