

MSC Guidelines for the Review of OSV Stability

Procedure Number: C1-06

Revision Date: February 13, 2013

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Purpose

To establish a procedure for reviewing stability calculations submitted for an Offshore Supply Vessel (OSV) regulated under 46 CFR Subchapters I or L, operating on domestic and/or international voyages.

References

- a. 46 CFR 170, Subpart F, Determination of Lightweight Displacement and Centers of Gravity
- b. NVIC 17-91, Guidelines for Conducting Stability Tests
- c. ASTM F1321-92 (Reapproved 2008), Standard Guide for Conducting a Stability Test (Inclining and Lightweight Survey) to Determine the Light Ship Displacement and Centers of Gravity of a Vessel
- d. Marine Technical Note 04-95, Light Ship Change Determination
- e. 46 CFR 170, Subpart E, Weather Criteria
- f. 46 CFR 174, Subpart G, Special Rules Pertaining to Offshore Supply Vessels
- g. International Convention for the Safety of Life at Sea, 1974, and its Protocol of 1988 (SOLAS), as amended.
- h. IMO Resolution A.469 (XII), Guidelines for the Design and Construction of Offshore Supply Vessels
- i. Meyer, Richard and Feeney, Kevin. "A Simplified Stability Letter for Offshore Supply Vessels." Marine Technology, January 1981. The Society of Naval Architects and Marine Engineers.
- j. NVIC 3-89, Guidelines for the Presentation of Stability Information for Operating Personnel
- k. CG-ENG Policy Letter No. 03-12, "Policy on the Implementation of IMO Resolution A.673 (16), Guidelines for the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk on Offshore Support Vessels, for New and Existing U.S. Offshore Supply Vessels," dated May 5, 2012
- l. IMO Resolution MSC. 235(82), including Adopted Amendments, IMO Resolution MSC. 335(90): Guidelines for the Design and Construction of Offshore Supply Vessels, 2006

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m. IMO Resolution A.749(18): IMO Intact Stability Code

n. IMO Resolution MSC.267(85): 2008 Intact Stability Code (2008 IS Code)

Contact Information

If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by email or phone. Please refer to the Procedure Number C1-06.

Email: MSC@uscg.mil

Phone: 703-872-6731

Website: <http://homeport.uscg.mil/msc>

Responsibilities

Using applicable portions of references (a) through (n), the submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements. The submission shall be made electronically to the above email address or, if paper, in triplicate to the MSC's address found on the above website. To facilitate plan review and project management, all plans and information specified in these guidelines should be submitted as one complete package through a single point of contact for the project.

General Guidance

- ❑ If the vessel is new and not a sister vessel, has the Application for Inspection been submitted? In general no plan review may occur until receipt of a copy of the Application has been received
 - ❑ Is it clearly stated what is desired from the MSC? Are all plans requiring Coast Guard review and/or approval submitted in triplicate? Are there any special or unusual requests involved?
 - ❑ OSV stability reviews generally fall into one of three categories, depending on the method the submitter uses to establish the acceptable range of loading conditions. The greater this range, the greater the operational flexibility, and the greater complexity required in the stability review/guidance. The three most common methods are listed as follows, in order of increasing complexity:
 - Stability letter with a limited number of specific authorized loading conditions.
 - Simplified stability letter with approved loading diagram(s).
 - Approved T&S Book, with or without an accompanying stability letter.
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- The simplified stability letter with approved loading diagrams is the most common form of OSV stability review, as it provides a good balance of operational flexibility and simplified stability guidance for the operator (see reference (i)). Regardless of the type of stability review encountered, however, the basic requirement is that the submitter must clearly demonstrate that each possible loading condition meets the required stability criteria of 46 CFR, Subchapter S. In order to establish a range of acceptable loading conditions, a common technique involves generation of a maximum KG or minimum GM curve. These curves typically plot the maximum KG or minimum GM value on the ordinate axis (y-axis), against the range of operational drafts on the abscissa (x-axis). Acceptable curves incorporate values derived from the most stringent governing stability criteria, along with trim considerations.
- A satisfactory stability review results in operational guidance in the form of a stability letter, and approved vessel loading conditions as indicated above. If the T&S book includes sufficient operational restrictions, instructions, and guidance that would normally be included in a stability letter (see reference (j)), then the MSC may return correspondence approving the T&S book in lieu of a stability letter, noting that the operational instructions in the T&S book must be strictly followed.
- In addition, stability reviews may be preliminary or final, depending on the basis of the lightship values. Preliminary stability calculations are not required, but at the option of the owner/naval architect they may be submitted before the incline of the vessel, using assumed lightship values. This is often done to facilitate expedited final stability reviews. Preliminary stability reviews are conducted in the same manner as final stability reviews, except that a stability letter is not generated and all returned items are marked “Examined”. Following the incline of the vessel and calculated results indicating the true lightship of the vessel, a final stability review may be accomplished and a stability letter generated. A new set of stability calculations is not required if the submitter demonstrates that the assumed lightship values closely match those resulting from the incline experiment (see reference (d) for further guidance and acceptable ranges).
- Verify the applicability of Regulations. See 46 CFR 90.05 (Subchapter I), 46 CFR 125.100 (Subchapter L), and SOLAS I/2, I/3, and II-1/1.
- Ensure the following items have been received (* as applicable):
 - General Arrangements

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- Lightship values based on calculated results of stability test data
 - Lines, offsets, or computer disk with hull model (Recommended but not required)
 - Hydrostatic Tables
 - Tank Capacity Tables\Plan
 - Ullage & Sounding Tables
 - Maximum KG, or Minimum GM curves
 - Intact calculations
 - Damage Stability calculations*
 - Lifting calculations*
 - Towing calculations*
 - Trim and Stability (T&S) Booklet, Loading Diagrams, or summary loading conditions*
- Verify lightship characteristics utilizing one of the following methods:
- Does a sister vessel, with known characteristics, exist?
 - Has an approved procedure and subsequent stability test been performed in accordance with references (a), (b), and (c)?

For each OSV on domestic voyages, the following stability criteria apply for each condition of loading:

- Weather stability criteria of 46 CFR 170, Subpart E
- Intact stability criteria of either 46 CFR 170.173(b) or (c) {unusual proportion and form}, **or** 174.185 {Rahola}
 - the submitter may freely choose one of the two intact criteria but may not mix/match to suit depending on loading conditions or ranges in the vessels righting energy curve—the full requirements of the chosen criteria must be consistently used throughout the entire set of stability calculations
 - if the unusual proportion and form criteria is chosen, the angle of maximum righting arm determines the specific requirements:
 - if above 30 degrees, 170.173(b) applies
 - if less than or equal to 30 degrees, then 170.173(b) or (c) may be used
 - if the Rahola criteria is used, the stability letter must specify a maximum freeboard at the stern in accordance with Table 174.185
- If the OSV carries NLS cargo in Chapter 17 of IBC Code or any cargo that has flash point less than 60 deg Celsius (closed cup test), the OSV must meet the intact stability requirements in reference (k).

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- Damaged stability criteria of 46 CFR 174.200 or 205, if the vessel is regulated under Subchapter L. Note the following:
 - 174.200 applies if 16 or fewer offshore workers are carried (damage is applied only along the sides of the vessel along the length of the engine room).
 - 174.205 applies if more than 16 offshore workers are carried or if accommodations for crew members or offshore workers are located below the deepest load waterline (46 CFR 127.270(c)(1)). (Damage is applied along the entire sides of the vessel)
 - verify that correct damaged extents are used, according to Table 174.207(a)
 - check that the engine room is protected by longitudinal watertight bulkheads at least 30 inches from the outer shell, otherwise the engine room must be flooded
 - If the OSV carries NLS cargo in Chapter 17 of IBC Code or any cargo that has flash point less than 60 deg Celsius (closed cup test), the OSV must meet the damage stability requirements in reference (k).

- In intact and damaged stability calculations, free surface moment correction must be performed in accordance with 46 CFR Part 170 Subpart I. Excess fuel tanks including fuel oil day tanks are considered consumable tanks.

- Maximum KG or Minimum GM curve:
 - Verify that the curve is derived from the most stringent governing value among weather, intact and damaged stability requirements, as applicable.
 - The curve should also incorporate the most stringent values from different trim assumptions, as OSV hull forms often have trim sensitive stability properties. In any case, the final stability guidance should indicate the range of acceptable trims based on the provided calculations.

- Loading Conditions
 - Check that correct lightship values are used
 - Check that the final KG (or GM) value in each specified load condition is within allowable parameters established by the final KG or GM curve
 - Check that final KG (or GM) values are corrected for free surface. See 46 CFR 170, Subpart I

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- Loading Diagrams
 - Review loading diagrams according to the guidance of reference (i). Noted items to check include the following:
 - The reference loading conditions used for the loading diagram plot must sequentially place under deck weights into tanks in order of highest to lowest VCG.
 - The corrected GM or KG values from Conditions I, II, and other intermediate conditions, should be plotted on the GM/KG curve, with lines drawn connecting the loading conditions. The lines connecting the assumed loading conditions must fall entirely within the allowed parameters of the governing GM/KG curve.
 - Check that the reference loading conditions incorporate the correct VCG height of the above deck cargo.
 - A minimum free-surface correction must be incorporated, using the summation of required consumable liquids. Verify the correct usage of the liquid mud free surface values as well, as these values usually dominate the overall correction.
 - Generally, no more than two curves per diagram (each page) should be used. Larger numbers of curves can lead to confusion and errors. Use of the loading diagrams should require no more calculation than simple addition.
 - The label on the abscissa axis (x-axis) of the loading diagram should read as “Total Below Deck Tonnage (fuel oil, lube oil, cargo, ballast, etc.)”. It may not be labeled as “Below Deck Cargo”, as this incorrectly indicates the allowed below deck weight and may lead to errors and unsafe loading conditions.

- Trim and Stability Books (see reference (j) for additional guidance)
 - If approval of the T&S book is made in lieu of a stability letter, ensure that the T&S book includes a section listing operating/stability instructions of equal or greater detail and clarity, as compared to a typical stability letter. Stability instructions and operating guidance must have a satisfactory level of technical detail, sufficiency, clarity, and ease of use, in accordance with reference (j).
 - The T&S book should contain only that information necessary to ensure the vessel has adequate stability for the route and service intended. It should not contain extraneous information or information that might confuse operating personnel. If an owner wishes to present background information to operating personnel (such as stability test calculations or righting energy curves) then it should be provided as a separate, supplemental booklet.

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- Tank sounding tables should normally be included in the T&S booklet in those cases where their use is necessary to perform the required calculations. However, the tables need not be a part of the T&S booklet when they are bulky. Sample loading conditions should be provided to serve as a reference for operating personnel. They should be worked out fully so that operating personnel can follow through them if necessary. A minimum of three sample conditions is recommended; they should normally include conditions at the load line draft, conditions with 100, 50, and 10 percent of consumable liquids and stores, and any other important or typical conditions. All sample conditions should be accurate and shown to comply with the applicable stability criteria.

For each OSV on international voyages, the following stability criteria from reference (g) apply for each condition of loading:

- If 12 or fewer offshore workers are carried on international voyages and the vessel's length is less than 80 m, then the applicable requirements of reference (f) or the criteria in reference (l) is acceptable for use.
- If 12 or fewer offshore workers are carried on international voyages and the vessel's length is greater than or equal to 80 meters, , then the criteria of SOLAS II-1/Part B-1"Stability"applies.
- Note: Compliance with SOLAS damaged stability requires completion of the probabilistic damage stability calculations found in reference (g), which differ from the deterministic criteria found in reference (f). For dual certificated (I/L) vessels, compliance with SOLAS probabilistic damage stability is required due to the lack of an alternative standard specified in footnote of SOLAS II-1/Regulation 4. However, for vessels certificated under Subchapter L only, the criteria found in reference (l) is considered equivalent to the requirements of reference (f) and is therefore accepted as an alternative to meeting the SOLAS probabilistic damage stability standard.
- The following items will be included in the return correspondence (with copies provided to the cognizant OCMC and ABS (load line/stability group)):
 - Number of offshore workers on domestic voyages (for Sub. L OSVs, 16 or fewer, or 36 or fewer, depending on damaged stability criteria used), and on international voyages (usually 12 or fewer)

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- Maximum density of allowable cargo, if greater than 8.54 lb/gal (SG = 1.025), and the specific tanks permitted to carry the cargo
 - Approved lightship weight and location (VCG and LCG)
 - Comment to ABS noting the maximum allowed draft (specify molded or extreme)
 - Comment to ABS to include a statement in the Load Line certificate requiring compliance with the stability letter and approved stability guidance (T&S book, loading diagrams, etc.)
 - If a stability letter is generated, it will contain the appropriate standard phrases and stability instructions (bilges, hull openings, watertight doors, weight changes, slack tank restrictions, etc.). See reference (j) for additional information.
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- If the vessel is carrying a crane, ensure compliance with 46 CFR 173, Subpart B (for more information, see work instruction for review of Crane Lifting calculations).
 - If the owner requests towing authorization on the stability letter, review the required calculations to the towline pull criteria of 46 CFR 173, Subpart E.
 - At respective drafts, compare the displacement and KM values listed in the hydrostatic tables to the values used in corresponding loading conditions.
 - The following items are indicative of normal MSC plan review:
 - Independently generate the KM or GM curve, using all applicable stability criteria.
 - Construct an outer hull model in HECSALV or GHS and generate hydrostatics. In general, submitted values should be close to those independently generated; KM should be within 0.2 ft and displacement within 2 %.
 - Perform independent calculations to verify values used for free-surface corrections.
 - Independently calculate tank capacities. Compare 100% capacities, and weight loading values and locations to those used in the submitted calculations.
 - Construct a full HECSALV or GHS model including compartmentalization.
 - Analyze different loading conditions of the vessel and compare stability results using the computer model and the criteria.

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Definitions

Downflooding Point: The lowest opening on a vessel that allows the entry of seawater into the hull or superstructure of an undamaged vessel due to heel, trim, or submergence of the vessel.

Disclaimer

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact the MSC, the unit responsible for implementing this guidance.