# NON DESTRUCTIVE TESTING PROCEDURE FOR ULTRASONIC PROPELLER SHAFT INSPECTION

## Application

This generic equivalent solution (GES) provides a procedure for in-situ ultrasonic shaft inspection of propeller shafts at periodic survey inspections, in lieu of partial shaft removal and inspection by an **accredited** surveyor. This procedure is not suitable for the initial survey.

It may only be used with high risk vessels to the extent permitted by a delegate of the National Regulator.

The GES procedure is applicable to ultrasonic and visual examination of screw threaded, tapered marine propeller shafts.

*Where reference is made to an 'accredited surveyor' throughout this GES, it is providing that the surveyor is competent in engineering surveying.*

*Approval of NDT Subcontractors: This procedure may only be conducted by appropriately equipped, trained, qualified and experienced contractors. A delegate of the National Regulator shall approve the contractor prior to the inspection taking place. A delegate of the National Regulator may refuse to accept a non-approved contractors report. Arrangements for the inspection are the responsibility of the vessel's owner/agent.*

## Requirement

It should be understood that at all surveys the attending surveyor will visually inspect shafts and check bearing clearances, and the general integrity of the stern gear.

There may be a requirement to withdraw the shaft if maintenance is required or for further investigation if fitness for purpose is in question.

An unsatisfactory ultrasonic test result will be followed by full withdrawal and visual/other inspection by the accredited surveyor.

Owners shall immediately contact the accredited surveyor to determine the best course of action following an unsatisfactory result.

It remains the responsibility of the owner/operator to put in place an appropriate preventative maintenance regime that ensures that shafts remain easy to withdraw and bearings, stuffing boxes/drip-less seals propellers and couplings maintain their fitness for purpose, integrity and

do not deteriorate between shaft withdrawals. The requirement for a full shaft removal and visual inspection by an accredited surveyor in the 8th year remains extant. This requirement is retained to prevent the seizing of shaft to propeller and coupling and to allow empirical data to be gathered in order to allow a later determination of deterioration or otherwise to take place. The use of this procedure is at the owners' discretion. Authorised personnel are able to conduct 4 and 8 yearly inspections if the owner chooses to continue to do so.

## Equivalent solution procedure

**1.0 Personnel**

All personnel carrying out Ultrasonic and visual examination in accordance with this procedure shall be certified Level 2 AINDT or equivalent and have NATA signatory status for these methods. Contractors carrying out this process on behalf of an accredited surveyor shall have written approval from a delegate of the National Regulator prior to commencing these inspections. Failure to do so will result in reports not being accepted by the authority.

**2.0 Referenced documents**

The following standards apply, as amended from time to time:

NSAMS Section 4: Surveys of Vessels

AS 3998-2006 (ISO 9712:2005) Non-destructive testing-Qualification and certification of personnel

AS 3978-2004 Non-Destructive Testing –Visual inspection of metal products and components

AS 2083-2005 Calibration Blocks and their methods of Use in Ultrasonic Testing

**3.0 Safety**

Contractors are responsible for conducting job safety analyses and mitigating worksite risk when performing these inspections in accordance with their legal responsibilities. The accredited surveyor/ delegate of the National Regulator will not accept responsibility for contractors' errors or omissions.

**4.0 Equipment**

*4.1 Ultrasonic Flaw Detector*

Any properly calibrated ultrasonic A-scan unit may be used for the inspection.

*4.2 Probes*

Probes shall be straight beam(longitudinal) with operating frequencies between 2 and 10 Mhz.

*4.3 Reference Standards*

Reference test blocks shall comply with the requirements of AS 2083-2005.

*4.4 Couplant*

Couplant shall not affect any item under test nor surrounding vessel structure.

**5.0 Set-up**

*5.1 Coverage*

100% coverage of the propeller shaft is required unless agreed beforehand in writing with the accredited surveyor.

*5.2 Calibration*

All equipment shall be calibrated prior to commencement in accordance with the contractors written procedures. A calibration record shall be kept by the contractor and made available on request.

*5.3 Sensitivity*

Initial sensitivity shall be set to produce a 1st BWE to 80% screen height on the item under test with the probe located in the mid radial position. Secondary sensitivity will be set at the initial sensitivity +12 dB

*5.4 Reference Curve*

Reference curves shall be employed to compensate for beam path length and the material attenuation as required. The use of a distance amplitude correction curve or time corrected gain may be employed.

**6.0 Surface preparation**

Surface preparation shall take place to ensure the test piece is free of loose paint, scale, rust, oils and grease, splatter etc. which would affect probe contact with the test item.

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**7.0 Test details**

*7.1 Area of test*

100% of the shaft shall be inspected and reported accordingly. A datum point shall be nominated by the testing company and will be clearly indicated on the sketch which shall form part of the formal report of test to be submitted to the accredited surveyor.

Of critical importance are the areas covered by the coupling and propeller, and the test shall determine the integrity or otherwise of these particular areas. Depending on the vessels configuration, some shaft slip may be required to allow the contractor access to test these areas.

*7.2 Range*

Range shall be set to produce two back wall echo (BWE) from the test item.

*7.3 Examination*

An initial scan shall be carried out on the item under test using the initial scanning sensitivity. Any indication that produces a signal of greater than 50% screen height or a loss of back wall signal by more than 6 dB, which cannot be explained by the component geometry shall be noted.

A secondary scan shall then be carried out using the secondary scanning sensitivity. Any indication that produces a signal of greater than 50% screen height that cannot be explained by the component geometry shall be noted. Items should be inspected at both ends.

*7.4 Non-relevant indications*

Due to component length and diameter of the test part mode conversions will be evident after the first BWE.

**8.0 Visual examination**

The NDT contractor shall include in the written report a report on the visual inspection of the accessible shaft, indicating any areas which may place the shafts integrity at risk.

**9.0 Interpretation and recommendation to the Marine Safety Agency/delegate of the National Regulator**

The report submitted to the authority shall contain the following statement:

*It is this companies assessment that the propeller shaft inspected in vessel (name and unique identifying number) is/ is not (strike out applicable) fit for the purpose it is intended to perform, and will maintain that fitness for the period until the next inspection.*

**10.0 Reporting**

Reporting shall be on the contractors own test forms, and shall include all the information stipulated in this instruction. Prior to inspection, contractors are advised to contact the delegate of the National Regulator to agree the format of the report. A copy of the report should be given to the vessel owner, one to the accredited surveyor and one retained for the contractors' records.

**11.0 Submission to the authority for consideration**

All acceptable means of submission are available- fax, mail, electronic. Reports shall be legible, and contractors are advised that a late submission may delay the vessel certificate of survey issue.

**12.0 Notification of acceptance**

The delegate of the National Regulator will notify acceptance of the test report by the issue of a certificate of survey, when all repairs and renewals have been completed. In the event of non-acceptance, the owner will be immediately contacted by the delegate of the National Regulator and courses of action discussed and agreed upon.

**13.0 Auditability**

Reports shall be filed on the vessel file which is maintained for the service life of the vessel.