

Subject :

Alternative survey scheme of propeller shaft
based on approved preventive maintenance
system

NKTECHNICAL INFORMATION

No. : 2 2 1

Date : 15 Aug 1997

To Shipowners and shipbuilders concerned

As previously informed by NK Technical Information No.201 dated 28 November 1996, an alternative survey scheme of propeller shaft based on approved preventive maintenance system has become effective since 1 July 1997. A flow chart outlining such alternative survey scheme is attached for your reference.

The approval of this alternative survey scheme will be processed by Survey Department in Head Office. Vessels wishing to be approved under this alternative scheme need to submit two copies of Preventive Maintenance Manual for approval by the Society along with attached application form. This Preventive Maintenance Manual is to comply with those requirements specified in the APPENDIX B3.11.2-2 of the *Guidance for Approval of Preventive Maintenance System for Oil Lubricated Propeller Shaft*, Part B of the *Guidance for the survey and construction of steel ships*. In this connection, an example of such manual is also attached for your reference.

Prior to starting the alternative survey scheme of propeller shaft based on preventive maintenance, it is necessary to confirm the soundness of the propeller shaft and stern tube bearings. Therefore, the existing vessels are to undergo ordinary propeller shaft survey under drawn out condition prior to transfer to alternative survey scheme. However, special considerations may be made in those cases where a vessel has implemented a preventive maintenance system deemed as appropriate by NK and for which continuous data has been maintained since the previous propeller shaft survey.

After the cancellation of the approval, the survey scheme will be changed to the ordinary time-based (5 year) survey scheme. In the event that more than 5 years has been passed since the last drawn out inspection of the propeller shaft, a recommendation to undergo a drawn out examination of the propeller shaft as soon as possible will be imposed. Approval for the alternative survey scheme is automatically canceled whenever the management of a vessel is changed. In order for a vessel to continue being covered by the alternative survey scheme, it is

ClassNK

NIPPON KAIJI KYOKAI

4-7, KIOI-CHO, CHIYODA-KU,
TOKYO 102, JAPAN.

TELEX : 22975 CLASSNKJ
2324280 CLASNKJ
CABLE : CLASSNK TOKYO

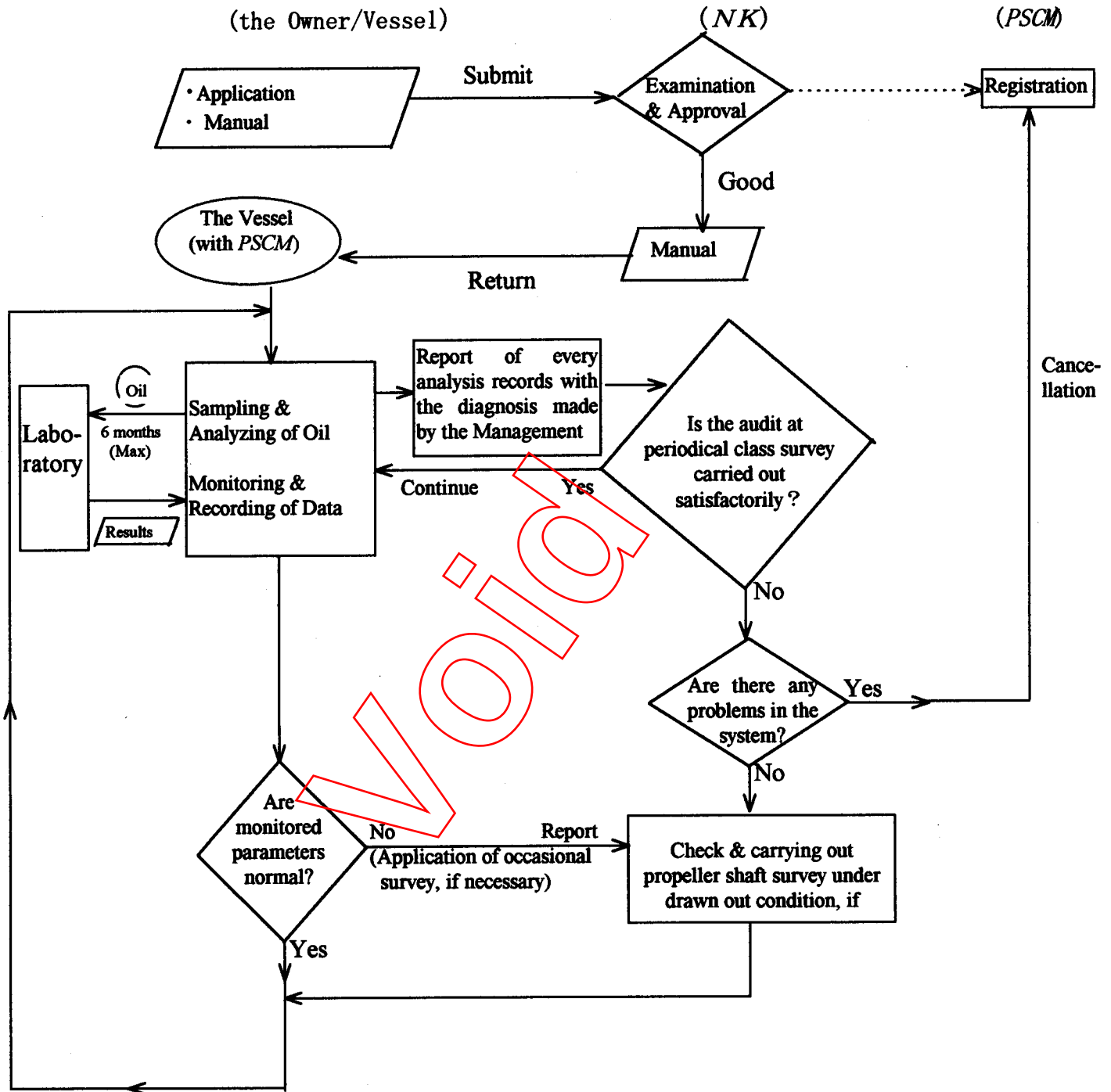
necessary for the new management of the vessel to make an application to the Society. In case where no application is received from the new management after delivery of the vessel, the survey scheme will be changed to the ordinary time-based (5 year) survey scheme as the same process as cancellation of the alternative scheme. Therefore, please note that necessary recommendation will be imposed after delivery, depending on the situation.

Please feel free to contact the Survey Department at the Head Office of the Society at Tel.: +81-3-5226-2027, Fax.: +81-3-5226-2029 for further information regarding this matter.

Attachment: Flow chart showing alternative survey scheme based on preventive maintenance system
 Application form
 A sample of Preventive Maintenance Manual

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**Alternative Survey Scheme of Propeller shaft based on periodical analysis of stern tube lubricating oil for Preventative Maintenance System
(the Owner/Vessel)**



(Note) Above alternative survey scheme is applicable only for the propeller shaft, bearings and relating devices. Those survey items not covered by the monitoring based on oil analysis, etc. (the open up inspection of propeller boss bore, for example) are subject to ordinary time-based survey scheme.

日本海事協会 御中

To: NIPPON KAIJI KYOKAI

日付:

Form PSCM-1

Date: _____

申込者

Applicant _____

住所

Address _____

予防保全管理方式に基づくプロペラ軸検査方式申込書
Application for Alternative Survey Scheme of Propeller Shaft
(based on Approved Preventive Maintenance System)

下記船舶につき予防保全方式に基づくプロペラ軸検査方式(PSCM)の採用を申し込みます。

We hereby request your approval for alternative survey scheme of propeller shaft based on preventive maintenance system (PSCM) to the following ship.

船名:

Ship's Name: _____

船級番号

Class No.: _____

プロペラ軸の予防保全管理方式については下記条件のもとに行います。

We assure you that the preventive maintenance will be conducted on the following conditions.

- (1) 承認された管理マニュアルに従ってプロペラ軸の状態を監視し、監視パラメータに異常が認められた場合には、プロペラ軸の抜き出し検査を行うため船をドックに入れる等の必要な措置を行うこと。

The condition of the propeller shaft is to be monitored according to the approved "Preventive Maintenance Manual". When abnormal parameters are observed, the undersigned shall take the responsibility of bringing the vessel into a drydock to draw out the shaft for examination.

- (2) プロペラ軸の抜き出しを行う場合には臨時検査を申請し検査員の立会検査を行うこと。

When the examination of propeller shaft under drawn out condition is conducted, an application is to be made to undergo the survey with the attendance of NK surveyor.

- (3) 船舶管理会社が変更される場合には予防保全管理システムによるプロペラ軸検査方式は取り消され従来の時間基準の検査方式に復帰する。またこの取扱いについて変更後の船舶管理会社に確実に伝達すること。

The information that propeller shaft survey scheme is to be changed to the ordinary time-based scheme when the management of the vessel is transferred to other party than undersigned, is to be transferred by the undersigned to the succeeding management company.

Applicant's Signature: _____

添付: 予防保全管理マニュアル (2 部)

Attachment: Preventive Maintenance Manual (2 Copies)

Document Number	NKPS-01
Distribution number	

Preventive Maintenance Manual
for Propeller shafts fitted with oil-lubricated bearings
on the basis of periodical oil sampling and analysis

(Sample)

VOID

Established on January 1st 1997

NK MARINE CO. LTD.

Preventive Maintenance Manual for Propeller shafts fitted with oil-lubricated bearings on the basis of periodical oil sampling and analysis

Contents and History

- Chapter 1 Management's maintenance policy
- Chapter 2 Responsibility and authority
- Chapter 3 Document and record control
- Chapter 4 Control of inspection, measuring and test equipment
- Chapter 5 Periodical oil sampling and analysis
- Chapter 6 Monitoring of parameters
- Chapter 7 Onboard audit and general inspection

- Attachment① : Record form for sampled stern tube oil
 Attachment② : Report form for abnormality or nonconformity
 Attachment③ : Report form for onboard audit and general inspection

Revision No.	Revised Date	Revised location	Revision contents	Approved
00	1997.1.1		Newly established.	

1.1 General

This manual is established for implementing preventive maintenance system to the propeller shaft fitted with oil lubricated bearings in the ship "NK Maru" by diagnosing the lubricating condition of the shaft and providing suitable maintenance based on the results of periodical lubricating oil analysis and monitoring of each parameter according to the relevant requirements for adopting preventive maintenance survey method, instead of being subjected to the periodical shaft drawing survey in Part B of the Rules for Survey and Construction of Steel Ships of NIPPON KAIJI KYOKAI.(hereinafter referred to as "NK Rules").

1.2 Maintenance items to be covered

Maintenance items to be covered by this system are the bearing parts of the propeller shaft, the bearing metals and the sealing devices.

1.3 Management's policy

I am fully responsible for establishing and implementing the preventive maintenance system to the propeller shaft in accordance with the NK Rules concerned and keeping the items to be covered by this system in a good condition by directing all the related crew members to be familiar with the system and to proceed with suitable maintenance according to the preventive maintenance manual, and I am obliged to report to NIPPON KAIJI KYOKAI immediately and take an appropriate countermeasure(including withdrawal of the shaft, if necessary.) in accordance with the relevant requirements in Part B of the NK Rules, in case where abnormality is found out on any of parameters monitored.

T.Kaiji
General Manager of
Technical Department
NK MARINE CO.LTD.

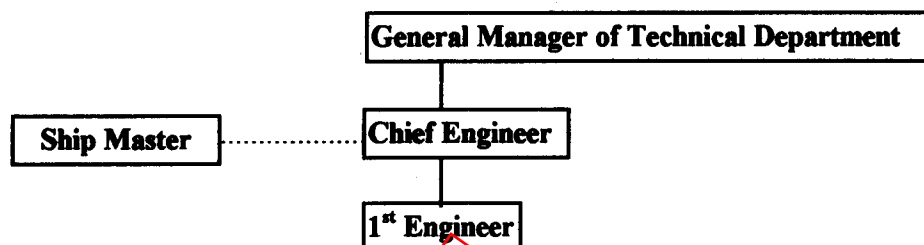
January 1st 1997

Preventive maintenance manual for propeller shaft	Chap.2: Responsibility and authority	2
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This chapter is prescribed for clarifying the responsibility, authority and interrelation of personnel who are engaged in the preventive maintenance system for the propeller shaft in the ship "NK Maru".

2.1 Organization

The organization in the preventive maintenance system is as follows:



2.2 Duties of personnel in charge

(1) General Manager of Technical Department

The General Manager of Technical Department (hereinafter referred to as "General Manager") is fully responsible for establishment and implementation of the preventive maintenance system in the ship "NK Maru" and some of his responsibility and authority, where occasions demand, are committed to the Chief Engineer by him.

(2) Chief Engineer

The chief engineer is responsible for verifying the system to be a good condition based on the records of parameters monitored as necessary in the NK Maru. In case any abnormality is found out, he shall take a necessary counter action, after informing the ship master of that, and report to the General Manager on the details for his approval or suitable direction. He shall implement the preventive maintenance in the "NK Maru" according to the instructions given by the General Manager.

(3) Ship Master

The ship master shall be informed of the results diagnosed on the basis of each parameter monitored by the chief engineer as necessary and help him as possible as he can at the chief engineer's request regarding to the implementation of the preventive maintenance system.

(4) 1st engineer

The 1st engineer shall watch and record each value of parameters as necessary, taking a test sample of oil periodically as directed in the manual and, in case any abnormal or cautious value is found out on the parameters monitored, he shall report to the chief engineer and take a necessary action according to the chief engineer's direction.

This chapter is prescribed on the procedures how to control the preventive maintenance manual(referred to as “maintenance manual”), each report and record regarding to the preventive maintenance system for propeller shaft in the ship “NK Maru”.

3.1 Maintenance manual

- (1) The General Manager shall establish and maintain the maintenance manual, reviewing it as required at such times as the following;
 - (a) when inconvenience or impropriety is found out in the current procedures, or
 - (b) when the applied rules such as the relevant NK rules have been revised, or
 - (c) when the General Manager has been off the duty of the system.
- (2) The General Manager shall distribute copies of the manual to the ship master, the chief engineer and the 1st engineer after getting approval by NIPPON KAIJI KYOKAI. The manuals distributed to each concerned shall be the latest ones.
- (3) The General Manager shall revise the manual as necessary on the basis of the results of review by NIPPON KAIJI KYOKAI.

3.2 Record of the parameters monitored

- (1) Logbook
The 1st engineer shall record each value of monitoring parameters such as bearing temperature, circulating oil temperature and oil consumption rate in the logbook periodically.
- (2) Sampled stern tube oil record
The 1st engineer shall take a sample oil and record necessary data as required in a form sheet(attachment①) periodically, and submit them to the chief engineer.
- (3) Abnormality or non-conformity report
The 1st engineer, the chief engineer and the General Manager shall make a non-conformity report as required in a form sheet(attachment②) and take a necessary counter action upon finding any abnormality or non-conformity.
- (4) Oil analysis record
The General Manager shall verify oil analysis records reported from the test laboratory to be all within the specified limits and satisfactory.
- (5) Audit check sheet
The General Manager or the person designated by him shall do periodical audits and general inspections to ensure that satisfactory maintenance be kept onboard the ship and record the results in an audit check sheet(attachment③). In case any abnormality or non-conformity is found out, he shall make a non-conformity report as shown in above (3) and direct the person concerned to take a necessary corrective action.

3.3 Maintenance of each record and report

The person in charge of each record and report shall be as follows:

Kinds of each record and report	Person in charge
Logbook	1 st Engineer
Sampled stern tube oil record	Chief Engineer
Abnormality or non-conformity report	Chief Engineer
Oil analysis record	General Manager (copy to Chief Engineer)
Audit check sheet	General Manager (copy to Chief engineer)

Preventive maintenance manual for propeller shaft	Chap.4: Control of inspection, measuring and test equipment	4
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This chapter is prescribed on the way how to control inspection, measuring and test equipment for monitoring parameters specified in the chapter 6 regarding to the preventive maintenance system for propeller shaft in the ship "NK Maru".

4.1 Analysis of test oil

- (1) The General Manager who is responsible for analysis of test oil shall define required accuracy of inspection, measuring and test equipment for analyzing on items specified in the chapter 6 and select the appropriate equipment to meet the requirements.
- (2) The test equipment shall be calibrated to ensure the following accuracy and performance required for the test equipment by taking use of the standard test samples prior to the tests.

Test equipment	Accuracy and performance to be required
ICP	Possible to be measured by 1 PPM
Ferrography	Possible to be measured by DR method (WPC/ml)
IR oxidation	Possible to be measured by differential method

- (3) Where analysis of test oil is subcontracted, the General Manager shall evaluate and select the subcontractor to be able to meet the requirements specified in the chapter 6. At subcontracting, the General Manager shall instruct the subcontractor to follow the specified test procedures and to submit analysis records together with calibration records used for verifying the test equipment for their accuracy at each analysis of test oil.

4.2 Bearing metal temperature

- (1) The General Manager is responsible for providing the temperature sensors and their recorder for the bearing metals that is calibrated properly.
- (2) The 1st engineering shall ensure that the equipment for measuring the temperature are all in good operation. He shall report to the chief engineer with an abnormality report immediately where any abnormality is found.

4.3 Consumption rate of lubricating oil

- (1) The General Manager is responsible for providing the equipment for measuring the oil consumption rate that is calibrated properly.
- (2) The 1st engineer shall ensure that the equipment are all in good condition. He shall report to the chief engineer with an abnormality report immediately where any abnormality is found.

4.4 Wear-down of propeller shaft bearing metal

- (1) The General Manager responsible for providing the equipment for measuring bearing wear-down at the after end of the stern tube bearing that is calibrated properly.
- (2) The 1st engineer shall ensure that the equipment are all in good condition. He shall report to the chief engineer with an abnormality report immediately where any abnormality is found.

This chapter is prescribed on the procedures how to take a sample of test oil regarding to the preventive maintenance system for propeller shaft in the ship "NK Maru".

5.1 Sampling of test oil

The 1st engineer shall take a sample of test oil at least every 6 month. The sample shall be taken out by about 200cc into a specified bottle after being drained to the extent as it seems to be fully uniform, and then the sampling date be marked on the bottle.

5.2 Recording of necessary data

- (1) The 1st engineer shall record the following in the specified form(attachment①) at each sampling and submit the oil sampled with the report to the chief engineer.
 - (a) Sampling date
 - (b) Circulating oil temperature
 - (c) Bearing metal temperature
 - (d) Oil brand
 - (e) Service hours of the oil
 - (f) Oil quantity
 - (g) Oil consumption rate(l/day)
 - (h) Bearing wear down measured at the last docking survey
- (2) The chief engineer shall give his opinion on the lubricating condition from the data of each parameter monitored except analytical items in the sheet specified above (1) and send it with the oil sample to the General Manager .
- (3) The General Manager shall ask the prescribed analysis laboratory for the oil analysis. He shall verify the results from the laboratory according to the criteria specified in Chapter 6 and make a comprehensive evaluation on the whole parameters in the sheet above (1) , and send the copy of the sheet and the analysis records to NK with description of counter measure in the sheet if necessary. When analytical values are beyond their cautious limits specified in the chapter 6, he shall direct re-sampling of test oil and re-analysis for all analytical items .

This chapter is prescribed on the procedures how to monitor parameters concerned regarding to the preventive maintenance system for propeller shaft in the ship "NK Maru".

6.1 Kinds of parameters

Parameters to be monitored are as follows;

(1) Analytical items

- (a) Water content
- (b) Chloride content
- (c) Bearing material and metal particles contents
- (d) Oil aging (resistance to oxidation)

(2) Oil consumption

(3) Bearing temperatures

(4) Wear-down for oil lubricated bearing

6.2 Criteria for parameters

Standard, cautious and abnormal values are to be as follows;

	Standard values (max.)	Cautious values (max.)	Abnormal values (max.)
Fe (ppm)	50	Twice each standard value	Three times each standard value
Sn (ppm)	20		
Ni (ppm)	10		
Na (ppm)	80		
Infrared Resistance @ $5.85\mu\text{m}$, Abs. unit/cm	10		
Oil consumption (l/day)	2.0	4.0	6.0
Wear-down for oil lubricated bearing (mm)	0.1	0.3	0.4

6.3 Monitoring of each parameter

- (1) The 1st engineer shall keep watching the bearing temperatures at sea. In case any alarm is issued, he shall investigate into the cause and take a note of it in the logbook. When the lubricating condition is judged to be abnormal beyond the specified limit, he shall record it in an abnormality report and report to the chief engineer. (refer to the attached sheet ②)

The 1st engineer shall be responsible for supplying of stern tube lubricating oil, checking it up and recording the oil consumption every 10 day.

- (2) The chief engineer shall monitor the bearing temperatures and oil consumption to be watched by the 1st engineer appropriately and direct him to take a suitable counter action to any abnormal condition reported after investigating the cause of the abnormal condition based on the past records, etc. and report to the ship master, too if necessary.

- (3)The chief engineer shall submit the abnormality report to the General Manager and ask his confirmation or an additional instruction from him ,if any. The chief engineer shall report to the ship master depending on the necessity and implement the additional actions. In case any monitored parameter is found to be beyond the abnormal value specified in 6.2, the General Manager shall investigate the cause immediately and prepare for necessary maintenance or survey to the system.
- (4)The General Manager shall verify that there is no abnormality on analysis results of sampled oil forwarded from the test laboratory by taking into account the past records concerned and information from the ship side, and submit copies of the report to the chief engineer and NIPPON KAIJI KYOKAI after providing his estimation on it. In case any analytical item on the records is found to be beyond cautious value, the General Manager shall direct re-sampling and re-analyzing of test oil for all analytical items to be carried out immediately. The General Manager shall direct the chief engineer to take a counteraction in case judged to be abnormal based on the analysis results or non-conformity reports submitted from the chief engineer, and report to NIPPON KAIJI KYOKAI on the case and prepare for a necessary occasional survey.

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Preventive maintenance manual for propeller shaft	Chap.7: Onboard audit and general inspection	6
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This chapter is prescribed on the procedures how to implement onboard audits and general inspection for ensuring that proper maintenance is being kept according to the preventive maintenance manual regarding to the preventive maintenance system for propeller shaft in the ship "NK Maru".

7.1 Onboard audit

- (1) The General Manager or a person designated by him (hereinafter referred to as "a responsible person") shall ensure that proper maintenance is being kept onboard the ship at each docking survey according to preventive maintenance manual and check it up with a specified sheet. (attachment③)
- (2) At auditing, the responsible person shall record audit results in the checklist and direct taking necessary corrective actions depending on the results, after getting confirmation of the chief engineer and the ship master on the results.
- (3) The chief engineer shall be responsible for implementing corrective actions and try to complete the corrective actions as soon as possible.

7.2 General Inspection

- (1) The responsible person shall ensure that there is no abnormal condition on the system concerned by doing general inspection such as checking the past analysis records, the records of each parameter monitored and the bearing wear-down reading. (attachment ③) In case any abnormality is found out, he shall prepare for undergoing complete propeller shaft survey or necessary maintenance immediately, after making a non-conformity report on it and reporting to NIPPON KAIJI KYOKAI.
- (2) The responsible person shall attend the complete survey and record the survey results in the non-conformity report with a necessary additional instructions subject to confirmation of the chief engineer and the ship master and submit the report to NIPPON KAIJI KYOKAI.

Stern tube oil record		No.:
Name of the ship :		CNo.:
Sampling date of test oil :		
Temperature of circulating oil at the inlet of oil cooler :		
Temperature at stern tube bearing metal	No.1:	No.2 :
Name of stern tube oil :		
Service hours of stern tube oil :		
Oil quantity (value measured at last time):	l (l)	
Oil consumption rate (l/day) :		
Bearing wear-down (top / bottom) (mm):	() Date :	() Date :
(Opinion of ship side)		
_____ Chief Engineer Date :		
(Comprehensive estimation of responsible person based on analysis results)		
_____ General Manager _____ Chief Engineer		

Attachment : Oil analysis record No. :

Abnormality or Nonconformity Report		No. :
Name of the ship :	CNo.:	
Date :		
Description of abnormality or nonconformity :		
		_____ 1 st Engineer
Corrective Action :		
_____ _____ Chief Engineer Ship Master Date :		
Confirmation and additional instructions by the responsible person :		
_____ _____ General Manager Date : _____ Chief Engineer Ship Master		

Check sheet (Report) for onboard audit and General Inspection		No.:
Name of the ship :	Cno.:	
Date audited :	Place audited :	
(1) Are all staff concerned familiar with the manuals and are the manuals being kept properly?		
(2) Are reference codes such as NK Rules available onboard the ship?		
(3) Are bearing temp., circulating oil temp. and oil quantity being recorded in the logbook properly? And are all the values being monitored checked on their abnormality and investigated, if necessary?		
(4) Are stern tube oil records being made and kept onboard properly? And are the responsible person's direction being confirmed and counter-measured by the chief engineer, if necessary?		
(5) Are calibration records for measuring or testing machines being kept properly?		
(6) Are the abnormality and nonconformity reports being made and kept onboard properly? And are the responsible person's direction being implemented and recorded properly?		
(7) Are there any abnormality as results of verification of each record of parameters monitored and general inspection?		
(8) Others		
Audit results and direction of corrective actions :		
		_____ General Manager Date :
_____ Chief Engineer		_____ Ship Master