



Marine Safety Center Technical Note

MTN 04-95, CH-2
16710/Lightship Change
January 11, 2016

MARINE SAFETY CENTER TECHNICAL NOTE (MTN) NO. 04-95, CH-2

Subj: LIGHTSHIP CHANGE DETERMINATION: WEIGHT – MOMENT CALCULATIONS
VS. DEADWEIGHT SURVEY VS. FULL STABILITY TEST

Ref: (a) Marine Safety Manual, Volume IV, section 6.D.4
(b) Navigation and Inspection Circular (NVIC) 17-91 dated 4 November 1991
(c) ASTM Standard Guide F 1321 Series, "Standard Guide for Conducting a Stability Test (Inclining and Lightweight Survey) to Determine the Light Ship Displacement and Centers of Gravity of a Vessel."

1. Purpose: The purpose of this Marine Technical Note (MTN) is to describe the process for determining when weight changes to a vessel are significant enough to warrant a new deadweight survey or a full stability test (deadweight survey and inclining). Compliance with all applicable stability criteria must be demonstrated to the satisfaction of the Marine Safety Center (MSC), regardless of the magnitude of lightship weight change. Change 2 (CH-2) incorporates minor administrative changes and clarification on stability test preparation.
2. Discussion:
 - a. Lightship Characteristic Changes. A vessel's lightship characteristics form the foundation for calculations that demonstrate its compliance with applicable stability requirements. Accordingly, the accuracy of these characteristics is of paramount importance, both at the time of delivery and throughout the vessel's service life. Changes to a vessel, through the addition, removal, or relocation of items which are included as a part of the vessel's lightship, could jeopardize the accuracy of the lightship characteristics. Minimizing the adverse effects of weight changes is a key element in preserving confidence in a vessel's stability analysis.

In accordance with reference (a), a complete stability test is normally required when modifications to the vessel's structure or arrangements could adversely affect stability. In some cases, however, small weight changes may not be significant enough to warrant a full stability test. Therefore, an evaluation must be made as to whether or not a vessel needs to undergo a deadweight survey or a full stability test following any change to the lightship characteristics. The MSC will determine whether calculations alone are sufficient, in lieu of a stability test or deadweight survey, based on the accuracy of the calculations and/or the application of appropriate conservative assumptions in vertical center of gravity (VCG). In making this determination, the MSC will consider the

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summation of all weight changes that have been made since the last stability test (not just the net change).

This total weight change (W_{total}) is determined by summing the magnitudes of all weights added (W_a), all weights relocated (W_r) and all weights removed (W_r) as follows:

$$W_{total} = |W_a| + |W_r| + |W_r|$$

In applying the above formula, those items whose weight and center of gravity are known exactly through actual measurement may be excluded from the total aggregate weight change; however, such items are subject to review and approval of the MSC and acceptance and verification by the cognizant Officer in Charge, Marine Inspection (OCMI).

- b. Weight-Moment Calculations Only Required. When the total aggregate weight change does not exceed 2% of the currently approved lightship displacement and the longitudinal center of gravity (LCG) does not shift by more than 1% of the vessel's length between perpendiculars (LBP), weight-moment calculations will generally suffice in lieu of a deadweight survey. However, if the amounts or locations of items being added or removed cannot be determined with reasonable accuracy, then a deadweight survey will be required. If weight-moment calculations only are used, then any future weight changes evaluated must include the total aggregate weight changes since the last stability test, not just from the approved lightship characteristics determined by these calculations.
- c. Deadweight Survey Only Required. In accordance with 46 CFR 170.175 and the guidelines established in reference (a), a deadweight survey only will generally be required when a vessel has undergone a total aggregate weight change since the last stability test of between two and ten percent (2-10%) of its currently approved lightship displacement, or when it's lightship LCG shifts by more than 1% of the vessel's LBP.

If, however, upon completion of a required deadweight survey, the results show that, when compared to the vessel's calculated lightship characteristics (anticipated based on the weight-moment calculations), there is a difference of less than 1% for the displacement or a shift in the LCG of less than 1% of the vessel's LBP, then the vessel's lightship VCG can be assumed as being the one determined by the weight-moment calculations. If the displacement or LCG fall outside the above tolerances, then the vessel must either undergo a full stability test or apply a sufficiently conservative margin to the calculated lightship VCG. Vessels undergoing a deadweight survey shall comply with the requirements and recommendations of references (b), (c) and paragraph (e) below.

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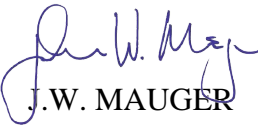
- d. Full Stability Test Required. When the total aggregate weight change exceeds 10% of a vessel's currently approved lightship displacement, a full stability test will be required. Vessels undergoing a full stability test shall comply with the requirements and recommendations of references (b), (c) and paragraph (e).
- e. Stability Test Preparations. Prior to any deadweight survey or full stability test, the vessel's condition shall be as close to lightship as practicable. Total weights to add or subtract which are necessary to convert from the condition of the vessel during the test to the lightship condition should be limited to a maximum of 2% of the vessel's anticipated lightship displacement. Liquids which are to remain on board shall be listed in the approved inclining procedure and should be consolidated to comply with reference (c). Tanks which contain liquids must either be pressed full or the shape of the tank must be such that the free surface effect can be accurately determined.

3. Action:

- a. The owner of a vessel which requires approved lightship characteristics to show compliance with Coast Guard stability requirements must advise the OCMI or Load Line assigning authority of any changes to the vessel's lightship characteristics. Detailed lists of the items to be added, removed or relocated, including weight estimates and calculations showing their effect on the vessel's lightship characteristics, must be submitted to the MSC (or ABS using the NVIC 3-97 process) for review. The owner should include documentation of the last approved lightship characteristics that were based upon a stability test as well as any previous weight-moment calculation adjustments.
- b. The MSC or ABS will then examine the information in accordance with the above policy and determine if a deadweight survey or full stability test is required. In making this determination, the MSC will consider the types of weight involved, the error inherent in the changes, and their effect on stability. Accordingly, a small number of large items with well defined centers of gravity will generally receive more favorable consideration than a large number of small items or items such as extensive piping systems where the accuracy and level of detail is questionable.

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4. Disclaimer: While the guidance contained in this document may assist the industry, the public, the Coast Guard, and other Federal and State agencies in applying statutory and regulatory requirements, this guidance is not a substitute for the applicable legal requirements, nor is it in itself a regulation. It is not intended to, nor does it impose legally binding requirements on any party, including the Coast Guard, other Federal agencies, the States, or the regulated community.



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