

Alternative Inspection Methods for Seawater Lubricated Propeller Shafts and Stern Tube Shafts

Amended Rules and Guidance

Rules for the Survey and Construction of Steel Ships Parts A, and B
Rules for Automatic and Remote Control Systems
Rules for the Survey and Construction of Passenger Ships
Rules for the Survey and Construction of Inland Waterway Ships
Guidance for the Survey and Construction of Steel Ships Part B
Guidance for the Survey and Construction of Inland Waterway Ships

Reason for Amendment

IACS Unified Requirement Z21(Rev.4) specifies inspection requirements for propeller shafts and stern tube shafts according to their respective bearing lubrication systems and propeller connection structures. Among these requirements are ones that specify that, in principle, propeller shafts and stern tube shafts adopting seawater lubricated bearings be subjected to drawing-out shaft inspections at least once every five years. However, it is also specified that other reliably approved methods may be adopted in lieu of drawing-out inspections on the condition that said methods provide an equivalent or higher degree of safety.

In recent years, the development of mechanical type sealing devices, and bearings with lower wear properties as well as improvements in corrosion prevention technology have led to fewer wear and corrosion defects in both shafts and bearings. In addition, interest in seawater lubricated bearings, which do not use lubricating oil, and their effectiveness has increased among relevant industry members due to concerns for the environment.

Accordingly, in view of these circumstances, relevant requirements are amended to add new alternative means to the inspection requirements related to the drawing-out of propeller and stern tube shafts every five years for those shafts adopting seawater lubricated bearings.

Outline of Amendment

The main contents of this amendment are as follows:

- (1) Specifies that the notation “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated to *PSCM-1A*) is to be affixed to the Classification Characters of ships provided with shaft Kind 1A and whose propeller shafts surveys are carried out based upon a specified preventive maintenance system.
- (2) Specifies the requirements related to the equipment, documentation, surveys required for propeller shafts as described in (1) above.

“Rules for the survey and construction of steel ships” has been partly amended as follows:

Part A GENERAL RULES

Chapter 1 GENERAL

1.2 Class Notations

Paragraph 1.2.7 has been amended as follows.

1.2.7 Application of Special Survey Scheme

1 For oil tankers defined in 1.3.1(11), **Part B**, chemical tankers defined in 1.2.4-2 with integral tanks, bulk carriers defined in 1.3.1(13), **Part B** and self-unloading ships defined in 1.3.1(19), **Part B**, for which enhanced surveys are carried out in class maintenance surveys in accordance with the relevant provisions of **Part B**, the notation of “*Enhanced Survey Programme*” (abbreviated to *ESP*) is affixed to the Classification Characters.

2 For ships approved for In-water Surveys in accordance with the provisions of 6.1.2, **Part B**, the notation of “*In Water Survey*” (abbreviated to *IWS*) is affixed to the Classification Characters.

3 The notation “*Propeller Shaft Condition Monitoring System*” (abbreviated to *PSCM*) is affixed to the Classification Characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the provisions of ~~8.1.3(1)2-1~~, **Part B**.

4 The notation “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated to *PSCM-1A*) is affixed to the Classification Characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the provisions of 8.1.2-2, **Part B**.

~~5~~**5** The notation of “*Extended Drydock*” (abbreviated to *EDD*) is affixed to the Classification Characters of ships for which In-water Surveys are consecutively carried out in lieu of docking surveys in accordance with the requirements in 6.1.2-2, **Part B**.

~~5~~**6** The notation “*Hull Construction Monitoring*” (abbreviated to *HCM*) is affixed to the Classification Characters of ships whose surveys for critical structural areas are carried out based upon a construction monitoring plan in accordance with the requirements in 1.1.12, **Part B**. For ships subject to *SOLAS Chapter II-1 Regulation 3-10*, the additional notation of “*Goal-based Ship Construction Standards*” (abbreviated to *GBS*) is suffixed to the notation “*HCM*” (e.g. *HCM-GBS*).

Part B CLASS SURVEYS

Chapter 3 ANNUAL SURVEYS

3.3 Annual Surveys for Machinery

3.3.1 General Examinations*

Sub-paragraph -1 has been amended as follows.

1 At Annual Surveys for Machinery, a general examination of all the machinery in the engine room as well as the following (1) to (4) inspections are to be carried out:

- (1) It is to be ascertained that the main propulsion machinery, power transmission machinery, shafting systems, prime movers other than main propulsion machinery, boilers, thermal oil heaters, incinerators, pressure vessels, auxiliaries, piping systems, control systems, electrical installations and switchboards are placed in good order.
- (2) It is to be ascertained that the engine room, boiler spaces and means of escape are placed in good order with respect to dangers of fire and explosion.
- (3) For ships affixed with the notation “*PSCM*” or “*PSCM-IA*”, the records of the parameters monitored are to be reviewed, in addition to a general examination, so as to ascertain that the relevant installations are well maintained.
- (4) For ships other than those referred to in (3) above with oil lubricated or freshwater lubricated bearings, it is to be checked as to whether lubricating oil analysis or fresh water sample tests are regularly carried out except for the cases specified in 3.3.4-2(3). In cases where lubricating oil analysis or water sample tests are carried out, it is to be checked as to whether the reference standards deemed appropriate by the Society are complied with based upon the lubricating oil analysis or fresh water sample test reports, in addition to a general examination.

Chapter 8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

Title of Section 8.1 has been amended as follows.

8.1 ~~Definitions~~General

Paragraph 8.1.1 has been amended as follows.

8.1.1 Terms

The terms which appear in this chapter are defined as follows.

((1) to (22) are omitted.)

- (23) “*Propeller Shaft Condition Monitoring System*” (abbreviated as *PSCM*) is notation affixed to the classification characters of ships provided with shaft Kind 1B or shaft Kind 1C and whose preventive maintenance systems are approved in accordance with the requirements of 8.1.2-1.
- (24) “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated as *PSCM-1A*) is notation affixed to the classification characters of ships provided with shaft Kind 1A and whose preventive maintenance systems are approved in accordance with the requirements of 8.1.2-2.
- (245) “Alternative means” means shafting arrangements such as an approved condition monitoring scheme or other reliable approved means for assessing and monitoring the condition of the shafts, sealing devices and the stern tube lubricant system capable to assure the condition of the propeller shaft assembly with an equivalent level of safety as obtained by survey methods specified in this part.

Paragraph 8.1.2 has been amended as follows.

8.1.2 Preventive Maintenance System of Shafts

1 The notation *PSCM* is affixed to the classification characters of ships equipped with following (1) to (3) and whose preventive maintenance system are approved in accordance with the procedures specified in Table B8.1-1.

- (1) Oil lubricated stern tube bearing
- (2) Stern tube sealing devices can be repaired or replaced without drawing out the shafts
- (3) One or more temperature sensors embedded into the metal at the aft end bottoms of stern tube

2 The notation *PSCM-1A* is affixed to the classification characters of ships equipped with the following (1) to (10) and whose preventive maintenance systems are approved in accordance with the procedures specified in Table B8.1-2.

- (1) Water lubricated stern tube bearings
- (2) Inspection methods by means of inspection hole and borescope camera that enable a detailed checking of the surface of the shaft (including the sleeve) and bearings while the shaft is fixed without withdrawal of the shafts, or other inspection methods deemed appropriate by the Society.
- (3) Stern tube sealing devices can be repaired or replaced without drawing out the shafts
- (4) At least two independent lubricating water pumps are to be provided that are capable of continuously supplying lubricating water to the stern tube while the ship is anchoring or mooring. In addition, pump operation is to be capable of automatically switching from one pump to another when either of the following (a) or (b) is applicable.
 - (a) A pump in operation stops.
 - (b) The differential pressure between the suction and discharge or flow rate of lubricating water drops below a preset value.
- (5) Filtration systems capable of continuously filtering lubricating water that conform to

requirements specified by bearing manufacturers.

- (6) Interlock devices that prevent shafts from starting to rotate when the flow rate of lubricating water is not sufficiently established.
- (7) Remote monitoring devices for wear-down of shafts deemed appropriate by the Society that are capable of the onboard monitoring of such wear-down and have redundancy.
- (8) Monitoring devices for lubricating water supply systems that activate the alarms listed in **Table B8.1-3** at main control stations (as defined in **18.1.2(3)** of **Part D**). However, when there is no main control station, alarms may be activated at locations easily accessible to the crew.
- (9) Grounding devices and grounding condition monitoring devices for shafts
- (10) Inspection procedures approved by the Society which include following items:
 - (a) Procedures for checking the surfaces of shafts (including sleeves) and bearings which include following i) to iv).
 - i) Areas and extent to be checked
 - ii) Methods and criteria for evaluating the condition of shafts
 - iii) Arrangement of inspection holes
 - iv) Specifications of borescope camera
 - (b) Recommended test procedures to verify the function of the equipment specified in (4) to (9) above.

Table B8.1 has been renumbered to Table B8.1-1, and the Title has been amended as follows.

Table B8.1-1 Approval Procedure of Preventive Maintenance System for Oil Lubricated
Propeller Shafts (*PSCM*)

(Table are omitted.)

Table B8.1-2 has been added as follows.

Table B8.1-2 Approval Procedure of Preventive Maintenance System for Water Lubricated Propeller Shafts (*PSCM-1A*)

<u>Item</u>	<u>Procedures</u>
<u>1 General</u>	(1) These procedures apply to ships intended for the preventative maintenance of propeller shafts. This system permits shipowners to maintain shafts using preventive measures such as the monitoring of the wear down of shafts, water lubricating systems, grounding conditions between shafts and the hull as well as additionally diagnosing the lubricating conditions of shafts based on monitoring results.
<u>2 Application</u>	<p>(1) The executive management (hereinafter referred to as “management”) responsible for adopting the preventive maintenance system according to the procedures is to submit to the Society three copies of a maintenance manual specifying at least the following (a) to (g).</p> <p>(a) Management policy for implementing the preventive maintenance system</p> <p>(b) Procedures for monitoring parameters such as the following and recording necessary data</p> <p>i) Wear down of shafts by remote monitoring devices</p> <p>ii) At least the flow rates and the differential pressures specified in Table B8.1-3 related to the water lubricating systems.</p> <p>iii) Grounding conditions between shafts and the hull, including the monitoring of values for voltage, current, or resistance.</p> <p>(c) Procedures and personnel responsible for controlling the items specified in (b) above</p> <p>(d) Procedures and personnel responsible for review and evaluating the monitored values specified in (b) above. In addition, the criteria for each parameter mentioned in 4(3) is to be specified.</p> <p>(e) Procedures and personnel responsible for handling any abnormalities found (including procedures for reporting to the Society) in the monitored values specified in (b) above</p> <p>(f) Procedures and personnel responsible for ensuring that proper maintenance is carried out according to the maintenance manual</p> <p>(g) Plans and documents for equipment or systems related to water lubrication.</p> <p>(2) The Society returns two copies of the documents to the applicant after review and approval. Management is to keep one copy of the approved documents on board the ship and the other copy of the approved documents either on hand or at the shipowner’s office.</p> <p>(3) The application is to be submitted within 6 months from the date of completion of the Classification Survey or the previous Ordinary Survey of the propeller shaft. However, this 6-month period may be waived in cases where supplementary documentation confirming the soundness of the propeller shafting system is submitted.</p>
<u>3 Approval and Notation</u>	(1) The Society examines the documents submitted and bases its approval on items such as the management system, the maintenance procedures and the criteria for parameters (including the criteria for alarm and abnormal conditions). The Society assigns approved ships with the notation (<i>PSCM-1A</i>) as classification characters.

Table B8.1-2 Approval Procedure of Preventive Maintenance System for Water Lubricated Propeller Shafts (*PSCM-1A*) (Continued)

<p><u>4 Approval Conditions</u></p>	<p>(1) <u>Management system</u></p> <p>(a) <u>Management is to state clearly that it will take responsibility for proper implementation of the preventive maintenance of the related parts according to the manual and familiarise the crew concerned with the procedures.</u></p> <p>(b) <u>Management is to verify that parameters are all within their limits and to take suitable measures as necessary. In addition, management is to report to the Society immediately where any abnormality is found.</u></p> <p>(c) <u>Management is to verify that suitable maintenance is carried out according to the manual.</u></p> <p>(d) <u>The items monitored or reviewed according to the manual are to be recorded.</u></p> <p>(2) <u>Maintenance procedures</u></p> <p>(a) <u>Weardown measurement is to be carried out regularly at the intervals of 3 months or less and the procedures are to be in accordance with the following.</u></p> <p>i) <u>In principle, the measurement is to be carried out with the condition that shaft is fixed and the load of the propeller fully on the stern tube bearing at the draft specified by the bearing manufacturer.</u></p> <p>ii) <u>At least three measurements are to be carried out and the average value is to be treated as the measured value.</u></p> <p>iii) <u>The estimated remaining operating time to reach the maximum allowable wear down specified by the bearing manufacturer is to be calculated from the measured value.</u></p> <p>iv) <u>The measured values and estimated values in ii) and iii) above are to be properly recorded and controlled.</u></p> <p>(b) <u>In principle, lubricating water pumps are to be operated even when the vessel is anchoring or mooring so as to supply the lubrication water to the stern tube at all times. However, in case where the supply of lubricating water is stopped due to unavoidable reasons, the duration of such times is to be recorded.</u></p> <p>(c) <u>At least the flow rates and the differential pressures specified in Table B8.1-3 related to the lubricating water supply system are to be continuously monitored, periodically measured, recorded and controlled (at least monthly).</u></p> <p>(d) <u>The grounding condition between shafts and hull is to be continuously monitored, periodically measured, recorded and controlled (at least monthly).</u></p> <p>(3) <u>Criteria for parameters</u></p> <p><u>Management is to determine the criteria for each parameter for the ship based on reference standards specified by the bearing manufacturer of the maximum allowable wear down, the flow rates and the differential pressures specified in Table B8.1-3, and the grounding condition between shafts and hull in consideration of management's experience and knowledge.</u></p>
<p><u>5 After Approval</u></p>	<p>(1) <u>Monitoring, measuring and recording are to be performed in accordance with the preventive maintenance system approved by the Society.</u></p> <p>(2) <u>Records of measurements are to be kept on board so they can be presented to the surveyor at the time of inspection.</u></p> <p>(3) <u>Arrangement is to be made to replace worn parts such as sleeves and stern tube bearings at an appropriate time before the measured wear down reaches the criteria for the parameters (maximum allowable wear down). The history of these replacements is to be recorded and kept on board so they can be presented to the surveyor at the time of inspection.</u></p> <p>(4) <u>Where any abnormality or improper maintenance is found through examination, management is required to apply for an Ordinary Survey of the shaft.</u></p>
<p><u>6 Cancellation of Approval</u></p>	<p>(1) <u>Where one of the following (a) to (c) is applicable, the Society may cancel the ship's approval to adopt the preventive maintenance system for propeller shafts. In such cases, the Society is to notify the ship's management of the cancellation, and the ship is to undergo an Ordinary Survey immediately in accordance with Table B8.2.</u></p> <p>(a) <u>Where any improper conduct is found regarding entries in the records.</u></p> <p>(b) <u>Where it is regarded by the Society that proper maintenance is not carried out according to the approved manual.</u></p> <p>(c) <u>Where the shipowner or ship management company has changed, or cancellation of the approval to adopt the preventive maintenance system has been requested by the ship's management.</u></p>

Table B8.1-3 has been added as follows.

Table B8.1-3 Lubricating Water Supply System Alarms

<u>Item to be monitored</u>	<u>Alarm type</u>
<u>Flow rate (lubricating water)</u>	<u>Low</u>
<u>Differential pressure (filtration systems) ⁽¹⁾</u>	<u>High</u>
<u>Abnormality (lubricating water pumps)</u>	<u>Abnormal</u>

(Note)

(1) The items to be monitored for non-filter methods are those deemed appropriate by the Society.

8.2 Surveys of Water Lubricated Shafts

Paragraph 8.2.1 has been amended as follows.

8.2.1 Surveys of Shafts Kind 1A

1 Surveys ~~for~~of shafts Kind 1A are to be the Ordinary Surveys specified in **Table B8.2** and are to be carried out within 5 *years* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey.

2 In addition to -1 above, surveys ~~for~~of shafts Kind 1A which are used corrosion resistant materials specified in **6.2.7-1(3), Part D** are to be the Partial Surveys specified in **Table B8.2** and are to be carried out within 36 *months* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey specified in -1 above. In cases where the results of the Partial Survey are not satisfactory, the Ordinary Survey specified in **Table B8.2** is to be carried out.

3 For the surveys referred to -1 and -2 above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

4 The survey due date may be extended in cases where a survey is carried out in accordance with following (1) to (4) and the shafts condition is confirmed to be satisfactory. The interval of the Ordinary Survey specified in **Table B8.2** is not to exceed 6 *years*.

- (1) The survey due date may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table B8.2** is carried out. No further extension survey may be carried out.
- (2) The survey due date may be extended for up to 3 *months* in cases where the 3Month Extension Survey specified in **Table B8.2** is carried out. No further 3Month Extension Surveys may be carried out. In the event an additional extension is requested, the survey due date, prior to the previous extension, may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table B8.2** is carried out.
- (3) The period of extension counts from the survey due date in cases where the extension survey is carried out within 1 *month* prior to the survey due date.
- (4) The period of extension counts from the date on which the extension survey is carried out in cases where the extension survey is carried out more than 1 *month* prior to the survey due date.

8.2.2 Surveys of Shafts Kind 2

1 Surveys of shafts Kind 2 are to be the Ordinary Surveys specified in **Table B8.2** and are to be carried out in accordance the following (1) and (2) periods (survey due dates).

- (1) Concurrently with Special Surveys, ; and
- (2) Within 36 *months* from the date of completion of the Classification Survey or the previous Ordinary Survey.

2 For the surveys referred to -1 above that are completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

Paragraph 8.2.3 has been added as follows.

8.2.3 Surveys of Shafts of ships whose classification characters are affixed with the notation *PSCM-1A*

1 Notwithstanding **8.2.1** above, survey of shafts of ships whose classification characters are affixed with the notation *PSCM-1A* are subject to this paragraph.

2 The surveys are to be the Alternative Ordinary Surveys specified in **Table B8.2** and are to be completed within 5 *years* from the date of completion (survey due date) of the Classification Survey or the previous Alternative Ordinary Survey. In cases where the Alternative Ordinary Survey is carried out and the result is not satisfactory, the Ordinary Survey specified in **Table B8.2** is to be carried out.

3 Notwithstanding **-2** above, the interval of the Ordinary Survey specified in **Table B8.2** above is not to exceed 15 *years*. This interval may be extended for up to 3 *months*. No further extension may be granted.

4 For the surveys referred to **-2** or **-3** above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

5 The survey due date may be extended in cases where a survey is carried out in accordance with the following **(1)** to **(4)**. The interval of the Survey specified in **-2** above is not to exceed 6 *years*.

(1) The survey due date may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table B8.2** is carried out. No further extension survey may be carried out.

(2) The survey due date may be extended for up to 3 *months* in cases where the 3Month Extension Survey specified in **Table B8.2** is carried out. No further 3Month Extension Surveys may be carried out. In the event an additional extension is requested, the survey due date, prior to the previous extension, may be extended for up to 1 *year* in cases where the 1Year Extension Survey is carried out.

(3) The period of extension counts from the survey due date in cases where the extension survey is carried out within 1 *month* prior to the survey due date.

(4) The period of extension counts from the date on which the extension survey is carried out in cases where the extension survey is carried out more than 1 *month* prior to the survey due date.

Table B8.2 has been amended as follows.

Table B8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A ~~and~~,
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A*

Items	Examinations	Ordinary Survey	Partial Survey	<u>Alternative Ordinary Survey</u>	Extension Survey	
					1 Year	3Month
1 Drawing out of the shafts						
-1 Entirely drawing out	(1) Drawing the propeller shaft and the stern tube shaft and examining the entire shaft (including liners, corrosion protection system and stress reducing features, where provided), inboard seal system and bearings.	○				
-2 Partially drawing out	(1) Drawing the propeller shaft to confirm the contacting parts to stern tube bearing. The propeller shaft may be withdrawn with the condition fitting propeller to propeller shaft.		○			
-3 <u>Alternative drawing out</u>	<u>(1) In accordance with the inspection procedures specified in 8.1.2-2(10), shafts (including seals, liners, corrosion protection system and stress reducing features, where provided.) and bearing surfaces are to be inspected after they have been cleaned to the extent feasible and found to be free from defects without drawing the propeller shafts or stern tube shafts. In the case of shafts with split-sleeve structures (wrapped with rubber, synthetic resin, etc.), the joints between dissimilar materials are to be inspected all the way around.</u>			○		
2 Propeller connections						
-1 Keyed connections	(1) Removing the propeller to expose the forward end of the taper. (2) Performing a non-destructive examination (<i>NDE</i>) to all around the shaft in way of the forward portion of the taper section, including the keyway with the method deemed appropriate by a surveyor. (When shafts provided with liners, the <i>NDE</i> is to be extended to the after edge of the liner.)	○		○		
-2 Keyless connections	(1) Removing the propeller to expose the forward end of the taper. (2) Performing a non-destructive examination (<i>NDE</i>) to all around the shaft in way of the forward portion of the taper section with the method deemed appropriate by a surveyor. For shafts provided with liners, the <i>NDE</i> is to be extended to the after edge of the liner. (3) Notwithstanding (2) above, with the interval not to exceed 15 years, performing a non-destructive examination (<i>NDE</i>) to whole one parts of shaft including the forward portion of the taper section with the method deemed appropriate by a surveyor.	○		○		
-3 Flanged connections	(1) Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs or when deemed necessary by a surveyor, performing a non-destructive examination (<i>NDE</i>) to the coupling bolts and flange radius with the method deemed appropriate by the surveyor.	○		○		

Table B8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A ~~and~~
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A* (Continued)

Items	Examinations	Ordinary Survey	Partial Survey	<u>Alternative Ordinary Survey</u>	Extension Survey	
					1 Year	3Month
3 Clearance between bush of the stern tube bearing and propeller shaft	(1) Checking and recording the clearance between bush of the stern tube and propeller shaft. (2) Confirm the clearance does not exceed following value. (a) Shaft diameter no more than 230 mm: 6 mm (b) Shaft diameter more than 230 mm but no more than 305 mm: 8 mm (c) Shaft diameter more than 305 mm: 9.5 mm	○	○	<u>○</u>	○	
4 Propeller	(1) Verification that the propeller is free of damages which may cause the propeller to be out of balance. (For extension survey, the information is confirmed by the record etc.) (2) For ordinary surveys, checking propeller fitting condition to shaft. When the propeller shaft with keyless connection is force fitted to the shaft, it is to be ascertained that the pull-up length is within the upper and lower limits given in 7.3.1-1, Part D.	○	○	<u>○</u>	○	○
5 Sealing device for stern tube	(1) Verification of the satisfactory conditions of inboard seals during the re-installation of the shaft and propeller. (For ordinary surveys, the verification is carried out during the re-installation of the shaft and propeller.)	○	○	<u>○</u>	○	○
6 Shaft and coupling bolts	(1) Examination of shaft and coupling bolts (For extension survey, visual inspection of accessible parts of shaft and coupling bolts.). However, performing a non-destructive examination (<i>NDE</i>) to coupling bolts with the method deemed appropriate by a surveyor in cases where the surveyor, based on the results of external examinations, deems such addition examination to be necessary. In addition, anti-corrosion covers are to be removed for shafts Kind 2.	○	<u>○</u>	<u>○</u>	○	○
7 Stern tube bearing	(1) Examination of the stern tube bearings.	○		<u>○*1</u>		
8 Propeller boss surfaces in contact with the propeller shaft taper	(1) Examination of the propeller boss surface.	○		<u>○</u>		
9 Controllable pitch propeller connections (Only applies to shafts with flanged connections)	(1) Open-up examination of the pitch control gear and working parts as well as performing a non-destructive examination (<i>NDE</i>) to the propeller blade fixing bolts with the method deemed appropriate by a surveyor.	○		<u>○</u>		
10 Water lubrication lines	(1) Examination of water lubrication lines.	○	○	<u>○</u>	○	○

Table B8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A and
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A* (Continued)

Items	Examinations	Ordinary Survey	Partial Survey	Alternative Ordinary Survey	Extension Survey	
					1 Year	3Month
11 <u>Monitoring devices etc.</u>						
-1 <u>Remote monitoring device for wear down of shaft</u>	(1) <u>Confirm that the values of the wear down obtained from the remote monitoring device is consistent with the measured clearance between bush of the stern tube bearing and propeller shaft as referred in 3 above.</u> (2) <u>Confirm that the functions of the device operate normally in accordance with the inspection procedures specified in 8.1.2-2(10).</u>			○	○	○
-2 <u>Others</u>	(1) <u>Confirm that the functions of each equipment operate normally in accordance with the inspection procedures specified in 8.1.2-2(10).</u>			○	○	○
14 2 <u>Review of records etc.</u>	(1) <u>Review of following (a) to (d).</u> (a) <u>Previous clearance recording</u> (b) <u>Service records</u> (c) <u>No report to repairs by grinding or welding of shafts or propellers</u> (d) <u>The information of the shafting arrangement is in good working condition by the chief engineer</u> (2) <u>For shafts subjected to Alternative Ordinary Survey, review documents and records of following (a) to (d).</u> (a) <u>Inspection procedures specified in 8.1.2-2(10)</u> (b) <u>Measurement records of each monitoring parameter specified in Table B8.1-2 and the estimated remaining operating time to reach the maximum allowable wear down</u> (c) <u>Records of cleaning of the filtration systems of lubrication water</u> (d) <u>Video records of previous borescope camera inspections</u>			○	○	○

Notes

*1 : It is acceptable by confirmation of the result of Section 1-3 of the table.

8.3 Surveys of Oil Lubricated Shafts

Paragraph 8.3.2 has been amended as follows.

8.3.2 Surveys of Shafts of ~~the~~ ships whose classification characters are affixed with the notation *PSCM*

1 Notwithstanding ~~8.3.1~~ above, survey of shafts of the ships whose classification characters are affixed with the notation *PSCM* are subject to this paragraph.

~~42~~ The ~~surveys of shafts of ships affixed with the notation *PSCM*~~ are to be the Ordinary Surveys or Partial Surveys specified in **Table B8.3** and are to be completed within 5 *years* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey. In cases where a Partial Survey is carried out and the result is not satisfactory, the Ordinary Survey specified in **Table B8.3** is to be carried out.

~~23~~ Notwithstanding ~~42~~ above, for shafts with keyless or flanged connections, the Simplified Partial Survey specified in **Table B8.3** may be carried out instead of an Ordinary Survey or Partial Survey. In cases where the results of the Simplified Partial Survey are not satisfactory, the Ordinary Survey specified in **Table B8.3** is to be carried out.

~~34~~ Notwithstanding ~~23~~ above, for shafts with keyless connections, the interval of the Ordinary Survey or Partial Survey specified in **Table B8.3** above is not to exceed 15 *years*. This interval may be extended for up to 3 *months*. No further extension may be granted. In cases where a Partial Survey is carried out and the result is not satisfactory, the Ordinary Survey specified in **Table B8.3** is to be carried out.

~~45~~ For the surveys referred to ~~42~~ to ~~34~~ above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

~~56~~ The survey due date may be extended in cases where a survey is carried out in accordance with the following (1) to (5).

((1) to (5) are omitted.)

Table B8.3 has been amended as follows.

Table B8.3 Surveys of Oil Lubricated Shafts – Shafts Kind 1B, 1C or Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM*

(Table is omitted.)

“Rules for automatic and remote control systems” has been partly amended as follows:

Chapter 3 CENTRALIZED MONITORING AND CONTROL SYSTEMS FOR MACHINERY

3.3 Additional Requirements for Safety Measures

3.3.7 Other Machinery

(-1 and -2 are omitted.)

3 Alarm devices

Other machinery is to be provided with alarm devices which activate in the event of any of those abnormal conditions given in **Table 3.9**.

Table 3.9 has been amended as follows.

Table 3.9 Other Machinery

Monitored Variables		Alarms	Remarks
(Omitted)			
Main shafting			
Temperature	Stern tube bearings or bearing oil in oil baths	H	or stern tube outlet oil when forced circulation systems are used, applied to oil lubrication systems
<u>Flow rate</u>	<u>Lubricating water for stern tube bearings</u>	<u>L</u>	<u>Applied to the ships whose classification characters are affixed with the notation <i>PSCM-1A</i></u>
<u>Differential pressure</u>	<u>Filtration systems of lubrication water for stern tube bearings</u>	<u>H</u>	<u>Applied to the ships whose classification characters are affixed with the notation <i>PSCM-1A</i></u> <u>Alarms for non-filter methods are to be those deemed appropriate by the Society.</u>
<u>Others</u>	<u>Abnormal lubricating water pumps for stern tube bearings</u>	<u>○</u>	<u>Applied to the ships whose classification characters are affixed with the notation <i>PSCM-1A</i></u>
Others	Critical speed	○	

“Rules for the survey and construction of passenger ships” has been partly amended as follows:

Part 1 GENERAL

Chapter 1 GENERAL

1.2 Class Notations

Paragraph 1.2.6 has been amended as follows.

1.2.6 Application of Special Survey Scheme

1 The notation “*Propeller Shaft Condition Monitoring System*” (abbreviated as *PSCM*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the requirements of **8.1.2-1, Part B of the Rules for the Survey and Construction of Steel Ships**, by the provisions of **7.1.1, Part 2**.

2 The notation “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated as *PSCM-1A*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the requirements of **8.1.2-2, Part B of the Rules for the Survey and Construction of Steel Ships in accordance with 7.1.1, Part 2**.

“Rules for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 1 GENERAL RULES

Chapter 1 GENERAL

1.2 Class Notations

Paragraph 1.2.4 has been amended as follows.

1.2.4 Application of Special Survey Scheme*

1 For ships approved for In-water Surveys in accordance with the provisions of **6.1.2, Part 2**, the notation of “*In Water Survey*” (abbreviated to *IWS*) is affixed to the Classification Characters.

2 The notation “*Propeller Shaft Condition Monitoring System*” (abbreviated to *PSCM*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the provisions of **8.1.2-1, Part 2**.

3 The notation “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated to *PSCM-1A*) is affixed to the classification characters of ships whose propeller shafts surveys are carried out based upon the preventive maintenance system specified in the provisions of **8.1.2-2, Part 2**.

34 In consideration of the navigating area and operating mode, ships whose surveys are to be carried out in accordance with standards deemed appropriate by the Society in accordance with the provisions of **1.1.3, Part 2**, a notation deemed appropriate by the Society is affixed.

Part 2 CLASS SURVEYS

Chapter 8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

8.1 General

Paragraph 8.1.1 has been amended as follows.

8.1.1 ~~Definitions~~ Terms

The terms which appear in this chapter are defined as follows.

((1) to (21) are omitted.)

(22) “*Propeller Shaft Condition Monitoring System*” (abbreviated as *PSCM*) is notation affixed to the classification characters of ships provided with shaft Kind 1B and whose preventive maintenance system are approved in accordance with the requirements of 8.1.2-1.

(23) “*Propeller Shaft Condition Monitoring System of Shaft Kind 1A*” (abbreviated as *PSCM-1A*) is notation affixed to the classification characters of ships provided with shaft Kind 1A and whose preventive maintenance system are approved in accordance with the requirements of 8.1.2-2.

~~(23)~~ (24) “Alternative means” means shafting arrangements such as an approved condition monitoring scheme or other reliable approved means for assessing and monitoring the condition of the shafts, sealing devices and the stern tube lubricant system capable to assure the condition of the propeller shaft assembly with an equivalent level of safety as obtained by survey methods specified in this part.

Paragraph 8.1.2 has been amended as follows.

8.1.2 Preventive Maintenance System of Shafts

1 The notation *PSCM* is affixed to the classification characters of ships equipped with following (1) to (3) and whose preventive maintenance system are approved in accordance with the procedures specified in Table 2.8.1-1.

(1) Oil lubricated stern tube bearing

(2) Stern tube sealing devices can be repaired or replaced without drawing out the shafts

(3) One or more temperature sensors embedded into the metal at the aft end bottoms of stern tube

2 The notation *PSCM-1A* is affixed to the classification characters of ships equipped with the following (1) to (10) and whose preventive maintenance systems are approved in accordance with the procedures specified in Table 2.8.1-2.

(1) Water lubricated stern tube bearings

(2) Inspection methods by means of inspection hole and borescope camera that enable a detailed checking of the surface of the shaft (including the sleeve) and bearings while the shaft is fixed without withdrawal of the shafts, or other inspection methods deemed appropriate by the Society.

(3) Stern tube sealing devices can be repaired or replaced without drawing out the shafts

(4) At least two independent lubricating water pumps are to be provided that are capable of continuously supplying lubricating water to the stern tube while the ship is anchoring or mooring. In addition, pump operation is to be capable of automatically switching from one pump to another when either of the following (a) or (b) is applicable.

(a) A pump in operation stops.

(b) The differential pressure between the suction and discharge or flow rate of lubricating water drops below a preset value.

(5) Filtration systems capable of continuously filtering lubricating water that conform to

requirements specified by bearing manufacturers.

- (6) Interlock devices that prevent shafts from starting to rotate when the flow rate of lubricating water is not sufficiently established.
- (7) Remote monitoring devices for wear down of shaft deemed appropriate by the Society that are capable of the onboard monitoring of such wear down and have redundancy.
- (8) Monitoring devices for lubricating water supply systems that activates the alarms listed in Table 2.8.1-3 at main control stations (as defined in 18.1.2(3) of Part D of the Rules for the Survey and Construction of Steel Ships). However, when there is no main control station, alarms may be activated at locations easily accessible to the crew.
- (9) Grounding devices and grounding condition monitoring devices for shafts
- (10) Inspection procedures approved by the Society which include the following items
 - (a) Procedures for checking the surfaces of shafts (including sleeves) and bearings which include the following i) to iv).
 - i) Areas and extent to be checked
 - ii) Methods and criteria for evaluating the condition of shafts
 - iii) Arrangement of inspection holes
 - iv) Specifications of borescope camera
 - (b) Recommended test procedures to verify the function of the equipment specified in (4) to (9) above.

Table 2.8.1 has been renumbered to Table 2.8.1-1, and the Title has been amended as follows.

Table 2.8.1-1 Approval Procedure of Preventive Maintenance System for Oil Lubricated
Propeller Shafts (*PSCM*)

(Table are omitted.)

Table 2.8.1-2 has been added as follows.

Table 2.8.1-2 Approval Procedure of Preventive Maintenance System for Water Lubricated Propeller Shafts (*PSCM-1A*)

<u>Item</u>	<u>Procedures</u>
<u>1 General</u>	(1) These procedures apply to ships intended for the preventative maintenance of propeller shafts. This system permits shipowners to maintain shafts using preventive measures such as the monitoring of the wear down of shafts, water lubricating systems, grounding conditions between shafts and the hull as well as additionally diagnosing the lubricating conditions of shafts based on monitoring results.
<u>2 Application</u>	<p>(1) The executive management (hereinafter referred to as “management”) responsible for adopting the preventive maintenance system according to the procedures is to submit to the Society three copies of a maintenance manual specifying at least the following (a) to (g).</p> <p>(a) Management policy for implementing the preventive maintenance system</p> <p>(b) Procedures for monitoring parameters such as the following and recording necessary data</p> <p>i) Wear down of shafts by the remote monitoring devices</p> <p>ii) At least the flow rates and the differential pressures specified in Table 2.8.1-3 related to the water lubricating systems.</p> <p>iii) Grounding conditions between shafts and the hull, including the monitoring of values for voltage, current, or resistance.</p> <p>(c) Procedures and personnel responsible for controlling the items specified in (b) above</p> <p>(d) Procedures and personnel responsible for review and evaluating the monitored values specified in (b) above. In addition, the criteria for each parameter mentioned in 4(3) is to be specified.</p> <p>(e) Procedures and personnel responsible for handling any abnormalities found (including procedures for reporting to the Society) in the monitored values specified in (b) above.</p> <p>(f) Procedures and personnel responsible for ensuring that proper maintenance is carried out according to the maintenance manual</p> <p>(g) Plans and documents for equipment or systems related to water lubrication</p> <p>(2) The Society returns two copies of the documents to the applicant after review and approval. Management is to keep one copy of the approved documents on board the ship and the other copy of the approved documents either on hand or at the shipowner’s office.</p> <p>(3) The application is to be submitted within 6 months from the date of completion of the Classification Survey or the previous Ordinary Survey of the propeller shaft. However, this 6-month period may be waived in cases where supplementary documentation confirming the soundness of the propeller shafting system is submitted.</p>
<u>3 Approval and Notation</u>	(1) The Society examines the documents submitted and bases its approval on items such as the management system, the maintenance procedures and the criteria for parameters (including the criteria for alarm and abnormal conditions). The Society assigns approved ships with the notation (<i>PSCM-1A</i>) as classification characters.

Table B8.1-2 Approval Procedure of Preventive Maintenance System for Water Lubricated Propeller Shafts (PSCM-1A) (Continued)

<p><u>4 Approval Conditions</u></p>	<p>(1) <u>Management system</u></p> <p>(a) <u>Management is to state clearly that it will take responsibility for proper implementation of the preventive maintenance of the related parts according to the manual and familiarise the crew concerned with the procedures.</u></p> <p>(b) <u>Management is to verify that parameters are all within their limits and to take suitable measures as necessary. In addition, management is to report to the Society immediately where any abnormality is found.</u></p> <p>(c) <u>Management is to verify that suitable maintenance is carried out according to the manual.</u></p> <p>(d) <u>The items monitored or reviewed according to the manual are to be recorded.</u></p> <p>(2) <u>Maintenance procedures</u></p> <p>(a) <u>Weardown measurement is to be carried out regularly at the intervals of 3 months or less and the procedures are in accordance with the following.</u></p> <p>i) <u>In principle, the measurement is to be carried out with the condition that shaft is fixed and the load of the propeller fully on the stern tube bearing at the draft specified by the bearing manufacturer.</u></p> <p>ii) <u>At least three measurements are to be carried out and the average value is to be treated as the measured value.</u></p> <p>iii) <u>The estimated remaining operating time to reach the maximum allowable wear down specified by the bearing manufacturer is to be calculated from the measured value.</u></p> <p>iv) <u>The measured values and estimated values in ii) and iii) above are to be properly recorded and controlled.</u></p> <p>(b) <u>In principle, lubricating water pumps are to be operated even when the vessel is anchoring or mooring so as to supply the lubrication water to the stern tube at all times. However, in case where the supply of lubricating water is stopped due to unavoidable reasons, the duration of such times is to be recorded.</u></p> <p>(c) <u>At least the flow rates and the differential pressures specified in Table 2.8.1-3 related to the lubricating water supply system are to be continuously monitored, periodically measured, recorded and controlled (at least monthly).</u></p> <p>(d) <u>The grounding condition between shafts and hull is to be continuously monitored, periodically measured, recorded and controlled (at least monthly).</u></p> <p>(3) <u>Criteria for parameters</u></p> <p><u>Management is to determine the criteria for each parameter for the ship based on reference standards specified by the bearing manufacturer of the maximum allowable wear down, the flow rates and the differential pressures specified in Table 2.8.1-3, and the grounding condition between shafts and hull in consideration of management's experience and knowledge.</u></p>
<p><u>5 After Approval</u></p>	<p>(1) <u>Monitoring, measuring and recording are to be performed in accordance with the preventive maintenance system approved by the Society.</u></p> <p>(2) <u>Records of measurements are to be kept on board so they can be presented to the surveyor at the time of inspection.</u></p> <p>(3) <u>Arrangement is to be made to replace worn parts such as sleeves and stern tube bearings at an appropriate time before the measured wear down reaches the criteria for the parameters (maximum allowable wear down). The history of these replacements is to be recorded and kept on board so they can be presented to the surveyor at the time of inspection.</u></p> <p>(4) <u>Where any abnormality or improper maintenance is found through examination, management is required to apply for an Ordinary Survey of the shaft.</u></p>
<p><u>6 Cancellation of Approval</u></p>	<p>(1) <u>Where one of the following (a) to (c) are applicable, the Society may cancel the ship's approval to adopt the preventive maintenance system for propeller shafts. In such cases, the Society is to notify the ship's management of the cancellation, and the ship is to undergo an Ordinary Survey immediately in accordance with Table 2.8.2.</u></p> <p>(a) <u>Where any improper conduct is found regarding entries in the records.</u></p> <p>(b) <u>Where it is regarded by the Society that proper maintenance is not carried out according to the approved manual.</u></p> <p>(c) <u>Where the shipowner or ship management company has changed, or cancellation of the approval to adopt the preventive maintenance system has been requested by the ship's management.</u></p>

Table 2.8.1-3 has been added as follows.

Table 2.8.1-3 Alarm of lubricating water supply system

<u>Item to be monitored</u>	<u>Alarm type</u>
<u>Flow rate (lubricating water)</u>	<u>Low</u>
<u>Differential pressure (filtration systems) ⁽¹⁾</u>	<u>High</u>
<u>Abnormality (lubricating water pumps)</u>	<u>Abnormal</u>

(Note)

(1) The items to be monitored for non-filter methods are those deemed appropriate by the Society.

8.2 Surveys of Water Lubricated Shafts

Paragraph 8.2.1 has been amended as follows.

8.2.1 Surveys of Shafts Kind 1A

1 Surveys of shafts Kind 1A are to be the Ordinary Surveys specified in **Table 2.8.2** and are to be carried out within 6 *years* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey.

2 In addition to -1 above, surveys ~~for~~ of shafts Kind 1A which are used corrosion resistant materials specified in **6.2.7-1(3), Part D of the Rules for the Survey and Construction of Steel Ships** are to be the Partial Surveys specified in **Table 2.8.2** and are to be carried out within 36 *months* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey specified in -1 above. In cases where the results of the Partial Survey are not satisfactory, the Ordinary Survey specified in **Table 2.8.2** is to be carried out.

3 For the surveys referred to -1 and -2 above completed with 3 *months* prior to the survey due date, the next period is to start from the survey due date.

4 The survey due date may be extended in cases where a survey is carried out in accordance with following (1) to (4) and the shafts condition is confirmed to be satisfactory. The interval of the Ordinary Survey specified in **Table 2.8.2** is not to exceed 7 *years*.

- (1) The survey due date may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table 2.8.2** is carried out. No further extension survey can be carried out.
- (2) The survey due date may be extended for up to 3 *months* in cases where the 3Month Extension Survey specified in **Table 2.8.2** is carried out. No further 3Month Extension Survey may be carried out. In the event an additional extension is requested, the survey due date, prior to the previous extension, may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table 2.8.2** is carried out.
- (3) The period of extension counts from the survey due date in cases where the extension survey is carried out within 1 *month* within the survey due date.
- (4) The period of extension counts from the date on which the extension survey in cases where the extension survey is carried out more than 1 *month* prior to the survey due date.

8.2.2 Surveys of Shafts Kind 2

1 Surveys of shafts Kind 2 are to be the Ordinary Survey specified in **Table 2.8.2** and are to be carried out in accordance with the following (1) and (2) periods (survey due dates).

- (1) Concurrently with Special Surveys, and
- (2) Within 36 *months* from the date of completion of the Classification Survey or the previous Ordinary Surveys.

2 For the surveys referred to -1 above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

Paragraph 8.2.3 has been added as follows.

8.2.3 Surveys of Shafts of ships whose classification characters are affixed with the notation *PSCM-1A*

1 Notwithstanding **8.2.1** above, surveys of shafts of ships whose classification characters are affixed with the notation *PSCM-1A* are subject to this paragraph.

2 The surveys are to be the Alternative Ordinary Surveys specified in **Table 2.8.2** and are to be completed within 6 *years* from the date of completion (survey due date) of the Classification Survey or the previous Alternative Ordinary Survey. In cases where a Partial Survey is carried out and the result is not satisfactory, the Ordinary Survey specified in **Table 2.8.2** is to be carried out.

3 Notwithstanding **-2** above, the interval of the Ordinary Survey specified in **Table 2.8.2** above is not to exceed 18 *years*. This interval may be extended for up to 3 *months*. No further extension may be granted.

4 For the surveys referred to **-2** or **-3** above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

5 The survey due date may be extended in cases where a survey is carried out in accordance with the following **(1)** to **(4)**. The interval of the Survey specified in **-2** above is not to exceed 7 *years*.

(1) The survey due date may be extended for up to 1 *year* in cases where the 1Year Extension Survey specified in **Table 2.8.2** is carried out. No further extension survey may be carried out.

(2) The survey due date may be extended for up to 3 *months* in cases where the 3Month Extension Survey specified in **Table 2.8.2** is carried out. No further 3Month Extension Surveys may be carried out. In the event an additional extension is requested, the survey due date, prior to the previous extension, may be extended for up to 1 *year* in cases where the 1Year Extension Survey is carried out.

(3) The period of extension counts from the survey due date in cases where the extension survey is carried out within 1 *month* prior to the survey due date.

(4) The period of extension counts from the date on which the extension survey is carried out in cases where the extension survey is carried out more than 1 *month* prior to the survey due date.

Table 2.8.2 has been amended as follows.

Table 2.8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A ~~and~~,
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A*

Items	Examinations	Ordinary Survey	Partial Survey	<u>Alternative Ordinary Survey</u>	Extension Survey	
					1 Year	3Month
1 Drawing out of the shafts						
-1 Entirely drawing out	(1) Drawing the propeller shaft and the stern tube shaft and examining the entire shaft (including liners, corrosion protection system and stress reducing features, where provided), inboard seal system and bearings.	○				
-2 Partially drawing out	(1) Drawing the propeller shaft to confirm the contacting parts to stern tube bearing. The propeller shaft may be withdrawn with the condition fitting propeller to propeller shaft.		○			
-3 <u>Alternative drawing out</u>	<u>(1) In accordance with the inspection procedures specified in 8.1.2-2(10), the shaft (including seals, liners, corrosion protection system and stress reducing features, were provided.) and bearing surfaces are to be inspected after they have been cleaned to the extent feasible and found to be free from defects without drawing the propeller shafts or stern tube shafts. In the case of shafts with split-sleeve structures (wrapped with rubber, synthetic resin, etc.), the joints between dissimilar materials are to be inspected all the way around.</u>			○		
2 Propeller connections						
-1 Keyed connections	(1) Removing the propeller to expose the forward end of the taper. (2) Performing a non-destructive examination (<i>NDE</i>) to all around the shaft in way of the forward portion of the taper section, including the keyway with the method deemed appropriate by a surveyor. (When shafts are provided with liners, the <i>NDE</i> is to be extended to the after edge of the liner.)	○		○		
-2 Keyless connections	(1) Removing the propeller to expose the forward end of the taper. (2) Performing a non-destructive examination (<i>NDE</i>) to all around the shaft in way of the forward portion of the taper section with the method deemed appropriate by a surveyor. For shafts provided with liners, the <i>NDE</i> is to be extended to the after edge of the liner. (3) Notwithstanding (2) above, with the interval not to exceed 18 <i>years</i> , performing a non-destructive examination (<i>NDE</i>) to whole com parts of shaft including the forward portion of the taper section with the method deemed appropriate by a surveyor.	○		○		
-3 Flanged connections	(1) Whenever the coupling bolts of any type of flange-connected shaft are removed or the flange radius is made accessible in connection with overhaul, repairs or when deemed necessary by a surveyor, performing a non-destructive examination (<i>NDE</i>) to the coupling bolts and flange radius with the method deemed appropriate by the surveyor.	○		○		

Table 2.8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A ~~and~~
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A* (Continued)

Items	Examinations	Ordinary Survey	Partial Survey	<u>Alternative Ordinary Survey</u>	Extension Survey	
					1 Year	3Month
3 Clearance between bush of the stern tube bearing and propeller shaft	(1) Checking and recording the clearance between bush of the stern tube and propeller shaft. (2) Confirm the clearance does not exceed the following values. (a) Shaft diameter no more than 230 mm: 6 mm (b) Shaft diameter more than 230 mm but no more than 305 mm: 8 mm (c) Shaft diameter more than 305 mm: 9.5 mm	○	○	○	○	
4 Propeller	(1) Verification that the propeller is free of damages which may cause the propeller to be out of balance. (For extension survey, the information is confirmed by the record etc.) (2) For ordinary surveys, checking propeller fitting condition to shaft. When the propeller shaft with keyless connection is force fitted to the shaft, it is to be ascertained that the pull-up length is within the upper and lower limits given in 7.3.1-1, Part D <u>of the Rules for the Survey and Construction of Steel Ships</u> .	○	○	○	○	○
5 Sealing device for stern tube	(1) Verification of the satisfactory conditions of inboard seals during the re-installation of the shaft and propeller. (For ordinary surveys, the verification is carried out during the re-installation of the shaft and propeller.)	○	○	○	○	○
6 Shaft and coupling bolts	(1) Examination of shaft and coupling bolts (For extension survey, visual inspection of accessible parts of shaft and coupling bolts.). However, performing a non-destructive examination (<i>NDE</i>) to coupling bolts with the method deemed appropriate by a surveyor in cases where the surveyor, based on the results of external examinations, deems such addition examination to be necessary. In addition, anti-corrosion covers are to be removed for shafts Kind 2.	○	○	○	○	○
7 Stern tube bearing	(1) Examination of the stern tube bearings.	○		○*1		
8 Propeller boss surfaces in contact with the propeller shaft taper	(1) Examination of the propeller boss surface.	○		○		
9 Controllable pitch propeller connections (Only applies to shafts with flanged connections)	(1) Open-up examination of the pitch control gear and working parts as well as performing a non-destructive examination (<i>NDE</i>) to the propeller blade fixing bolts with the method deemed appropriate by a surveyor.	○		○		
10 Water lubrication lines	(1) Examination of water lubrication lines.	○	○	○	○	○

Table 2.8.2 Surveys of Water Lubricated Shafts – Shafts Kind 1A and
Kind 2 and Shafts of Ships Whose Classification Characters Are Affixed with the Notation *PSCM-1A* (Continued)

Items	Examinations	Ordinary Survey	Partial Survey	Alternative Ordinary Survey	Extension Survey	
					1 Year	3Month
11 <u>Monitoring devices etc.</u>						
-1 <u>Remote monitoring device for wear down of shaft</u>	(1) <u>Confirm that the values of the wear down obtained from the remote monitoring device is consistent with the measured clearance between bush of the stern tube bearing and propeller shaft as referred in 3 above.</u> (2) <u>Confirm that the functions of the device operate normally in accordance with the inspection procedures specified in 8.1.2-2(10).</u>			○	○	○
-2 <u>Others</u>	(1) <u>Confirm that the functions of each equipment operate normally in accordance with the inspection procedures specified in 8.1.2-2(10).</u>			○	○	○
14 2 <u>Review of records etc.</u>	(1) <u>Review of following (a) to (d).</u> (a) <u>Previous clearance recording</u> (b) <u>Service records</u> (c) <u>No report to repairs by grinding or welding of shafts or propellers</u> (d) <u>The information of the shafting arrangement is in good working condition by the chief engineer</u> (2) <u>For shafts subjected to Alternative Ordinary Surveys, review documents and records of following (a) to (d).</u> (a) <u>Inspection procedures specified in 8.1.2-2(10)</u> (b) <u>Measurement records of each monitoring parameter specified in Table 2.8.1-2 and the estimated remaining operating time to reach maximum allowable wear down</u> (c) <u>Records of cleaning of the filtration systems of lubrication water</u> (d) <u>Video records of previous borescope camera inspections</u>			○	○	○

Notes

*1 : It is acceptable by confirmation of the result of Section 1-3 of the table.

8.3 Surveys of Oil Lubricated Shafts

Paragraph 8.3.2 has been amended as follows.

8.3.2 Surveys of Shafts of ~~the~~ ships whose classification characters are affixed with the notation PSCM

1 Notwithstanding ~~8.3.1~~ above, survey of shafts of ships whose classification characters are affixed with the notation *PSCM* are subject to this paragraph.

~~42~~ The ~~surveys of shafts of ships affixed with the notation PSCM~~ are to be the Ordinary Surveys or Partial Surveys specified in **Table 2.8.3** and are to be carried out within 6 *years* from the date of completion (survey due date) of the Classification Survey or the previous Ordinary Survey Surveys. In cases where a Partial Survey is carried out and the result is not satisfactory, Ordinary Survey specified in **Table 2.8.3** is to be carried out.

~~23~~ Notwithstanding ~~42~~ above, for shafts with keyless or flanged connections, the Simplified Partial Survey specified in **Table 2.8.3** may be carried out instead of an Ordinary Survey or Partial Survey. In cases where the results of the Simplified Partial Survey is not satisfactory, Ordinary Survey specified in **Table 2.8.3** is to be carried out.

~~34~~ Notwithstanding ~~23~~ above, for shafts with keyless connection, the interval of the Ordinary Survey or Partial Survey specified in **Table 2.8.3** above is not to exceed 18 *years*. This interval may be extended for up to 3 *months*. No further extension may be granted. In cases where a Partial Survey is carried out and the result is not satisfactory, the Ordinary Survey specified in **Table 2.8.3** is to be carried out.

~~45~~ For the surveys referred to ~~42~~ to ~~34~~ above completed within 3 *months* prior to the survey due date, the next period is to start from the survey due date.

~~56~~ The survey due date may be extended in cases where a survey is carried out in accordance with following (1) to (5).

((1) to (5) are omitted.)

Table 2.8.3 has been amended as follows.

Table 2.8.3 Surveys of Oil Lubricated Shafts – Shafts Kind 1B or Shafts of Ships Whose Classification Characters Are Affixed with the Notation PSCM

(Table is omitted.)

“Guidance for the survey and construction of steel ships” has been partly amended as follows:

Part B CLASS SURVEYS

B8 has been added as follows.

B8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

8.1 General

8.1.2 Preventive Maintenance System of Shafts

1 The wording “borescope camera” in 8.1.2-2(2), Part B of the Rules is to be capable of conducting inspections with clear images of 300,000 pixels or more and is to be equipped with a recording function.

2 The wording “Remote monitoring devices for wear-down of shaft deemed appropriate by the Society” in 8.1.2-2(7), Part B of the Rules means devices approved by the Society in accordance with Chapter 1, Part 7 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use.

3 The wording “redundancy” in 8.1.2-2(7), Part B of the Rules may be provided by having at least one set of spare sensors in cases where the design allows sensors to be replaced without drawing out the shafts and propellers.

4 The wording “Grounding devices” in 8.1.2-2(9), Part B of the Rules for slip rings and brushes are recommended to be made of silver alloy and silver-graphite combinations, respectively.

5 The wording “grounding condition monitoring devices” in 8.1.2-2(9), Part B of the Rules are to be capable of indicating values for voltage, current or resistance.

“Guidance for the survey and construction of inland waterway ships” has been partly amended as follows:

Part 2 CLASS SURVEYS

Chapter 8 has been added as follows.

Chapter 8 PROPELLER SHAFT AND STERN TUBE SHAFT SURVEYS

8.1 General

8.1.2 Preventive Maintenance System of Shafts

1 The wording “borescope camera” in 8.1.2-2(2), Part 2 of the Rules is to be capable of conducting inspections with clear images of 300,000 pixels or more and is to be equipped with a recording function.

2 The wording “Remote monitoring devices for wear-down of shaft deemed appropriate by the Society” in 8.1.2-2(7), Part 2 of the Rules means devices approved by the Society in accordance with Chapter 1, Part 7 of Guidance for the Approval of Materials and Equipment for Marine Use.

3 The wording “redundancy” in 8.1.2-2(7), Part 2 of the Rules may be provided by with having at least one set of spare sensors in cases where the design allows sensors to be replaced without drawing out the shafts and propellers.

4 The wording “Grounding devices” in 8.1.2-2(9), Part 2 of the Rules for slip rings and brushes are recommended to be made of silver alloy and silver-graphite combinations, respectively.

5 The wording “grounding condition monitoring devices” in 8.1.2-2(9), Part 2 of the Rules are to be capable of indicating values for voltage, current or resistance.