

Guidance for Repowering Vessels Inspected Under 46 CFR Subchapter T



Inspections Division

This guide was developed to aid the Owner/Operator a Small Passenger Vessel in planning for the repowering of their vessel. It covers the most common items that need to be addressed and is not intended to be all inclusive. It is the responsibility of the owner/operator to ensure the vessel is in compliance with the regulations.

Installation of new propulsion engine/s and generator engine/s will have to meet the Environmental Protection Agencies (EPA) requirements for Control of Emissions of Air Pollution, see the following website for details
<http://www.epa.gov/otaq/marine.htm>.

If replacing existing engines, generators or piping installations with the exact same equipment/materials that's reflected in the vessel's approved plans, plan review is not required; otherwise, plan review needs to be conducted by the Marine Safety Center. To avoid delays due to re-submissions, please submit plan review package through your respective geographical inspection office, whether San Juan's Inspection Division, MSD St. Thomas, RIO St. Croix or RIO Ponce.

In accordance with 46 CFR 183.115(b) plan review will be required for replacement of any electrical wiring on an existing vessel (built before March 11, 1996).

Several factors that need to be considered when installing new engines, reduction gears and generators are addressed in this guide. It's imperative that before the vessel goes to a yard/repair facility to start the work, you have the plans approved by the Coast Guard. This preplanning will avoid costly delays.

Repowering is considered a major conversion under 46 CFR 177.115(b). All vessels will be required to submit plans using New 46 CFR Subchapter T.

Regardless of whether replacing in-kind or installing new engines; you will need to schedule a series of inspections over the project's life so the installation can be verified against the approved plans.

If you have any questions please feel free to contact your local Marine Inspection Office

Vessel Name: _____ Official Number: _____

Vessel Representative Name: _____

Address for Response: _____

Phone: _____ E-mail: _____

The following information is to be recorded below or included in attachments to this checklist:

Main Engine New Installation				
Number of Units	Engine	Reduction Gear	Propeller Size	Shaft Strut
	Make/Model	Ratio	<input type="checkbox"/> No change <input type="checkbox"/> Changes made (provide details)	<input type="checkbox"/> No change <input type="checkbox"/> Changes made (provide details)
	Horsepower	Weight		
	Weight			
<input type="checkbox"/> Copy of EPA Certification for Marine Engine attached.				

Main Engine Old Installation				
Number of Units	Engine	Reduction Gear	Propeller Size	Shaft Strut
	Make/Model	Ratio		
	Horsepower	Weight		
	Weight			
<input type="checkbox"/> Copy of EPA Certification for Marine Engine attached.				

Note: Wooden vessels that are increasing horsepower or are converting from gasoline to diesel propulsion may be required to submit additional information taking in account the affects that the higher torque these engines will have on the hull structures, to prevent catastrophic hull failure.

Generator Installation				
	Number of units	Make/Model	Weight	Name Plate Data
New				(include, kW, kVA, amps, power factor (PF), temperature rating, single or three phase)
Old				

Systems Plan Review: Attach explanation, diagram and/or list of materials to be used in each system for main engine and generator)

Piping system

All vital system piping shall be in compliance with 46 CFR 182.710. Plans shall be submitted and approved for these systems. Vital systems include:

- Fuel,
- Raw water cooling,
- Attached pumps, (bilge/fire).

Note 1: Non-metallic hoses must meet 46 CFR 182.720. This is a new installation replacement in kind is not allowed.

Note 2: The above referenced Code of Federal Regulations can be downloaded from <http://ecfr.gpoaccess.gov>

Exhaust system

Exhaust systems upgrades shall meet the standards of 46 CFR 182.430 or as an alternative the American Boat and Yacht Council (ABYC) Project P-1. Changes in weight from exhaust renewal shall be provided in conjunction with engine weights for stability test consideration.

Note 1: ABYC Project P-1 can be purchased from <http://www.abycinc.org/>

Note 2: The above referenced Code of Federal Regulations can be downloaded from <http://ecfr.gpoaccess.gov>

Electrical system

(wire or cable type(s), conductor size (s), ampacity of interlock switches, new equipment, etc.)

- Battery cables and installation shall be in compliance with 46 CFR 183.340.
- Conductor sizing shall be calculated from table 183.340(p) in 46 CFR 166-199, or
- American Boat and Yacht Council (ABYC) Project E-11, using a 10% voltage drop.
- Length of run shall be calculated using length from battery to starter and from engine back to battery. (Total length of circuit for DC power.)

Note 1: Many of the newer engines have high amperage starters that require using two (2) 00 cables to and from the starter. Undersized cables can cause a fire hazard.

Note 2: Factory supplied engine harnesses are typically not plan reviewed however, the harness must have over current protection. Over current protection should be verified. If the harness must be lengthened, or spliced for any reason, plan review will be conducted to ensure conductor size and installation is in compliance with 46 CFR 183.340.

Note 3: If changing the voltage of the engine starters, the weight of the batteries must be included in the weight calculations.

Note 4: ABYC Project E-11 can be purchased from <http://www.abycinc.org/>

Note 5: MSC Guidelines E2-07(T) Electrical Plans – Small Passenger Vessel (T) to assist in plan submittal attached to the end of this document.

Note 6: The above referenced Code of Federal Regulations can be downloaded from <http://ecfr.gpoaccess.gov>

Single line electrical diagram

* For new generators provide at least main circuit breaker information and size/type of feeder cable from the generator to the main electrical panel - manufacturer supplied wiring harnesses need not be included.

Note 1 : new regulation at 46 CFR 183.380 requiring control and indicator circuits to have over current protection.

Propulsion Shaft material

Installed Shaft diameter _____

Type of Shaft Material _____

Attach calculations showing shaft size is adequate.

Note 1: Shaft material composition is vital to performing size calculation. If unknown, it is the responsibility of owner/operator to provide via data sheet from manufacturer or supplier for this information

Note 2: Use the calculations found in one of the following acceptable standards for determining shaft size:

- a. ABS Rules for Building and Class “Steel Vessel Under 90 Meter (295 feet) n Length”, Part 4 Vessel System and Machinery, Section 1 Propulsion Shafting, 7.1 Shaft Diameters. This standard can be downloaded from <http://www.eagle.org>
- b. ABYC P-6 Propeller Shafting Systems. This standard can be purchased from <http://abycinc.org>

Stability Review:

1. Vessels that had a Stability Letter based on a Simplified Stability Test:

The Coast Guard Marine Safety Manual Volume IV, Chapter 6, paragraph D.4 (Evaluation of Weight Changes to Lightship) notes that **any weight additions or removals must be documented** to track the aggregate weight change of the vessel through its service life. If the aggregate total of these weight changes exceeds two percent of the vessel's approved lightship or the Longitudinal Center of Gravity (LCG) shifts by more than one percent of the vessel's length between perpendiculars (LBP), a new simplified stability test will be required.

To determine the aggregate weight change the owner/operator must provide the documented weight of the vessel upon completion of construction and outfitted with all equipment required by 46 CFR Subchapter T, and any weight changes made though out the vessel's service life. Use Marine Technical Note (MTN) 04-95 (Lightship Change Determination; Weight-Movement Calculation vs. Deadweight Survey vs. Full Stability Test) to calculate the aggregate weight change. Without documented weights a new simplified stability test must be conducted.

The OCMI may send the aggregate weight changes to the Marine Safety Center to determine if the vessel's stability has been adversely affected.

Note 1: MTN 04-95 is attached at the end of this document.

Note 2: If it has been determined that a new simplified stability test is required it is the vessel representative responsibility to conduct the test. This test must be witnessed by a Marine Inspector.

Note 3: Procedures on how to conduct a simplified stability test can be found on Sector San Juan's Port Directory Page/under Domestic Inspection at <http://homeport.uscg.mil>. Due to website security a direct link can not be provided.

Note 4. A new Stability Letter must be issued prior to the vessel being issued a Certificate of Inspection

2. Vessels that have Stability Letter based on calculations:

The changes in weight do to the repowering of the vessel will have to be evaluated by the MSC using Marine Technical Note (MTN) 04-95 (Lightship Change Determination; Weight-Movement Calculation vs. Deadweight Survey vs. Full Stability Test)

The purpose of this Marine Technical Note (MTN) is to publish the Coast Guard's long-standing policy for determining when weight changes to a vessel are significant enough to warrant requiring a new deadweight survey or a full stability test (deadweight survey and inclining), in order to reestablish accurate lightship characteristics, which includes vessel displacement and the location of the center of gravity

The owner of a vessel which requires approved lightship characteristics to show compliance with Coast Guard stability requirements must advise the cognizant OCMI or Load Line assigning authority of any changes to the vessel's lightship characteristics. Detailed lists of the items to be added or removed, 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.

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.

Note 1: MTN 04-95 is attached at the end of this document.

Note 2: NVIC 3-97 can be downloaded from:
http://www.uscg.mil/hq/g-m/nvic/3_97/n3-97.pdf

MSC Guidelines for Review of Electrical Plans – Small Passenger Vessel

Procedure Number: E2-07T

Revision Date: 04/16/2003

References

- a) Title 46 Code of Federal Regulations, Part 181 – Fire Protection Equipment
 - b) Title 46 Code of Federal Regulations, Part 182 – Machinery Installation.
 - c) Title 46 Code of Federal Regulations, Part 183 – Electrical Installation.
 - d) Title 46 Code of Federal Regulations, Subchapter J (Parts 110-113) – Electrical Engineering
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Disclaimer

These guidelines were developed by the Marine Safety Center as an aid in the preparation and review of vessel plans and submissions. They were developed to supplement existing guidance. They are not intended to substitute or replace laws, regulations, or other official Coast Guard policy documents. The responsibility to demonstrate compliance with all applicable laws and regulations still rests with the plan submitter. The Coast Guard and the U. S. Department of Homeland Security expressly disclaim liability resulting from the use of this document.

Contact Information

If you have any questions or comments concerning this Guidance, please contact the Marine Safety Center by e-mail or phone. Please refer to Procedure Number: E2-07T.

E-mail: customerservicemsc@msc.uscg.mil

Phone: (202) 366-6440

General Review Guidance

The numbers following each item refer to a section of Title 46 of the Code of Federal Regulations.

- Is this a Sister Vessel? (177.210)
- Is this vessel on file at the MSC? Please include MSC project number.
- Is the office that is going to inspect and grant you the COI listed on your plan review cover letter so we may copy them on correspondence?
- Is this submittal in response to MSC correspondence you have received? If so please reference it and include a copy of the previous correspondence.

Elementary One-Line Diagram of the Power System: [177.202(a-4)(i-ix)]

- List on the plan, as applicable, the full load amps of generators or alternators and the total amp hours of battery banks. Vital loads must have two sources of power. (183.310.)
 - If your vessel is equipped with two or more generators to supply ship's service power, they must either be interlocked or arranged for parallel operation. (183.322)
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MSC Guidelines for Review of Electrical Plans – Small Passenger Vessel

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- ❑ Are the full load amps of the panelboards used on the plan? Is the circuit breaker feeding the panel set below the panel amps? (183.330)
- ❑ Required cable and wiring details to be included in submittal: type, temperature rating of insulation and conductor size. See 183.340(d) for acceptable cable type: IEEE-45, MIL-C-24643, UL Listed Boat Cable for cable, NEC Article 310 for wire. (183.340)
- ❑ Ensure no wire is installed on AC systems unless it is in an enclosure. (183.340(a)).
- ❑ Are the circuit breaker, overcurrent devices and switch ratings listed? Have you listed the number of circuit breaker poles? (183.380)
- ❑ Is the circuit breaker trip setting less than the conductor ampacity or the next “standard size” up? (183.380 (d))
- ❑ Are motor circuits properly protected? (183.380(h)(2) See NEC 2002 Edition, Table 430.52 for reference.)
- ❑ Is the steering gear motor circuit protected against short circuit only? (all overload contacts wired for alarm only, not trip) Is instantaneous trip setting for circuit breaker listed on the plan? (182.610 (f) / 183.380 (e-f))
- ❑ Does the battery charger or alternator connected provide power (volts x amps) above 2000 Watts? If so, no unprotected electrical equipment may be in space with the batteries. (183.350, 183.352)
- ❑ If electrical equipment is located in hazardous areas, is the equipment explosion proof, ignition proof, or part of an intrinsically safe system? (183.530)
- ❑ Semiconductor rectifier systems, if installed, must indicate proper heat removal, current limiting devices, and overcurrent protection in your one-line diagram. (183.360)
- ❑ Dual voltage generator system must be of the grounded type and provide ground detection. (183.324)
- ❑ Single voltage generator must be ungrounded.
- ❑ If grounded, is the single ground location clearly labeled in your submittal? (183.370)
- ❑ If an ungrounded system, is ground detection evident in your submittal? (183.378)
- ❑ Is the shore power circuit breaker setting listed on the plan? Is the shore power breaker interlocked with the generator breaker? (183.390)
- ❑ Does AC lighting meet UL1598A or the UL standard that supercedes it? (183.410)
- ❑ Does your emergency lighting have sufficient power capacity? (183.432)

Electrical Plant Load Analysis

- ❑ Are all electrical loads from switchboards, power distribution panels or DC load terminals (as applicable) included in your analysis?
- ❑ Have you included the amp rating of energy consuming devices and load usage factor for each load?
- ❑ Are the capacities of your storage batteries (Amp-Hours), and full load amps rating of your alternator(s) and generator(s) included in your analysis? Are they greater than the total of loads after the usage factor is applied?
- ❑ Are bilge pump power requirements included in your load analysis? (182.520 (a/d)(e-8))
- ❑ Have you included wire/cable lengths in your description? Have you computed the voltage drop using and determined that it is less than 10%? (183.340(p))

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Fire/Smoke Detection Systems

- ❑ Fire detection and extinguishing systems must be installed in compliance with 181.400 through 181.420.
- ❑ Is your vessel a fiber reinforced plastic (FRP) vessel constructed with general-purpose resins and fitted with a smoke detection system? (177.410 (c-3)/76.27)
- ❑ Is a fixed gas fire extinguishing system installed that is capable of automatic discharge upon heat detection? (181.400(a))
- ❑ Is your fire detection system “Type Approved”? (MSC approval list)
- ❑ Is fire detection located in the required spaces? (181.400(c))
- ❑ Spaces that do not require detectors. (181.400 (b-1))
- ❑ Requirements for each *overnight accommodation space* on a vessel with overnight accommodations for passengers. (181.400(e)/450(a))
- ❑ If there an *enclosed vehicle space* located on board which requires a detection system? (181.400 (f))
- ❑ Fire/Smoke detection zoning requirements. Verify that a engine-room-fire/smoke-detection loop does not share a common circuit with any detectors outside of the engine room. Isolator modules can be used to isolate the engine room. Ensure the isolator module is on the approved component’s list for the fire detection system. (76.27-5/76.33-5)
- ❑ Manual alarm system details. (76.35)



Marine Safety Center Technical Note

Date: 11 May 1995

SSIC: 16703/MSM Vol. IV Sec. 6.D.4/
46 CFR 170.175

MTN: 04-95

Subj: LIGHTSHIP CHANGE DETERMINATION; WEIGHT-MOMENT CALCULATION
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 1321-90, "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 publish the Coast Guard's long-standing policy for determining when weight changes to a vessel are significant enough to warrant requiring a new deadweight survey or a full stability test (deadweight survey and inclining), in order to reestablish accurate lightship characteristics, which includes vessel displacement and the location of the center of gravity.

2. DISCUSSION:

a. Lightship Characteristic Changes. A vessel's lightship characteristics form the basis for performing the calculations necessary to demonstrate a vessel complies with applicable stability requirements. Accordingly, the accuracy of these characteristics is of paramount importance, both at the time of construction 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. It is incumbent upon vessel owners and their naval architects to minimize the possible adverse affects of the weight changes.

In accordance with reference (a), a complete stability test is usually required after work is completed unless weight changes are minor and do not adversely affect the vessel's stability. However, the Marine Safety Center (MSC) is given the authority to determine whether calculations alone are sufficient, based on the accuracy of the information available or based on applying acceptable penalties. 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. In making this determination, the MSC will consider the total aggregate of all weight changes that have been made since the last stability test (not just the net change).

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

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

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 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 a reasonable accuracy, then a deadweight survey will be required in order to confirm the new calculated lightship VCG. If weight-moment calculations only are used, then any future weight changes evaluated must include the total aggregate weight changes from 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 displacement, or when its 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 on the other hand, the displacement or LCG fall outside the above tolerances, then the vessel must either undergo a full stability test or, apply an indisputably conservative penalty to the calculated lightship VCG.

d. **Full Stability Test Required.** When the total aggregate weight changes exceed 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) and (c) and the guidance of paragraph (e) below.

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 so that the number of tanks involved is minimized. Tanks which contain liquids must comply with the conditions of paragraph 5.2 of reference (c). Specifically, they 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 cognizant OCMI or Load Line assigning authority of any changes to the vessel's lightship characteristics. Detailed lists of the items to be added or removed, 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 3-84 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. Also included in these considerations will be the sizes and locations of the individual items being changed and the accuracy with which the weights and centers of gravity can be determined. 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.



T. H. WALSH

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