



TECHNICAL INSTRUCTIVE
(Survey of Propeller Shafts and Tube Shafts)
Propeller Shaft Survey

Code: PO02-TI04
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1. Objectives.

- .1 The purpose of this Instructive is to provide guidelines and provisions to carry out the survey of Propeller Shafts and Tube Shafts (**Propeller Shaft Survey**) in accordance with the Classification Rules, IMO Regulations and national legislation of the flag States.

2. Application.

- .1 This Instructive is applied to all ships with conventional shafting fitted with a propeller.
- .2 The Instructive will enter into force on **01 July 2020**.

3. Scope.

- .1 This Instructive must be used by the designated Surveyors to carry out the following surveys and related activities:
 - .1 Propeller Shaft Survey.
 - .2 Propeller Shaft Survey extension.

4. Relevant documentation.

- .1 The following documentation is relevant for the control of this Instructive.
 - .1 IMO Resolution A.1140(31) Survey Guidelines under HSSC (2019).
 - .2 ICS Class General Regulations for the Supervision.
 - .3 ICS Class Rules for the Classification and Construction of Ships.
 - .4 IACS Unified Requirements URs Z.
- .2 Under permission granted by IACS Procedure, Volume 1: General Procedures, D3.6, Term and Conditions for use the IACS Resolutions, URs, CSR and Technical Information, by the Classification Societies which are not members of IACS, the URs Z has been used in this Instructive as reference for providing technical requirements.

5. Definitions.

- .1 **Shaft:** For the purpose of this Instructive shaft is a general definition that includes:
 - .1 Propeller shaft.
 - .2 Tube shaft.The definition does not include the intermediate shaft(s) which is(are) considered part of the propulsion shafting inside the ships.
- .2 **Propeller Shaft:** Propeller shaft is the part of the propulsion shaft to which the propeller is fitted. It may also be called screwshaft or tailshaft.
- .3 **Tube Shaft:** Tube shaft is a shaft placed between the intermediate shaft and propeller shaft, normally arranged within a stern tube or running in open water. It may also be called Stern Tube Shaft.
- .4 **Shafting Arrangement:** Refer to the Typical Shafting Arrangement shown in UR Z21, Diagram 1.
- .5 **Stern tube:** Tube or pipe fitted in the shell of a ship at the stern (or rear part of the ship), below the waterline, through which passes the tube shaft or aftermost section of the propeller-shaft. Sterntube is the housing of the shaft bearings, generally two (one aft and one fore), that sustain the shaft and allows its rotation with less frictional resistance. The stern tube also accommodates the shaft sealing arrangement.
- .6 **Close Loop (system) Oil Lubricated bearing:** Closed loop oil lubricating systems use oil to lubricate the bearings and are sealed against the environment (seawater) by adequate sealing/gland devices.



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- .7 **Water Lubricated Bearing:** Water lubricated bearings are bearings cooled/lubricated by water (fresh or salt).
- .8 **Closed Loop System Fresh Water Lubricated Bearing:** Closed loop water lubricating systems use fresh water to lubricate the bearings and are sealed against the environment (such as seawater) by adequate sealing/gland devices.
- .9 **Open Systems (water):** Open water lubricating systems use water to lubricate the bearings and are exposed to the environment.
- .10 **Adequate means for protection against corrosion:** An adequate means for protection against corrosion is an approved means for full protection of the core shaft against sea water intrusion and subsequent corrosion attack. Such means are used for the protection of common steel material against corrosion particularly in combination with water lubricated bearings. Typical means are for example:
 - .1 continuous metallic, corrosion resistant liners.
 - .2 continuous cladding.
 - .3 multiple layer synthetic coating.
 - .4 multiple layer of fiberglass.
 - .5 combinations of above mentioned.
 - .6 rubber/elastomer covering coating.
- .11 **Corrosion Resistant Shaft:** Corrosion resistant shaft is made in approved corrosion resistant steel as core material for the shaft.
- .12 **Stern tube Sealing System:** Stern tube sealing system is the equipment installed on the inboard extremity and, for closed systems, at outboard extremity of the stern tube.

Inboard seal is the device fitted on the fore part of the stern tube that achieve the sealing against the possible leakage of the lubricant media in to the ship internal.

Outboard seal is the device fitted on the aft part of the stern tube that achieve the sealing against the possible sea water ingress and the leakage of the lubricant media.
- .13 **Service records:** Service records are regularly recorded data showing in-service conditions of the shaft(s) and may include, as applicable: lubricating oil temperature, bearing temperature and oil consumption records (for oil lubricated bearings) or water flow, water temperature, salinity, pH, make-up water and water pressure (for closed loop fresh water lubricated bearings depending on design).
- .14 **Oil sample Examination:** An oil sample examination is a visual examination of the stern tube lubricating oil taken in presence of the Surveyor with a focus on water contamination.
- .15 **Lubricating oil analysis:** Lubricating oil analysis is to be carried out at regular intervals not exceeding six (6) months taking into account the applicable standards to this purpose. The documentation on lubricating oil analysis is to be available on board.

Oil samples, to be submitted for the analysis, shall be taken under service conditions.
- .16 **Fresh Water sample test:** Fresh water sample test shall be carried out at regular intervals not exceeding six (6) months. Samples are to be taken under service conditions and are to be representative of the water circulating within the stern tube. Analysis results are to be retained on board and made available to the Surveyor. At time of survey the sample for the test has to be taken at the presence of the Surveyor.

Fresh water sample test shall include the following parameters:

 - a) chlorides content.
 - b) pH value.
 - c) presence of bearing particles or other particles (only for laboratory analysis, not required for tests carried out in presence of the Surveyor).



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- .17 **Keyless connection:** Keyless connection is the forced coupling methodology between the shaft and the propeller without a key achieved through interference fit of the propeller boss on the shaft tapered end.
- .18 **Keyed connection:** Keyed connection is the forced coupling methodology between the shaft and the propeller with a key and keyway achieved through the interference fit of the propeller boss on the shaft tapered end.
- .19 **Flanged connection:** Flanged connection is the coupling methodology, between the shaft and the propeller, achieved by a flange, built in at the shaft aft end, bolted to propeller boss.

6. General provisions for Propeller Shaft Survey.

- .1 The Propeller Shaft Survey is a Classification Survey required by the Rules for the Classification and Construction of Ships, Chapter 1-Classification, Regulation 3.2.2.
- .2 The Propeller Shaft Survey is a mandatory Statutory Survey required by the Survey Guidelines under HSSC, Annex 1, Guidelines (B)3, Regulation (CB)3.1.3.
- .3 During any “five-year period” of the Special/Renewal Survey, there shall be at least one Propeller Shafts Survey.
- .4 Any “five-year period” is the five-year period of validity of the following Certificates, as appropriate:
 - .1 Hull Class Certificate.
 - .2 Machinery Class Certificate.
 - .3 Cargo Ship Safety Construction Certificate (CSSC).
 - .4 Cargo Ship Safety Certificate (CSS).
- .5 The interval between two Propeller Shaft Surveys shall not exceed 60 months (five years). Only in exceptional circumstances, the Marine Division may grant an extension of the Propeller Shaft Survey after the due date, subject to provisions prescribed in paragraphs 6.16 to 6.18 below.
- .6 “Exceptional circumstances” mean unavailability of dry-docking facilities or unavailability of repair facilities; unavailability of essential materials, equipment or spare parts; or delays incurred by action taken to avoid severe weather conditions.
- .7 The Propeller Shaft Survey may be carried in conjunction with the Dry Dock Survey, either during the Special/Renewal Survey or Intermediate Survey. In any case, the interval between two Propeller Shaft Surveys shall not exceed 60 months (five years).
- .8 The Propeller Shaft Survey shall consist of the examination of the following related Items:
 - .1 Propeller shaft.
 - .2 Tube shaft.
 - .3 Seals system and bearings.
 - .4 Clearances in the propeller shafts and bearings.
 - .5 Propeller connection.
 - .6 Propeller.
- .9 The Propeller Shaft Survey shall be carried out by Surveyors duly qualified and authorized for this purpose.
- .10 In accordance with paragraph 1.4.3, Section 1.4 of the General Regulations for the Supervision, when the Propeller Shaft Survey has not been carried out as required, the classification of the ship will be automatically suspended and Class Certificates become invalid.
- .11 In accordance with paragraph 5.6, Section 5 of the Survey Guidelines under HSSC, when the Propeller Shaft Survey has not been carried out as required, the CSSC Certificate or CSS Certificate cease to be valid.



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- .12 In accordance with the flag States requirements, when the Propeller Shaft Survey has not been carried out as required, any Cargo Ship Safety Certificate issued to ships of below international convention size or ships engaged in domestic service cease to be valid.
- .13 All deficiencies found during the Propeller Shaft Survey shall be totally rectified and not to be dealt as any items of outstanding condition of class, statutory condition or recommendation.
- .14 When ship suffers a damage related to the shaft or propeller that require repair in dry-dock due to emergency, the supervision of this repair shall not be considered as mandatory Propeller Shaft Survey, unless it satisfies all provisions required by this Instructive for such Survey.
- .15 To supervise the “emergency repair” mentioned in paragraph 6.14 above, the Surveyor shall carry out an Occasional Propeller Shaft Survey using the Propeller Shaft Survey Report. Along with this Survey Report, a narrative report shall be provided with the results of the inspected items, repairs made, pending items (if any) and relevant evidences.
- .16 The extension of the Propeller Shaft Survey shall only be considered in “Exceptional Circumstances” as specified in paragraph 6.6 above. In all cases, the extension of the Propeller Shaft Survey shall be authorized by the Marine Division. The maximum “non-extendible” period granted is 2.5 years for closed system and one (1) year for open system.
- .17 The request for the extension of the Propeller Shaft Survey shall be supported with the following documentation as appropriate:
 - .1 Navigation Registry (Patent of Navigation).
 - .2 Application Letter from the shipowner/operator stating the following information, as appropriate:
 - a) reasons of the request.
 - b) confirmation of unavailability of essential materials, equipment or spare parts.
 - c) confirmation of delays incurred by action taken to avoid severe weather conditions.
 - .3 Two letters from different Shipyard confirming the non-availability of a space.
 - .4 Booking confirmation letter from Shipyard.
 - .5 Lubricating Oil analysis (for oil lubricated shafts).
 - .6 Fresh Water Sample test (for closed system fresh water lubricated shafts)
 - .7 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition
- .18 The extension of the Propeller Shaft Survey shall be carried out in accordance with the Section 9 and 10 below, as appropriate.
- .19 For the purpose of this Instructive, the Shafting Arrangement is classified as follows:
 - .1 Closed System (Oil Lubricated Shafts or Closed Loop System Fresh Water Lubricated Shafts).
 - .2 Open System (Water Lubricated shafts).

7. Propeller Shaft Survey for Closed System.

- .1 The Closed System includes:
 - .1 Oil Lubricated Shafts, and
 - .2 Closed Loop System Fresh Water Lubricated Shafts.
- .2 The Survey Method is to consist of:
 - .1 Drawing the shaft and examining the entire shaft, seals system and bearings.
 - .2 For keyed and keyless connections:
 - a) Removing the propeller to expose the forward end of the taper,
 - b) Performing a non-destructive examination (NDE) by an approved surface crack detection method all around the shaft in way of the forward portion of the taper section,



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including the keyway (if fitted). For shaft provided with liners the NDE shall extended to the after edge of the liner.

- .3 For flanged connection:
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 the surveyor, the coupling bolts and flange radius are to be examined by means of an approved surface crack detection method.
- .4 Checking and recording the bearing clearances.
- .5 Visual Inspection of all accessible parts of the shafting system.
- .6 Verification that the propeller is free of damages which may cause the propeller to be out of balance.
- .7 Review of service records (refer to definition 5.13).
- .8 Review of test records of:
 - a) Lubricating Oil analysis for oil lubricated shafts (refer to definition 5.15), or
 - b) Fresh Water Sample test for closed system fresh water lubricated shafts (refer to definition 5.16).
- .9 Oil sample Examination for oil lubricated shafts or Fresh Water Sample test for closed system fresh water lubricated (refer to definition 5.14 or 5.16).
- .10 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- .11 Verification of the satisfactory conditions of inboard and outboard seals during the reinstallation of the shaft and propeller.
- .12 Recording the bearing wear down measurements (after re-installation).
- .3 The Survey Method specified in paragraph 7.2 above is applicable for all types of propeller connections (flanged, keyless or keyed).
- .4 The Propeller Shaft Survey for Closed System shall be carried out every five (5) years applying the Survey Method specified in paragraph 7.2 above.
- .5 For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

8. Propeller Shaft Survey for Open System.

- .1 The Open System is the open water lubrication systems for shafts.
- .2 The Survey Method is to consist of:
 - .1 Drawing the shaft and examining the entire shaft (including liners, corrosion protection system and stress reducing features, where provided), inboard seal system and bearings.
 - .2 For keyed and keyless connections:
 - a) Removing the propeller to expose the forward end of the taper,
 - b) Performing a non-destructive examination (NDE) by an approved surface crack detection method all around the shaft in way of the forward portion of the taper section, including the keyway (if fitted). For shaft provided with liners the NDE shall extended to the after edge of the liner.
 - .3 For flanged connection:
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 the surveyor, the coupling bolts and flange radius are to be examined by means of an approved surface crack detection method.
 - .4 Checking and recording the bearing clearances.
 - .5 Verification that the propeller is free of damages which may cause the propeller to be out of balance.



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- .6 Verification of the satisfactory conditions of inboard seal during re-installation of the shaft and propeller.
- .3 The Survey Method specified in paragraph 8.2 above is applicable for all types of propeller connections (flanged, keyless or keyed).
- .4 Applying the Survey Method specified in paragraph 8.2 above, the Propeller Shaft Survey for Open System shall be carried out every five (5) years for the following shafts configurations:
 - .1 Single shaft operating exclusively in fresh water.
 - .2 Single shaft provided with adequate means of corrosion protection, single corrosion resistant shaft.
 - .3 All kinds of multiple shafts arrangements.
- .5 Applying the Survey Method specified in paragraph 8.2 above, the Propeller Shaft Survey for Open System shall be carried out every three (3) years for shafts not belonging in one of the configurations specified in paragraph 8.4 above.
- .6 For keyless propeller connections, the maximum interval between two consecutive dismantling and verifications of the shaft cone by means of non-destructive examination (NDE) shall not exceed 15 years.
- .7 For surveys completed within 3 months before the shaft survey due date, the next period will start from the shaft survey due date.

9. Extension of Propeller Shaft Survey for Closed System.

- .1 Any extension of the Propeller Shaft Survey shall satisfy the provisions prescribed in Section 6/6.16 and 6.17 above.
- .2 For all types of propeller connections, the interval between two consecutive surveys may be extended after the execution of extension survey as follows:
 - .1 **Extension up to a maximum of 2.5 years:** no more than one extension shall be granted. No further extension, of other type, shall be granted.
 - .2 **Extension up to a maximum of 1 year:** no more than two consecutive "one-year extensions" shall be granted. In the event an additional extension is requested the requirements of the "2.5-year extension" are to be carried out and the shaft survey due date, prior to the previous extension(s), is extended for a maximum of 2.5 years.
 - .3 **Extension up to a maximum of 3 months:** no more than one "three months extension" shall be granted. In the event an additional extension is requested the requirements of the "one-year extension" or "2.5-years extension" are to be carried out and the shaft survey due date, prior to the previous extension, is extended for a maximum of one year or 2.5 years.
- .3 The Extension Survey shall normally be carried out within one (1) month of the shaft survey due date and the extension counts from the shaft survey due date.
- .4 If the Extension Survey is carried out more than one (1) month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.
- .5 **The Extension Survey for extension up to 2.5 years is to consist of:**
 - .1 Checking and recording the bearing wear down measurements, as far as practicable.
 - .2 Visual Inspection of all accessible parts of the shafting system.
 - .3 Verification that the propeller is free of damages which may cause the propeller to be out of balance.
 - .4 Verification of the effectiveness of the inboard seal and outboard seals.
 - .5 Review of service records (refer to definition 5.13).



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- .6 Review of test records of:
 - a) Lubricating Oil analysis for oil lubricated shafts (refer to definition 5.15), or
 - b) Fresh Water Sample test for closed system fresh water lubricated shafts (refer to definition 5.16).
- .7 Oil sample Examination for oil lubricated shafts or Fresh Water Sample test for closed system fresh water lubricated (refer to definition 5.14 or 5.16).
- .8 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
- .9 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.
- .6 The Extension Survey for extension up to 1 year is to consist of:**
 - .1 Visual Inspection of all accessible parts of the shafting system.
 - .2 Verification that the propeller is free of damages which may cause the propeller to be out of balance.
 - .3 Verification of the effectiveness of the inboard seal and outboard seals.
 - .4 Review of the previous wear down and/or clearance recordings.
 - .5 Review of service records (refer to definition 5.13).
 - .6 Review of test records of:
 - a) Lubricating Oil analysis for oil lubricated shafts (refer to definition 5.15), or
 - b) Fresh Water Sample test for closed system fresh water lubricated shafts (refer to definition 5.16).
 - .7 Oil sample Examination for oil lubricated shafts or Fresh Water Sample test for closed system fresh water lubricated (refer to definition 5.14 or 5.16).
 - .8 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
 - .9 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.
- .7 The Extension Survey for extension up to 3 months is to consist of:**
 - .1 Visual Inspection of all accessible parts of the shafting system.
 - .2 Verification of the effectiveness of the inboard seal.
 - .3 Review of the previous wear down and/or clearance recordings.
 - .4 Review of service records (refer to definition 5.13).
 - .5 Review of test records of:
 - a) Lubricating Oil analysis for oil lubricated shafts (refer to definition 5.15), or
 - b) Fresh Water Sample test for closed system fresh water lubricated shafts (refer to definition 5.16).
 - .6 Oil sample Examination for oil lubricated shafts or Fresh Water Sample test for closed system fresh water lubricated (refer to definition 5.14 or 5.16).
 - .7 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
 - .8 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.
- .8 The Extension Survey shall normally be carried out within one (1) month of the shaft survey due date and the extension counts from the shaft survey due date.
- .9 If the Extension Survey is carried out more than one (1) month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.



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10. Extension of Propeller Shaft Survey for Open System.

- .1 Any extension of the Propeller Shaft Survey shall satisfy the provisions prescribed in Section 6/6.16 and 6.17 above.
- .2 For all types of propeller connections, the interval between two consecutive surveys may be extended after the execution of extension survey as follows:
 - .1 **Extension up to a maximum of 1 year:** no more than one extension shall be granted. No further extension, of other type, shall be granted.
 - .2 **Extension up to a maximum of 3 months:** no more than one “three months extension” shall be granted. In the event an additional extension is requested the requirements of the “one-year extension” are to be carried out and the shaft survey due date prior to the previous extension is extended for a maximum of one year.
- .3 The Extension Survey shall normally be carried out within one (1) month of the shaft survey due date and the extension counts from the shaft survey due date.
- .4 If the Extension Survey is carried out more than one (1) month prior to the shaft survey due date, then the period of extension counts from the date of the extension survey was completed.
- .5 **The Extension Survey for extension up to 1 years is to consist of:**
 - .1 Visual Inspection of all accessible parts of the shafting system.
 - .2 Verification that the propeller is free of damages which may cause the propeller to be out of balance.
 - .3 Checking and recording the clearances of bearing.
 - .4 Verification of the effectiveness of the inboard seal.
 - .5 Review of the previous clearance recordings.
 - .6 Review of service records (refer to definition 5.13).
 - .7 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
 - .8 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.
- .6 **The Extension Survey for extension up to 3 months is to consist of:**
 - .1 Visual Inspection of all accessible parts of the shafting system.
 - .2 Verification that the propeller is free of damages which may cause the propeller to be out of balance.
 - .3 Verification of the effectiveness of the inboard seal.
 - .4 Review of the previous clearance recordings.
 - .5 Review of service records (refer to definition 5.13).
 - .6 Verification of no reported repairs by grinding or welding of shaft and/or propeller.
 - .7 Confirmation from the Chief Engineer that the shafting arrangement is in good working condition.

11. Applicable Forms for Propeller Shaft Survey.

- .1 Propeller Shaft Survey Report (2013/02).

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