

## Thordon Bearings

### Recommendations to fulfil new DNV-GL rules for TMON for open loop water lubricated tailshaft bearings

January 1, 2017

DNV-GL Rules Jan2016, Part6, Chapter9, Section5

#### 2.3 TMON (open loop water)

##### 2.3.1 General

2.3.1.1 Propeller shaft shall be made out of approved corrosion resistant material or be provided with approved corrosion protection to cover and seal all parts of the shaft exposed to sea water where subjected to dynamic stresses.

**Thordon recommendation:** Thordon approved shaft sleeves; propeller closing box; ThorShield shaft coating.

Approved corrosion protection involving coating shall be complemented by additional cathodic protection arrangement.

**Thordon recommendation:** Install cathodic protection as required. Thordon investigating alternative unit.

2.3.1.2 For shafts constructed with corrosion resistant steel of PREN of less than 34 and shafting installations with a combination of liners and protective coatings, provisions for alternative means of verifying satisfactory condition of all parts of the shaft, bearings, coating, sleeves and transient areas as applicable for respective installations in service shall be provided.

Inspection procedure shall be submitted and approved by the society before assignment of the notation.

Alternative means of visual inspection should deliver a similar level of information from a normal inspection involving withdrawal of the shaft.

**Guidance note:**

A combination of inspection covers, removable bearing segments, methods using boroscope etc are considered as alternative means.

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**Guidance note:**

Shafts assembled with a continuous corrosion resistant liner fabricated in one piece do not require provisions for alternative means of inspection in service.

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**Guidance note:**

PREN stands for pitting resistance equivalent number and is a measurement of the corrosion resistance of various types of stainless steel.

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**Thordon recommendation:** Inspection hatches in sterntube, preferably in way of shaft sleeve/coating transitions.

2.3.1.3 Shaft alignment shall be approved in accordance with Pt.4 irrespective of the size of the shaft.

**Thordon recommendation:** Comply as required. Alignment calculations usually from shafting designer.

2.3.1.4 Approved methods to remotely monitor the aft tailshaft bearing performance and wear shall be provided with redundancy. Redundancy may be exempted if the hardware is designed to be replaced without withdrawal of the shaft and propeller.

Hardware used for monitoring shall be type approved by the society. Case by case approval may be acceptable as an alternative.

**Guidance note:**

Static remote wear monitoring devices ie sensors are considered as suitable methods for bearing performance and wear monitoring.

Static remote wear monitoring sensors provide a wear down measurement reading when the shaft is in a stopped condition.

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**Thordon recommendation:** Thordon Bearings offers a DNV-GL Type Approved remote bearing condition monitoring system.

2.3.1.5 An arrangement for bearing wear-down measurement shall be provided for. Hand operated gauges (typically poker gauge, top / down) are acceptable. The history of measurements shall be documented in the record files.

**Thordon recommendation:** Thordon can supply poker gauges for measuring bearing wear down.

2.3.1.6 Tail shaft bearings shall be type approved for the application.

**Thordon recommendation:** Thordon propeller shaft bearings are Type Approved.

2.3.1.7 Nominal surface bearing pressure for aft stern tube bearing shall not exceed 6 bar.

**Thordon recommendation:** Ensure pressure is less than 0.6MPa

2.3.1.8 The sealing rings in the stern tube sealing box shall be of a type which allows them to be replaced without shaft withdrawal or removal of the propeller.

**Guidance note:**

Open loop water systems are normally provided only with a forward stern tube seal.

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**Thordon recommendation:** These are typically O-rings – replacements can be bonded in place.

2.3.1.9 Maximum acceptable stern tube aft bearing clearances shall be pre-defined.

Influence of shaft alignment, remaining bearing material and shaft lubrication to be considered as a minimum.

**Thordon recommendation:** Maximum wear may be limited by alignment studies, otherwise refer to Thordon Marine Bearing Installation Manual v2008.1, page19 for general guidelines.

2.3.1.10 Onboard procedure shall be in place to document and trend the rate of bearing wear monthly using readings obtained from performance monitoring devices. Interval between trending of bearing wear shall not exceed 1000 hours in the event of longer passages exceeding one(1) month. Procedures shall also include identification of prospective deterioration of bearing performance with subsequent remedial actions within a pre-defined safe operating margin before exceeding the wear limits or failure.

**Thordon recommendation:** Record and retain data on board vessel accordingly.

2.3.1.11 A shaft grounding (earthing) device shall be installed.

**Thordon recommendation:** Such units are standard supply - a normal part of the shaftline design and are installed – ensure it is operating efficiently.

2.3.1.12 Suitable external protection devices for shaft penetrations exposed to sea water shall be installed. This also applies for strut and A-bracket bearings fitted in open water.

**Guidance note:**

Rope guards are considered as suitable external protection devices.

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**Thordon recommendation:** Include fairwaters & rope-guards in designs as appropriate.

2.3.1.13 Open bearings fitted in A-bracket and strut bearings without forced lubricated arrangement of adequate quality shall be designed to withstand external abrasive conditions.

**Thordon recommendation:** Choose Thordon bearing grade according to expected operational profile of vessel.

## 2.3.2 Lubricant supply and monitoring

2.3.2.1 The tails shaft bearings shall be lubricated and cooled by a lubricant of adequate quality and circulation to ensure satisfactory operating conditions of the shaft, bearings and sealing arrangement.

**Guidance note:**

A lubricant of adequate quality shall meet the minimum filtration requirements defined by the bearing manufacturer. This is not applicable for bearings fitted in A- brackets and struts exposed to open sea from both ends where forced supply of lubricant is not feasible.

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**Guidance note:**

Maximum design temperature of the lubricant supply shall be capable of maintaining the bearing temperature below designer's limits.

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**Thordon recommendation:** Thordon does not have a water filtration requirement. However, removal of abrasives will prolong expected bearing wearlife; Thordon's 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.

2.3.2.2 Active components and filters in the lubricant system shall be provided with sufficient redundancy to ensure safe and uninterrupted service of the propulsion system. Automatic start of pumps shall be arranged upon failure of circulation of the lubricant below acceptable limits.

**Guidance note:**

Duplicated filters shall be provided with provisions for easy change over in service.

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**Guidance note:**

This does not apply for bearings fitted in A-brackets and struts exposed to open sea.

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**Thordon recommendation:** Thordon's Water Quality Packages are compliant with UMS redundancy and auto-start requirements.

2.3.2.3 Provisions for alternative means of lubricant supply shall be arranged to maintain a lubricant flow of adequate quality in the event of emergency.

**Guidance note:**

Grounding is one of the most common cases of emergency where sea chests may not necessarily provide clean water.

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**Thordon recommendation:** Dirty water from sea chests can be OK; however, wearlife of bearing(s) may be compromised. Emergency water supply from ballast tank(s) could be considered.

2.3.2.4 Monitoring of lubricant temperature, flow and pressure shall be provided at the inlet side of the lubricant piping to the stern tube with means of warning.

**Thordon recommendation:** Install sensors mounted in pipework and connected to ship's computer as required.

Lubricant flow shall be maintained in all modes of operation including stopped condition. This is not applicable for bearings fitted in A- brackets and struts exposed to open sea from both ends where forced supply of lubricant is not feasible.

**Thordon recommendation:** Do not stop pumps in Thordon's Water Quality Package.

2.3.2.5 Lubricant shall be continuously filtered to the specification defined by the bearing manufacturer.

**Thordon recommendation:** see Section 2.3.2.1 above.

2.3.2.6 Design temperature of the lubricant shall not exceed the critical pitting limits for the shaft and hull material combination.

**Guidance note:**

Consequential risk of shaft pitting from galvanic effect is regulated by the operating temperature of the lubricant.

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**Thordon recommendation:** Thordon propeller shaft bearing temperature limit is 60°C, set alarms at 55°C maximum.

## 2.3.3 Monitoring

2.3.3.1 Monitoring shall be arranged as per Table 6.

**Table 6 Monitoring of open loop water**

	<i>Gr 1 Indication Alarm Load reduction</i>	<i>Gr 2 Automatic start of standby pump with alarm</i>	<i>Gr 3 Shut down With alarm</i>	<i>Comments</i>
Lubricant flow	LA	AS		See [6.3.2.4] and [6.3.2.2]
Lubricant pressure	LA, IL	AS		See [6.3.2.4] and [6.3.2.2]
Lubricant temperature at stern tube inlet	HA, IL			See [6.3.2.4]
Aft bearing wear down	IR			See [6.3.1.4]
<p>Gr 1 = Common sensor for indication, alarm, load reduction (common sensor permitted but with different points and alarm shall be activated before any load reduction.            Gr 2 = Sensor for automatic start of standby pump            Gr 3 = Sensor for shut down            HA = Alarm for high value            LA = Alarm for low value            AS = Automatic start of standby pump with corresponding alarm            IL = Local indication (presentation of values), in vicinity of the monitored engine component or system            IR = Remote indication (presentation of values), in engine control room or another centralized control station such as the local platform/manoeuvring</p>				

2.3.3.2 The alarms shall either be provided as a part a separate sub alarm system in accordance with Pt.4, Ch.9 or as a part of the ship's main alarm system

**Thordon recommendation: Install sensors and set alarms accordingly.**