

Thordon Bearings

Recommendations to fulfil new CCS rules for SCM for water lubricated bearings

(Shaft Condition Monitoring)

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China Classification Society

Rules for classification of sea-going steel ships

Amendments 2015

Part one

Provisions of classification

Section 12 Surveys of propeller shafts and tube shafts

5.12.3 Scope of normal surveys

5.12.3.1 The complete shaft is to be sufficiently drawn to permit entire examination. The following are to be surveyed:

- (4) [...] sealing glands and [...] lubricating system;

5.12.6 Survey related to notation SCM

5.12.6.1 For ships which are assigned the notation SCM in accordance with Appendix 14 “Guidelines for Screwshaft Condition Monitoring System” of this Chapter, if they are found satisfactory at a survey of the items specified in 5.12.6.2, 5.12.6.3 and 5.12.6.4, **the interval of drawing the shaft for examination as specified in 5.12.3.1 for the normal survey may be extended to a maximum period not exceeding 15 years.**

5.12.6.4. For water-lubricated propeller shafts, the shaft condition monitoring (SCM) is to be verified during each annual survey of the ship, covering:

- (1) propeller shaft condition records, including alarm records, examination and maintenance records, lubricating water sampling/testing records and closed cycle lubricating water consumption records (if applicable);
- (2) confirmation that lubricating water samples have been submitted to a laboratory analysis organization complying with international standards (e.g. ISO17025) or accepted by CCS complying with equivalent standards at least once every 6 months for analysis and test of the samples according to the testing technology and the allowable ranges of sample analysis criteria provided by the manufacturer, the water quality parameters include:

- 1** size and proportion of suspended particles;
- 2** chloride content, bearing material and metal particles content (closed cycle water system).

(3) verification that water quality analysis report issued by the analysis organization, together with a qualification certificate of the organization and a conclusion on the condition and suitability of the water, are kept on board; the Surveyor is to verify a water quality analysis report from the last 6 months;

(4) examination and confirmation that the lubricating water supply system (including pumping and water filters/separators), alarm system and shaft starting interlock are in normal condition.

5.12.6.5 In addition to the items of 5.12.6.3 or 5.12.6.4 above, the following are to be confirmed for all shafts during the normal survey specified in 5.12.2:

- (1) wear-down of the bearings;
- (2) effectiveness of shaft glands.

5.12.8 Survey for extension of survey interval

5.12.8.1 The following are to be carried out with respect to an application for extension of interval between propeller shaft and tube shaft surveys:

(1) check of the ship's records to confirm the shafting is in normal working condition [...]. For closed cycle water-lubricated bearings, additional check of lubricating water consumption records to confirm the lubricating water consumption is in normal condition;

Appendix 14 GUIDELINES FOR SCREWSHAFT CONDITION MONITORING SYSTEM

1 General Provisions

1.1 General requirements

1.1.1 Scope

1.1.1.1 These Guidelines apply to the ships applying for the class notation SCM.

1.1.2 Application

1.1.2.1 Where the screwshaft condition monitoring (SCM) system is intended for a ship, the owner is to submit an application together with the following information to CCS for approval:

(1) Feasibility of condition monitoring (including approved shaft glands fitted and capable of being replaced without drawing the screwshaft, etc.);

1.1.3 Requirements for the analysis organization and its personnel

1.1.3.1

1.1.3.3 A lubricating water analysis organization carrying out water-lubricated screwshaft condition monitoring system is to comply with International Standards for Laboratory Approval (e.g. ISO 17025) or equivalent standards accepted by CCS. The analysis organization is to submit qualification certificate to the ship owner.

1.3 Water-lubricated screwshaft condition monitoring system

1.3.1 Role of condition monitoring system

1.3.1.1 Water-lubricated screwshaft condition monitoring system monitors quality, flow rate and temperature of screwshaft lubricating water as well as wear or protection condition of screwshaft and shaft liner so as to ensure indication of the wear condition of bearings and corrosion condition of shafts, determine quality condition of lubricating water and provide the basis for maintenance decision.

1.3.1.2 Within the interval between surveys, the screwshaft condition monitoring system may be used to replace the conventional drawing of screwshaft.

Thordon recommendation: Water sampling results to be retained on board for class surveyor review.

1.3.2 Technical requirements for condition monitoring system

1.3.2.1 The screwshaft is to either be made of corrosion resistant material or protected with a corrosion resistant protective liner or coating approved by CCS (i.e. shaft body is covered by paint between two bearing liners to prevent water corrosion). Where a protective liner or coating is used, the ship owner must submit measures for condition examination and evaluation (e.g. at tube shaft opening or fitted with endoscope), which are to be approved by CCS.

Thordon recommendation: Thordon recommends corrosion resistant liners (i.e. bronze, Inconel®) Liners & ThorShield shaft coating. Currently, visual inspection (stern tube inspection hatch) is used for assessing condition of liner and ThorShield. Alternatively, borescoping may be used for visual inspection.

1.3.2.2 Shaft glands are to be capable of being replaced without withdrawal of the screwshaft.

Thordon recommendation: Existing shaft seals on the market can meet this requirement.

1.3.2.3 A maximum permitted wear down of the bearing and the wear down at which it is recommended to carry out an inspection and maintenance are to be established, and equipment measuring bearing clearance is to be fitted. When the ship is docking, bearing wear down or

clearance is to be measured and the conditions of wear of protective shaft liner and integrity of coating are to be examined. The results are to be recorded and retained on board.

Thordon recommendation: Alignment analyses for new and worn bearings should be conducted by the shaftline designer/supplier. An example of typical/maximum clearances are indicated in Thordon Marine Bearing Installation Manual v2008.1. For wear monitoring, recommend periodic poker gauge measurements and/or bearing clearances to be recorded. Poker gauge mounts should be robust to provide dependable datum for repeatable measurements. (Alternatively feeler gauges could be used.) Recorded measurements allow a wear plot graph to be extrapolated. (A linear relationship is an indication the bearing envelope is operating properly.)

1.3.2.4 The ship is to be fitted with water supply processing system. The lubricating water supply is to be filtered, separated and purified, at least removing floating particles with specific gravity greater than 1.2 and diameter greater than 80 µm. The water supply pumps, filters and separators are to be easy for maintenance and replacement. The system is to be provided with sampling openings which are readily accessible, and the selected samples are to reflect the condition of processed water supply before entering stern tube. Samples are to be taken under service condition.

Thordon recommendation: The Thordon Water Quality Package conditions the seawater by removing suspended solids larger than 100 microns (0.004") and with a specific gravity of 1.2 or higher; separation to 80 microns (0.003") is achievable using the 75-150 l/min (20-40 GPM) unit. Two Thordon Water Quality Packages (one for redundancy) meet Unmanned Machine Spaces (UMS) requirements. A sampling point will be required before water entry to stern tube (or other).

1.3.2.5 The ship owner is to establish sampling procedure, appoint special person to collect water supply samples regularly at intervals not exceeding six months. The analysis organization mentioned in 1.1.3.3 is to carry out water sample detection and analysis according to detection technology and water sample analysis index allowance provided by the manufacturer, and analysis records are to be kept on board ship. For open water lubrication system, the size and specific gravity of suspending particles are to be detected. For closed water lubrication system, in addition to the size and specific gravity of suspending particles, chloride content as well as bearing material and metal particles content are to be detected.

Thordon recommendation: Thordon proposes periodic water sampling regime and on-board filtration of that sample with photo record of filter paper. Thordon offers a Sampling Kit Procedure (Shipboard Evaluation). The owner is responsible to submit this sampling regime to Class for acceptance.

Note: Thordon Bearings does not promote closed water lubrication systems.

1.3.2.6 Two independent sensors are to be provided to monitor flow rate of water supply, one of which is to be near inlet of screwshaft lubricating water as far as possible. When the shaft is started and the flow rate of lubricating water is below specified value, audible and visual alarm is to be given, and engine room monitoring and alarm system is to record such alarm.

Thordon recommendation: Ensure two flow sensors are installed. Thordon Water Quality Package (WQP) currently has one flow sensor activating a low flow alarm. A second sensor will need to be installed downstream from the WQP ideally in close proximity to the stern tube. Like the WQP flow sensor, the second flow sensor must be connected to the ships automated control system. It is envisaged that alarms will suffice.

1.3.2.7 Screwshaft interlock is to be provided to prevent starting screwshaft when normal flow rate of lubricating water is not established.

Thordon recommendation: Starting interlock should be included in the engine management system. Thordon's WQP Low Flow indication is provided per para. (1.3.2.6) recommendation. This signal could be integrated into the ships automated control system as a start-inhibit interlock.

1.3.2.8 For closed water lubrication system, the ship owner is to adopt fresh water as circulating lubrication medium. Circulating water temperature sensor is to be provided at circulating water outlet of stern tube. When water temperature exceeds specified value recommended by the manufacturer, audible and visual alarm is to be given by temperature sensor, and engine room monitoring and alarm system is to record such alarm. The ship is to record daily consumption of circulating water.

Note: Thordon Bearings does not promote closed water lubrication systems.

2 Surveys

2.1 Initial survey

2.1.1 Examination of plans and documentation

2.1.1.2 For a ship with water-lubricated screwshaft, when applying for SCM notation, the plans and documents listed in 1.1.2.1 are to be submitted for examination and approval, and compliance of all systems with relevant technical requirements in 1.3.2 of the Guidelines is to be confirmed.

2.1.1.23 Initial survey for new construction

(1) All systems required by these Guidelines are to be examined and tested to confirm compliance with the approved plans and documentation.

(2) Verification that management documents related to condition monitoring, as required by these Guidelines, are provided on board.

2.1.1.34 Initial survey for existing ships

(3) At least the following records of screwshaft condition monitoring (SCM) showing satisfactory results in the last 3 years are to be submitted:

- 1 ...records or lubricating water analysis records and qualification certificate of analysis organization;
- 2 ...closed circulating lubricating water consumption records;
- 3 [...]
- 4 stern bearing clearance and wear-down measurement records;
- 5 alarm records (water-lubricated screwshaft).

2.3 Miscellaneous

2.3.1 Availability of [...] lubricating water analysis information

2.3.1.1 The [...] lubricating water analysis information is to be kept on board the ship by the chief engineer for check by the attending Surveyor.

2.3.2 Cancellation of the class notation SCM

2.3.2.1 At the request of the owner or where the [...] lubricating water sampling analysis is not carried out on time, the SCM notation may be canceled and conventional survey is to be restored at the same time. The normal survey (drawing of the shaft) is to be carried out in accordance with Section 12, Chapter 5 of this PART at the next intermediate or special survey.