# No.31 Inclining test unified procedure

(1990) Corr. 1997 (Corr. Aug. 1998) (Rev.1 June 2000) (Rev.2 June 2002) (Corr. 1 Jan 2004)

1. Introduction

The purpose of this procedure is to achieve a satisfactory accuracy in the determination of the lightship weight and of the coordinates of its centre of gravity.

This general procedure is a recommendation. Alternative requirements which are considered to be equivalent to those specified by the following items may be accepted. Acceptance of such equivalents rests with the Society and, where the inclining test is performed to satisfy a statutory requirement, such equivalents also may be subject to the acceptance of the Flag Administration.

Where a surveyor of the Society is requested to attend the inclining test, his responsibility is to verify that the test is conducted according to accepted procedures and that all basic measurements and data are correctly taken and recorded. ◄

2. General Preparation for the Test

2.1 Information to be submitted

The Instruction, containing the information of date and location of the test, responsible person, stability, inclining weight, schemes of inclining weight positions etc., should be presented to the Classification Society before the inclining test.

The following information should be available at the time of the inclining test as necessary:

– General arrangement drawing;
– Tank capacity plan;
– Hydrostatic curves;
– Draft marks locations.

2.2 The inclining test condition

2.2.1 The ship should be as near to completion as possible. Equipment used by the yard on board should be limited to the utmost extent possible. Prior to the inclining test, lists of all items which are to be added, removed, or relocated should be prepared. These weights and their locations should be accurately recorded.

Normally, the total value of missing weights should not exceed 2 percent and surplus weights, excluding liquid ballast, not exceed 4 percent of the light ship displacement. For smaller vessels, higher percentages may be allowed.

2.2.2 All objects should be secured in their regular positions. All weights which may swing or shift must be secured in their known position. If more than one sea stowage position is possible, the actual stowage position used during the test should be recorded.

2.2.3 The ship should be cleared of residues of cargo, tools, debris, scaffolding and snow. Icing of the inner and outer surfaces, the underwater hull included, is not permitted.

2.2.4 All bilge water and other extraneous standing liquids must be removed. When draining individual tanks is impracticable, allowances for such liquids should be at the discretion of the Society.

2.2.5 All service tanks and machinery plant pipings are to be filled as for the working condition.

2.2.6 In general, only the people participating in the inclining test should stay on board the ship.

2.2.7 All spaces should be safe for inspection.

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2.3 Tank contents

2.3.1 Preferably, all tanks should be either full or empty. The number of tanks containing liquids should be kept to a minimum.

2.3.2 Soundings and density of liquids in tanks should be taken. Shapes of tanks which are partly filled are to be known in order to determine the free liquid surface effect.

2.3.3 Adequate measures are to be taken to preclude air pockets in completely full tanks. All connections between tanks are to be closed and all empty tanks are to be adequately dried.

2.4 Mooring Arrangements and Environmental Conditions

2.4.1 Mooring lines should be free of any tension in the transverse direction of the ship during the reading after each weight shift. No external moments should be brought upon the ship (from mooring lines, quay, etc.). If possible, the ship should be located in a calm, protected area free from external forces.

2.4.2 The depth of water under the hull should be sufficient to ensure that the hull will be entirely free of the bottom. Prior to the test the depth of water should be measured in as many locations as necessary to positively satisfy this requirement, taking into account tide differences, if applicable.

2.4.3 An ideal mooring arrangement would involve bow and stern lines on both sides of the ship attached at or near the centre-line. Longitudinal mooring lines should be as long as practicable. More commonly, a ship may be moored by bow and stern lines on one side only and supplemented by spring lines. Where a single bow or stern line is proposed, the surveyor should be assured that the ship's freedom of movement does not adversely effect the conduct of the experiment.

2.4.4 The ship may be moored by means of other special arrangement approved by the Society.

2.4.5 When tidal currents are present the experiment should normally be conducted at or around slack tide.

2.4.6 The ship's gangway should be in the stowed position and any shore gangway removed during the inclining test. As few cables, hoses, etc., as possible should be connected to shore. Those which are needed shall be slack.

2.4.7 The test should not be conducted under adverse wind, wave and current conditions where the accuracy of the results cannot be assured.

2.5 Inclining Weights

2.5.1 For the inclining test, solid inclining weights normally should be used.

2.5.2 Use of water ballast transfer to incline the vessel may be permitted only in cases where it is impractical to incline the vessel using solid weights. If the transfer of water ballast is to be used, a detailed procedure, including calculation procedure, is to be submitted to the society for approval prior to the experiment.

2.5.3 The total weight used should be sufficient to provide a minimum inclination of one degree and a maximum of four degrees of heel to each side of the initial position. However, in those cases where it is absolutely impractical to reach a minimum angle of 1 degree by use of solid weights or waterballast a lesser inclination angle may be accepted, provided that the requirements on pendulum deflection or U-tube difference in height in 2.6.1 are complied with.

2.5.4 Each weight is to be compact, impervious to water and shaped such that its centre of gravity may be accurately determined. It is recommended that not fewer than four weights (or sets of weights) be used, each approximately equal in mass, and that the inclining weights (or sets of weights) be positioned as symmetrically as possible and parallel to the centre line in places convenient for the shifting of weights and measurement of the arms.

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2.5.5 Each inclining weight should be marked with an identification number. The inclining weights should have been weighed with a calibrated instrument to the satisfaction of the Surveyor.

2.6 Pendulums and Instruments

2.6.1 The use of three measuring devices is recommended to determine the vessel's inclination after each weight shift, however, a minimum of two devices should be used, one of which is to be a pendulum or U-tube arrangement. The length and arrangement of pendulum/U-tube are to be such as to ensure the accuracy of the readings of deflection/difference. The minimum deflection/difference, to each side of the initial position, corresponding to the total weight shift, should be 15cm.

2.6.2 The use of a stabilograph is also acceptable provided the calibration of the instrument has been verified to the Surveyor's satisfaction prior to the experiment. A trace of the recorded heel pattern is to be included in the test report.

2.7 Trim and Stability

2.7.1 The vessel should be upright prior to the inclining. However, an initial list of the ship not exceeding 0.5° is permissible.

2.7.2 Excessive trim should be avoided for certain hull forms where changes in waterplane shape would occur in the region of the waterline when the ship is heeled. Such features should be taken into account to select a suitable draught and trim for the test.

2.7.3 The persons conducting the test should be satisfied that the vessel has adequate, positive stability and acceptable stress levels during the test. The estimated initial metacentric height should be at least 0.20 m. ◀

3 Inclining Test and Record of Data

3.1 Person in Charge
A competent person should be designated in charge of the preparation and execution of the inclining test.

3.2 Accuracy of Data
Measurement of Inclining Test data is to be as accurate as possible and to the satisfaction of the attending Surveyor.

3.3 Draught and Water Density Measurements

3.3.1 Draught/freeboard should be measured immediately before and verified after the test, to ensure that no significant changes in vessel's condition have occurred during the test.

3.3.2 Draughts/freeboards should be measured at fore and aft and midship draught marks at both sides. If the freeboards are not measured from the upper edge of deck line at side of freeboard deck or at the same frame locations as the draught marks, the locations and vertical datum must be stated.

3.3.3 A suitable boat with low freeboard should be available for the draught measurements.

3.3.4 To control the correctness of draught measurements, it is recommended to plot two waterlines by draught readings and by measured values of the freeboard when the latter is avaliable. With correct measurements, both waterlines are to coincide. In case of non-coincidence of separate points, additional measurements should be taken.

3.3.5 Sufficient water samples are to be taken at suitable locations and depths to enable and accurate assessment of water density to be made.

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3.4 Weight shifts and Inclination Measurements.

3.4.1 Two recommended procedures of shifting weights are shown in table 1.

**Table 1**

| No. of Weights or Weight Groups | | | | |
|---|---|---|---|---|
| Weight Shifts | Four | | Six | |
| | PS | SB | PS | SB |
| No. 0 | 2, 4 | 1, 3 | 2, 4, 6 | 1, 3, 5 |
| No. 1 | 4 | 1, 2, 3 | 4, 6 | 1, 2, 3, 5 |
| No. 2 | | 1, 2, 3, 4 | | 1, 2, 3, 4, 5, 6 |
| No. 3 | 1 | 2, 3, 4 | 6 | 1, 2, 3, 4, 5 |
| No. 4 | 1, 3 | 2, 4 | 2, 4, 6 | 1, 3, 5 |
| No. 5 | 1, 2, 3 | 4 | 1, 2, 3, 4, 6 | 5 |
| No. 6 | 1, 2, 3, 4 | | 1, 2, 3, 4, 5, 6 | |
| No. 7 | 2, 3, 4 | 1 | 1, 2, 4, 6 | 3, 5 |
| No. 8 | 2, 4 | 1, 3 | 2, 4, 6 | 1, 3, 5 |
| PS and SB denotes port and starboard sides of ship respectively.<br>The underlined numbers indicate the last weights or weight groups shifted. | | | | |

3.4.2 The inclining weight positions should be marked on the deck to ensure that consistency in placement is achieved. The transverse shift distance is to be as great as practicable and appreciable changes in longitudinal or vertical position when moving port to starboard and vice versa are to be avoided.

3.4.3 The pendulum length is to be measured from its point of suspension to the recording batten on which deflections are read.

3.4.4 Pendulum, or U-tube reading on the recording batten or scale can be registered by either of the following ways:

a) on the final stable position of the pendulum or liquid column after stopping of ship motions due to shifting of the inclining weight;

b) by marking the mean value within the range of residual oscilliation.

3.4.5 When using other devices, angles of inclination are to be recorded according to instructions supplied with each device.

3.4.6 Checks should be made in the process of the inclining test for each measuring device. These will, generally, be a progressive plot of angles of heel against heeling moments which should give a series of points lying about a straight line passing through (or close to) the origin.

If there is a deviation of points, either between the points for a particular weight movement, or from the straight line, the deflections and moments should be checked and corrected prior to the next weight movement.

3.4.7 Personnel should be instructed to remain on their assigned positions while inclination readings are being taken and a check should be made that all mooring lines, etc., remain slack following each weight shift until all deflections have been taken and recorded. ▶

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3.5 Other Relevant Data

3.5.1 In the case where the inclinations are carried out by means of transfer of water, it has to be possible to evaluate accurately the weight and the centre of the shifted liquid in relation to the ship's heel and trim.

3.5.2 The weather conditions, i.e., wind speed and direction relative to the vessel, sea state, air and water temperatures, etc., during the test are to be recorded.

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4 Postponement of the Test

If during the course of an inclining test circumstances arise such that the aforesaid requirements are not complied with the attending Surveyor should advise the Person in Charge that the results may not be accepted.

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5. Test Report and Analysis of Lightship Data

5.1 The Builder/Owner should incorporate the data gathered during the test into a compre-hensive test report, which may be combined with the analysis of the lightship data. Test readings not used in the final analysis should still be recorded in the report.

5.2 The Surveyor is to ensure that the data given in the report is consistent with that gathered during the test and to sign the report.

5.3 The inclining test report and analysis, combined with the report or separately, should be submitted to the Society for review and acceptance of results as the basis for approval of the stability information of the ship.

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# No.32 Guidelines on welding procedure qualification tests for hull construction (1992)

**Forward**

The present guidelines are to be regarded as preliminary. They will be reviewed if the relevant ISO-Standards are available. These guidelines intend to be in line with ISO-Standards.

**1. Scope of Application**

1.1 The present guidelines cover the welding procedure qualification of hull welds.

The purpose is to give guidelines for qualification of welding procedures used by the shipyards.

Welding procedure qualification tests are to be carried out in compliance with the procedures described below or with any other procedures considered equivalent.

1.2 These guidelines are based on the ISO-Standards '**Specification and Qualification of Welding Procedures for Fusion Welding**'

Part 1 - General Rules Ref. ISO/CD 9956-1
Part 2 - Welding procedure specification for arc welding of metallic materials Ref. ISO/CD 9956-2
Part 3 - Welding procedure tests for arc welding of steels - Ref. ISO/CD 9956-3

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