NR496 DT R02 JULY 2022

APPROVAL OF COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS USED ON BOARD SHIPS

NR496 - JULY 2022

RULE NOTE

BUREAU VERITAS

BUREAU VERITAS
RULES, RULE NOTES AND GUIDANCE NOTES

The PDF electronic version of this document available at the Bureau Veritas Marine & Offshore website https://marine-offshore.bureauveritas.com/ is the official version and shall prevail if there are any inconsistencies between the PDF version and any other available version.

These rules are provided within the scope of the Bureau Veritas Marine & Offshore General Conditions, enclosed at the end of Part A of NR467, Rules for the Classification of Steel Ships. The current version of these General Conditions is available at the Bureau Veritas Marine & Offshore website.

BUREAU VERITAS MARINE & OFFSHORE

8 cours du triangle
92937 Paris La Défense Cedex - France
+33 (0)1 55 24 70 00

marine-offshore.bureauveritas.com/rules-guidelines

NR496

APPROVAL OF COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEMS USED ON BOARD SHIPS

Section 1 Computerized Maintenance Management Systems

July 2022

Table of Content

Section 1 Computerized Maintenance Management Systems

1 General

1.1 Introduction

1.1.1 Computerized Maintenance Management Systems (CMMS) are softwares or web applications, which aim at supporting the maintenance on board ships. These software provide multiple functionalities to handle different aspects of the maintenance, such as: equipment data management, planned (or unplanned) maintenance management, maintenance scheduling, spare part or vendor management, inventory control…

CMMS are mainly installed and operated on board vessels, but may also be remotely operated at the ship management's office. In the last case, software data can either be stored on a local ship server and then be periodically communicated to the ashore company server, or be directly stored in the cloud.

Note 1: Such software or application are generally developed and maintained by a specialized Software Company. In some cases, the Ship Operator may have developed its own software.

From the Society's perspective, when a ship is operated under a Planned Maintenance Survey (PMS) scheme, it is to be supported by a reliable and trustworthy CMMS. The CMMS, by ensuring the traceability of maintenance actions, is a key support to the Society's audit, and must therefore comply with Class specific requirements.

Note 2: When a ship is operated under a PMS scheme, Class renewal for machinery items are no longer based on Class surveys but on the audit of the machinery systems instead.

Note 3: Where Planned Maintenance Survey system (PMS) (NR467, Pt A, Ch 2, Sec 2, [4.4]) is implemented, the Computerized Maintenance Management System (CMMS) on board is to met the functionalities described in this Rule note.

1.2 Application

1.2.1 This Rule Note provide requirements for the approval of CMMS used on board ships. The approval of a CMMS follows the Society's type approval scheme (refer to [1.4]).

1.2.2 The approval only covers the maintenance management functionalities described in this Rule Note.

Note 1: Although software may include other facilities (or modules) such as spare parts management, crew management, purchase management… these functionalities are not covered by the approval.

1.2.3 Softwares already certified by a recognized organization and on the basis of equivalent requirements will be subject to a special examination.

1.2.4 For specific application, case-by-case approval may be granted at the discretion of the Society, based on submission of adequate documentation and subject to the satisfactory outcome of any required tests.

1.3 Reference documents

1.3.1 IACS and ISO documents

This Rule Note refers to the following standards:

- IACS UR E22 On Board Use and Application of Computer based systems
- ISO 23323 Ships and marine technology — Specification for software-based planned maintenance systems.

1.3.2 Society Rules

This Rule Note refers to the following Rules and Rules Note:

- NR467 Rules for the Classification of Steel Ships
- NR320 Certification Scheme of Materials and Equipment for the Classification of Marine Units.

1.4 Type approval

1.4.1 CMMS type approval follows the Society's type approval scheme described in NR320, which consists of the following steps:

- documentation review
- type test of software functionalities for "on board" version, and "shore-based" version, if applicable
- issuance of Type Approval Certificate.

1.4.2 When the CMMS require specific software configuration, or the definition of installation parameters to comply with the requirements of this Rule Note, they are to be identified and listed with indication of their values or settings.

Note 1: The software approval is subject to the definition of these parameters which will be clearly mentioned in the Type Approval Certificate.

1.4.3 Type Approval only covers the "on board" version of the CMMS, and the "shore-based" version, if applicable.

1.4.4 The approval may be extended to mobile applications, on a case by case basis and at the discretion of the Society, depending on the software functionalities.

1.4.5 The applicant should notify the Society of any modification or changes to the software. In case of substantial modifications, a new approval process may be required.

2 Definitions

2.1 General definitions

2.1.1 The following general definitions are used in this Rule Note:

- Class Equipment: equipment covered by Society's Rules and subject to periodical survey for the maintenance of Class.
- Critical Equipment: equipment for which the sudden operational failure may result in hazardous situations as per Requirement 10.3 of the IMO ISM Code.
- Date of (or running hours at) job completion: latest date (or running hours) on which a maintenance job is scheduled.
- Done date (or done running hours): date (or running hours) on which a maintenance job is effectively performed.
- Running hours (equipment): cumulative operation time (in hours).
- Usage rate (equipment): ratio of the actual equipment running hours to the total hours available.
- Planned maintenance job: any maintenance activity that is planned, documented, and scheduled (e.g. machine counter reporting, condition monitoring task...).
- Unplanned maintenance job: any maintenance task that occurs unexpectedly (e.g. emergency, maintenance as a result of condition monitoring...).
- Performed maintenance job: the maintenance activity that was effectively executed.
- Maintenance job interval (or running hours counter): fixed running time at which a maintenance job will be performed after its previous execution, regardless of the equipment condition or calendar time (usually the interval unit is in "hours").
- Maintenance job interval (calendar period): fixed periodic time at which a maintenance job will be performed after its previous execution, regardless of the equipment operating time or condition (usually in days, weeks, months or years).
- Maintenance job scheduling: maintenance planning functionalities.
- Maintenance job history report: report which presents data recorded when the maintenance activity is recorded in the software.
- Traceability report (equipment or maintenance job): report which present data recorded in a period of time related to a piece of equipment (e.g. modification, deletion...) or of a planned maintenance job (e.g. modification of equipment name, modification of maintenance job interval...).
- On board version (CMMS): version of the CMMS that includes functionalities used by the vessel crew in order to manage the maintenance of the vessel assets. This version is usually the one installed on board the vessel.
- Office version (CMMS): version of the CMMS that includes functionalities used by the office staff in order to manage the maintenance of a vessel or a fleet of vessels from the shore. This version is usually the one installed in the office of the company responsible for the vessel maintenance, and the one used as a back-up of the on board version.
- CMMS "mobile application": version of the CMMS that includes the functionalities used by the vessel crew in order to manage the maintenance of the vessel assets. This version is usually the one installed on a smart phone and/or a tablet.

3 Documentation and material

3.1 General

3.1.1 Documentation and software to be submitted for approval, information or testing are listed in Tab 1.

The Society reserves the right to request the submission of additional documents if it is deemed necessary for the evaluation of the software.

4 Functional Requirements

4.1 General

4.1.1 The requirements of NR467, Pt C, Ch 3, Sec 3, for software of Category I, are applicable.

4.1.2 The software is to be clearly identified, with indication of its version. The information is to be available for the user.

4.1.3 Design of the User Interface is to follow common ergonomic principles.

4.1.4 The software is to be designed to get a satisfactory response time for each functionality on the hardware specified in "Software technical specification" (refer to Tab 1, item 2).

4.1.5 Software functionalities are to be (at least) displayed in the English language.

4.2 Software Access

4.2.1 The software must include the following functionalities regarding user access:

a) Software access is to be restraint and secured (e.g. username/password) for each user

b) Software is to enable access rights management (e.g. manage access rights of identified users or group of users).

Table 1 : Documentation to be submitted

No	Topic	I / A / W **(1)**	Deliverable
1	CMMS application letter	I	Type Approval Application form, or request of approval, with clear identification of the software, with name and version
2	Software technical specifications	I	Integrity Development Environment (IDE), programming language, database management system, recommended operating system, minimum hardware requirements
3	User Manual	I	Operator manual providing necessary information for software installation and use: description of standard installation (including associated database management system), description of main software modules, functions, interfaces, menus operation
4	Computer Based System Category I	I / A **(2)**	Documentation and requirements related to Computer Based System (Refer to NR 467 Rules for Steel Ships, Pt C, Ch 3, Sec 3)
5	Onboard Software Demo Version (or equivalent) and test database	W	• A software demo version (or equivalent) compliant with requirements of this Rule Note (as far as practicable without license duration limit). If different than the standard installation, the installation procedure of the demo version is to be provided. The "office version" may be requested by the Society on a case by case basis, to get a comprehensive overview of the software • A representative and complete test database, to enable the testing of software functionalities
(1) A: for approval ; I: for information ; W: for test **(2)** Upon request			

4.3 Data Management and Storage

4.3.1 The software is to be able to store the following data:

a) Data related to Equipment Definition, Planned Maintenance Job Definition and Maintenance Management as described in [4.4] and [4.5] respectively.

b) Data related to Maintenance History and Traceability for a minimum period of five years:

1) maintenance Job History data: The minimum data to be stored are data to be presented in the Maintenance Job History Reports (refer to [4.6.2])

2) traceability data: (in case of creation, deletion and modification of Equipment Definition or Planned Maintenance Job Definition). The minimum data to be stored are data to be presented in the traceability reports (refer to [4.6.3]).

4.3.2 The software is to support the following functionalities related to data management:

a) The creation, deletion and modification of Equipment Definition or of Maintenance Job Definition are not to delete corresponding Maintenance Job History or Traceability data.

b) The software is to backup dedicated software functions and data, so that the software, or the data stored, can be restored, reinstalled or repaired, without loss of essential information. Back up is to be performed at regular intervals, preferably on an external support (e.g. on board ship server, cloud, portable hard disk...).

Note 1: Although automatic backup are recommended for quality purpose, manual back-ups are also accepted by the Society.

Note 2: In the event of a failure, the software should be able to recover from a previous stable state, with all maintenance data.

c) The software is to be able to communicate data from on board application to shore-based (or cloud based) application and vice-versa.

Note 3: Data exchange may be manual or automatic, full, incremental or differential.

d) When closing a maintenance job in the system, description of the condition of the machine after repair is to be required by the software.

4.4 Equipment and Planned Maintenance Job definition

4.4.1 Equipment definition

Following information is to be provided for equipment definition:

a) equipment name

Note 1: It is recommended to also indicate the equipment code or the on board tag number.

b) Class equipment are to be appropriately flagged

Note 2: It is recommended to also indicate the Class equipment code or the on board tag number.

c) critical equipment are to be appropriately flagged.

Note 3: The concept of the criticality of an equipment is independent from the concept of Class (refer to the ISM Code).

4.4.2 Planned Maintenance Job definition

Following information and software functionalities are to be available for Planned Maintenance Job definition:

a) The following information are to be provided as a minimum for Planned Maintenance Job identification:

- equipment name (and code if available)

Note 1: It is recommended to use an equipment coding system.

- job title (and code if available)

Note 2: It is recommended to use a job coding system.

- job type: renewal, inspection, lubrication, condition monitoring...
- job description: description of the Maintenance Job to be performed (e.g. maintenance procedures, information on instrumentation, safety procedures, condition monitoring…)
- planned Maintenance Job interval, which can be based on running hours, on calendar period or, on parameter threshold. In case of one-time job, a specified date is to be specified. The time unit is to be clearly specified (hours, day, week, month, and year).

Note 3: The job interval can be defined based on running hours and calendar period at the same time. In that case, the job is to be scheduled at the date whichever comes first.

Note 4: Condition Monitoring tasks (e.g. periodical vibration measurements...) can be defined as Planned Maintenance Jobs in the software.

b) The software is to enable to filter or sort Planned Maintenance Jobs by Class equipment and Critical equipment

c) The software is to enable to export Planned Maintenance Jobs in an electronic table, under a machine readable format (e.g. csv, xls, xlsx…), with at least information listed in item a).

d) The software is to be able to upload information (baseline, thresholds values...) from ship Condition Monitoring System or from Approved Service Suppliers.

Note 5: People or department in charge of maintenance may be provided in the definition. It depends on ship internal organization and are usually defined by profession (electrical, machinery…) or crew team (deck, bridge…).

4.5 Maintenance Management

4.5.1 Equipment running hours record

When running hours are recorded in the software for the maintenance scheduling, the following are to be considered:

a) Users are not to be allowed to record hours from a date in the future (e.g. recording running hours for the 23/10/2021 when computer time indicate 20/10/2021).

b) Users are not to be allowed to record negative value for running hours.

c) The software is to request confirmation from the user when recording running hours with a daily average more than 24 h/days.

Note 1: User may record running hours with a daily average more than 24 h/day intentionally, for example when crossing time zone.

d) The software is to request confirmation from the user when recording a total of running hours which is less than the previously updated value.

Note 2: The equipment usage rate may be considered by the software to provide an estimation of the due date of maintenance, as a support for maintenance scheduling. Details of this calculation method may be requested by the Society.

4.5.2 Equipment parameters record

When the evolution of parameters is recorded in the software and considered for maintenance scheduling (Condition Based Maintenance), the following are to be considered:

a) users are not to be allowed to record parameter value from a date in the future (e.g. recording a parameter value on the 23/10/2021 when computer time indicate 20/10/2021).

Note 1: The software may be fitted with trend estimation as a support for maintenance scheduling. Details of this trend estimation method may be requested by the Society.

4.5.3 Maintenance Job Scheduling

Following information and software functionality are to be available for Maintenance Job Scheduling:

Note 1: Maintenance Job Scheduling task is performed both for planned and unplanned/corrective maintenance.

a) When Maintenance Job Scheduling is based on:
   - calendar period: the software is to be able to calculate the job due date
   - running hours: the software is to be able to provide an estimation of the job due date or due running hours on the basis of equipment running hours
   - parameter (Condition Based): the software is to be able to provide an estimation of the job due date based on trend estimation.

b) The software is to be able to schedule Unplanned Maintenance Jobs

c) Scheduled Maintenance Jobs for which date or running hours are overdue are to be clearly identified in the software

d) If software functionalities enable the postponement of Maintenance Jobs, the modification or the suppression of the job is to be recorded with the following information:
   - the first original due date and re-scheduled due date
   - reason for postponement.

Note 2: In case of multiple postponement, the original due date is to remain the first original due date.

e) Software is to enable the filtering or the sorting of scheduled jobs by:
   - class equipment
   - critical equipment
   - overdue jobs
   - postponed jobs.

f) Users are not to be able to modify the date of job completion, the running hours at job completion, or the description of the maintenance performed once a Maintenance Job has been reported in the software.

4.5.4 Performed Maintenance Job record

The software is to enable the user to keep record of Performed Maintenance Job. Following information are to be requested by the software when recording Performed Maintenance Job in the system:

a) depending on the type of maintenance:
   - date of job completion
   - running hours at job completion
   - parameter at job completion (Condition Monitoring).

   The user is not to be allowed to record a Performed Maintenance Job on a future date in the system.

b) if a Performed Maintenance Job is overdue (e.g. reported after the due date), the reason for delay is to be compulsorily imputed by the user

c) indication if the Performed Maintenance Job was Unplanned Maintenance (e.g. after breakdown, failure, abnormal wear, Condition Based Maintenance…)

d) description of the condition of the machine after repair

e) when performing Condition Based Maintenance, Condition Monitoring diagnostic or prognostic reports.

Note 1: The presence of a free text field is recommended for the indication of different remarks on the job performed: observations, satisfactory/ unsatisfactory condition, description of damage, running hours at time of damage, possible cause (human failure, wear and tear), spares...

4.6 Data Reporting

4.6.1 The software is to include functionalities regarding the restitution and presentation of Maintenance Job History and Traceability data stored in the maintenance database. Minimum requirements are described in [4.6.2] and [4.6.3].

4.6.2 Maintenance Job History reports

The software is to be able to produce Maintenance Job History report:

a) The Maintenance Job History report is to present the following information:
   - equipment name (and code if available)
   - job category: Planned (e.g. renewal) or Unplanned Maintenance Job (e.g. equipment failure...)
   - job title (and code if available)
   - job type (e.g. inspection...)
   - job interval
   - job due date or due running hours
   - date of job completion, or running hours at job completion
   - reason for overdue
   - reason for postponement, and date of postponement
   - any reported remark.

b) The software is to enable to filter Maintenance Job History reports:
- between dates
- by Class equipment
- by critical equipment
- by planned or unplanned jobs
- by overdue reported jobs
- by postponed reported jobs.

c) The software is to enable to export Maintenance Job History reports in an electronic, machine readable, table format (e.g. csv, xls, xlsx…), with at least the data listed in item a).

d) The information listed in a) are not to be alterable by users.

Note 1: It is recommended to enable the upload of photo or external report (e.g. lube-oil analysis, measurement analysis) to ease job reporting.

4.6.3 Traceability reports

The software is to be able to produce an "Equipment Traceability report" and "Planned Maintenance Job Traceability report" to present information related to the traceability of Equipment Definition and Planned Maintenance Job Definition:

a) The "Equipment Traceability report" is to present the information listed below, along with the equipment name (and the equipment code if available), the date (of creation, deletion or modification), and old and new value (if applicable):
- the creation of a piece of equipment
- the deletion of a piece of equipment
- the modification of any of the following information belonging to a piece of equipment:
  - equipment name or equipment code
  - equipment Class flag
  - equipment Criticality flag
  - equipment running hours records.

b) "Planned Maintenance Job Traceability report" is to present the information listed below, along with the job title (and job code if available), the date (of creation, deletion or modification), and old and new value (if applicable):
- the creation of a Planned Maintenance Job
- the deletion of a Planned Maintenance Job
- the modification of any of the following information within a Planned Maintenance Job:
  - job title, job code or job scope
  - planned job interval
  - job criticality.

c) The software is to enable to filter traceability reports:
- between dates
- by Class equipment
- by Critical equipment.

d) The "Equipment Traceability report" and the "Planned Maintenance Job Traceability report" contents are not to be alterable by users.

e) The deletion of a piece of equipment or of a Planned Maintenance Job in the database is not to delete the data related to corresponding Planned Maintenance Job or Equipment traceability in the database.

5 Testing

5.1 General

5.1.1 Type tests of software functionalities ("on board" version, and if applicable, "shore-based" version) are to be performed by the Surveyor on the software version and the test database provided in Tab 1, item 5.

BUREAU VERITAS MARINE & OFFSHORE

8 cours du triangle
92937 Paris La Défense Cedex - France
+33 (0)1 55 24 70 00

marine-offshore.bureauveritas.com/rules-guidelines

BUREAU VERITAS
1828
BUREAU
VERITAS

Shaping a World of Trust