

CONDITION MONITORING SYSTEMS

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RULE NOTE



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RULES, RULE NOTES AND GUIDANCE NOTES

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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

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NR674

CONDITION MONITORING SYSTEMS

Section 1 Condition Monitoring Systems

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Section 1 Condition Monitoring Systems

1 General

1.1 Application

1.1.1 This Rule Note applies to design, installation and testing of permanently installed Condition Monitoring Systems (CMS) where condition monitoring results are used to influence the scope and/or frequency of Class surveys.

The objective of a Condition Monitoring System is to provide an equivalent or greater degree of confidence in the condition of the machinery to traditional survey techniques.

Note 1: In addition to the requirements of this Rule Note:

- The requirements for the assignment of the additional service features **CBM** and **[CBM]** are given in NR467, Pt A, Ch 1, Sec 2, [4.16.13].
- The requirements for approval of Condition Based Maintenance (CBM) Scheme are given in NR467, Pt A, Ch 2 App 4. These requirements apply only to vessels operating on approved Planned Maintenance Survey (PMS) scheme.
- The requirements related to surveys for the assignment and maintenance of the additional service features **CBM** and **[CBM]** are given in NR467, Pt A, Ch 2, App 4.

Note 2: Refer to NI684 "Guideline for Condition Based Maintenance".

1.1.2 This Rule Note does not apply to tailshaft monitoring system.

Note 1: For shaft monitoring, refer to **MON-SHAFT** notation as defined in NR467, Pt A, Ch 1, Sec 2, [6.6.3].

1.1.3 This Rule Note applies to permanently installed CMS of type A or B.

Note 1: CMS types are defined in NI684 "Guidelines for Condition Based Maintenance".

1.1.4 Review of CMS of predictive type will be handled on a case-by-case basis. In that case, a written agreement from the Original Equipment Manufacturer (OEM) is to be provided to the Society.

1.2 Definitions

1.2.1 Terms used in this Rule Note are described in the NI684 "Guidelines for Condition Based Maintenance".

2 Documentation

2.1 General

2.1.1 Documentation to be submitted for approval or for information are listed in Tab 1.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the systems or components.

Table 1 : Documentation to be submitted

No.	Documentation to be submitted	I / A (2)	Reference
CMS DEFINITION			
1	CMS Definition (1)	I	[3.1]
2	List of sensors with specifications	A	[3.2]
CMS DESIGN ASSESSMENT			
3	List of computerized systems and corresponding documentation (see NR467, Pt C, Ch 3, Sec 3)	A	[4]
4	Requirements for Cyber Security and Safety	A	[4.5]
5	List of CMS data for traceability	A	[4.6]
TESTING			
6	Tests reports according to Pt C, Ch 3, Sec 6, [3] and [4]	A	[4.3]
(1) For applicable items			
(2) A = to be submitted for approval; I = to be submitted for information			

3 Condition Monitoring System Definition

3.1 General

3.1.1 Diagrams and functional schemes (e.g. bloc diagram) describing the CMS are to be provided, with general definition of the monitoring techniques and interfaces.

Note 1: Refer to “CMS Definition” as described in NI684, Sec 2, [3.3].

3.2 Sensors

3.2.1 Following information are to be provided regarding sensors definition:

- ID of sensors, along with the physical parameter monitored

Note 1: Representation of sensor location on the equipment, with spatial orientation should be provided.

- Sensors characteristics (e.g. sensitivity, range...) and calibration.

Note 2: Description of sensor attachment method should be provided.

Note 3: Refer to “CMS Definition” as described in NI684, Sec 2, [3.3].

4 Requirements for Condition Monitoring System

4.1 General

4.1.1 A human machine interface (integrated or stand alone) is to be provided on-board to enable CM data visualization, follow-up of CMS breakdown and log display.

Note 1: The Chief Engineer is the responsible person on board in charge of CMS, and therefore sufficient information and instrumentation are to be made available on-board for his use.

4.1.2 CMS are to be capable, through their own interface or integrated in another system, to produce a condition report and maintenance recommendation.

4.1.3 CMS are to include a method for backing up data at regular intervals, to prevent loss of data in case of CMS failure (e.g. CMS data, software...).

4.1.4 The operation or the installation of a CMS is not to have any impact on the equipment, or on the availability or functionality, of computer based systems already installed on board. A risk assessment report may, be requested by the Society.

4.2 Components

4.2.1 Systems or components, as indicated in NR467, Pt C, Ch 2, Sec 15, [2], are to be chosen from among the list of type approved products. They are to be approved on the basis of the applicable requirements and in particular the ones defined in NR467, Part C, Chapter 3.

Note 1: All sensors, transmitters and data processing equipment already used within the scope of notations **AUT-UMS**, **AUT-CCS**, **AUT-PORT** or **AUT-IMS** may be used as an input for CMS.

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

4.2.2 Installation of sensors are to be performed by a personal qualified for condition monitoring. Sensors are to be permanently marked or labelled.

Installation of cables is to follow approved cable tray path. Cable installation is to comply with the requirements of NR467, Pt C, Ch 2, Sec 12.

Note 1: Where it may not be possible/suitable for permanent markings or labels, exact location could be shown in schematic drawings, machinery information diagrams or photos.

4.3 Computer based systems

4.3.1 CMS of Type A for which functions are performed through computer based systems are to comply with the requirements of NR467, Pt C, Ch 3, Sec 3, as Category I system:

- software functional description and associated hardware description is to be submitted for information
- test programs for on board tests, including wireless network testing, are to be submitted for information
- acceptance testing and on board tests, as described in NR467, Pt C, Ch 3, Sec 6, [3] and [4], are to be witnessed by the Surveyor.

4.3.2 Pre-integrated systems are to comply with the requirements stated in NR467, Pt C, Ch 3, Sec 3, [8].

4.4 Alarms and failures

4.4.1 CMS are to be self-checking and able to detect faults, malfunctions or interruptions of its different parts: data acquisition (DA), data processing (DP), diagnostic and prognostic assessment (D & P) and health management (HM), as defined in NI684. Especially, it is to be able to detect the following when applicable:

- Loss of main source of power or low battery.
- Sensor faults (e.g. missing value, calibration expired, value outside range, slope excess, constant value...). The list of detected faults is to be specified.
- Loss of communication or network failures.
- Failure of storage device.
- Storage capacity nearly complete (e.g. 90% storage warning).
- Software abnormal operation.
- Processor failure (e.g. overheating).
- Loss of UTC synchronization.

Detected failures are to initiate an alarm and are to be logged in the system. A no-fault condition is to be positively indicated (e.g. green light).

Note 1: For data quality concerns, it is recommended that a system is implemented on board to ensure that, data recorded during an identified fault or malfunction event, are flagged appropriately as untrustworthy data. The list of flag definitions is the responsibility of the designer.

4.5 Cybersecurity

4.5.1 Access to computerized systems for modification of CMS parameters are to be secured (e.g. username/password).

Note 1: Access is to be restraint to the Chief Engineer or other authorized person.

4.5.2 Where CMS use remote monitoring or diagnosis (i.e. data is transferred from the vessel and analyzed remotely), the system is to be capable to maintain continuous on-board operation in the event of loss of the communication function. In addition, the system is to comply with the applicable requirements for cyber security of equipment in accordance with NR659 "Rules on cyber security for the classification of marine units".

4.6 Traceability

4.6.1 CMS parameters

A system is to be provided to identify where CMS parameters (e.g. baseline, limiting parameters, data collection task interval, sampling time...) are modified during the operation. Parameters and user performing the modification are to be logged in the system.

4.6.2 CMS operation data

CMS are to have the ability to store, or to communicate to external storage, the CMS operation data according to NR467, Pt A, Ch 2, App 4.

Note 1: Refer to "Data storage and backup" as defined in NI684, Sec 2, [5.3].



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