U.S. Department of Homeland Security

United States Coast Guard

Marine Safety Center Technical Note

MTN 02-95, CH-1
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October 14, 2011

MARINE SAFETY CENTER TECHNICAL NOTE (MTN) NO. 02-95, CH-1

Subj: DAMAGE STABILITY EQUALIZATION FOR VESSELS (MONOHULL ONLY) SUBJECT TO 46 CFR 171.080

Ref: (a) 46 CFR 171.080(e)-(h)
(b) Marine Safety Manual, Vol. IV, Technical, COMDTINST M16000.9

1. Purpose: This updated Marine Technical Note (MTN) provides guidance on the physical arrangement of equalization systems for vessels required to meet the damage stability requirements of 46 CFR 171.080(e), (f) or (g), and sets specific stability criteria for acceptance of the final and interim angles of equilibrium in accordance with 46 CFR 171.080(e)(1)(ii) and 171.080(g)(3). Change 1 (CH-1) incorporates minor administrative corrections and updates obsolete references to the applicable sections of 46 CFR 171.080 and reference (b) to reflect changes from the Final Rule (60 FR 53713, October 17, 1995). In addition, in the discussion section, the gross tonnage threshold has been corrected from 100 to 150 gross tons for manual equalization per the requirements of 46 CFR 171.080.

2. Applicability: The guidelines provided in this MTN apply to all monohull, U.S. flag passenger vessels, with Type I or Type II subdivision, required to meet damage stability. Sections 4.d. and 4.e. of this MTN (Stability Criteria for the Transient Condition and Acceptance of Equilibrium Angle Greater Than 7 Degrees) are not applicable to vessels demonstrating compliance with 46 CFR 171.080(f), as this regulation independently addresses these considerations.

3. Discussion:

a. This MTN sets specific guidelines for the arrangement of automatic and manual (where automatic is impracticable) equalization systems to ensure that they are both safe and reliable. Title 46 CFR 171.080(e)(1), (e)(2), (f)(8) and (g) allow the use of equalization systems to meet the requirements for the maximum final angle of equilibrium after damage. Equalization systems are required to be automatic however, for vessels over 150 gross tons and in ocean service, manual equalization systems are permitted if the arrangement of an automatic system is impracticable. Further details on manual equalization systems are provided in section 4.b and 4.c of this MTN. For automatic systems, equalization must be achieved after damage in any loading condition without the use of any valves. If any valves are used (even automatically actuated valves), the system is considered manual. Typically, automatic equalization systems involve two tanks, cross connected through a "high hat" system, which involves a cross connection pipe that rises above the top of both tanks but remains below the light load waterline (Figure 1). Automatic equalization systems must be arranged so that there will be no

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transfer of liquid between the two tanks in the intact condition, but with sufficient hydrostatic head to drive equalization after either tank is damaged.

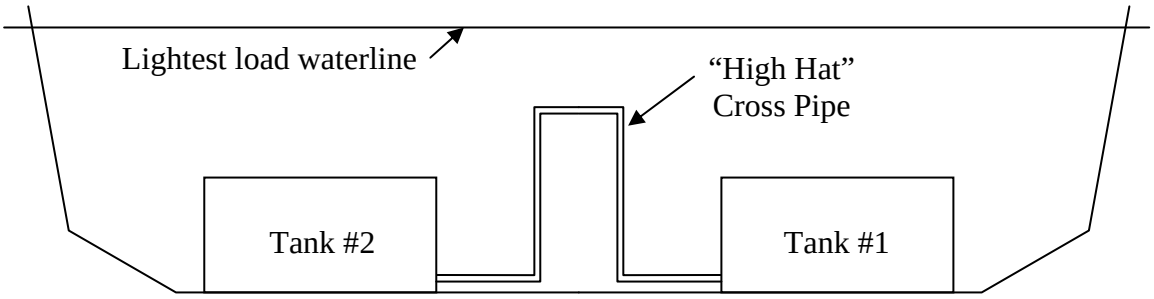

Figure 1. Typical Automatic Equalization Arrangement

b. The maximum angle of heel after damage but prior to equalization must be approved by the Commanding Officer, Marine Safety Center in accordance with 46 CFR 171.080(h)(3), regardless if automatic or manual equalization is used. This MTN sets specific stability criteria to improve the survivability of a vessel in the transient condition, and requires that the pre-equalization condition be analyzed in every case.

c. 46 CFR 171.080(e)(1)(ii) states that the Commanding Officer, Marine Safety Center can accept a final angle of equilibrium of greater than 7 and less than or equal to 15 degrees as long as the vessel can demonstrate sufficient range of stability post-damage.

4. Action:

a. Requirements for Automatic Equalization Systems - Equalization is considered "automatic" if a high hat cross-flooding pipe arrangement is provided such that:

i. the top of the high hat cross-flooding pipe is always below the lightest operating waterline to ensure adequate hydrostatic head to equalize the cross-connected tanks in 15 minutes or less; and

ii. there is no transfer of liquid between the cross-connected tanks in the intact condition up to a heel angle of 40 degrees; and

iii. all equalization piping is located inboard of the assumed maximum transverse extent of damage as defined by 46 CFR Table 171.080(a).

If, due to vessel and tank configuration, these conditions cannot be met, the installation of an automatic equalization system is considered to be "impracticable" under the terms of 46 CFR 171.080(h).

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b. Requirements for Manual Equalization Systems - For arrangements where it is "impracticable" to make the equalization automatic, the cross-flooding pipe arrangement must fully meet the requirements of 46 CFR 171.080(h)(1), all equalization piping must be located inboard of the assumed maximum transverse extent of damage as defined by 46 CFR Table 171.080(a), and the vessel must survive the transient damage condition described in paragraph (d) below.

c. Restrictions on the Use of Manual Equalization Systems - In accordance with 46 CFR 171.080(h)(2), equalization on vessels under 150 gross tons in ocean service and on all vessels in other than ocean service, must not depend on the operation of valves. Equalization on these vessels must, therefore, be automatic and meet the requirements in paragraph 3(a) above.

d. Stability Criteria for the Transient Condition - For vessels required to meet reference (a), the survival criteria for the non-equalized transient damage condition, regardless of the method of equalization (automatic or manual), are:

i. No downflooding points may be submerged. Downflooding points must be reevaluated in the damage stability analysis; openings with effective weathertight closures are not acceptable, as they are for the intact stability criteria. All weathertight closures must be considered as downflooding points as they may be submerged during equalization; and

ii. the vessel must have an after damage maximum righting arm of at least 0.05 m (0.16 feet) and a range of positive righting arms to at least 7 degrees.

Note: The margin line is allowed to be submerged and there is no specific limit on the non-equalized maximum angle of heel in the transient damage condition.

e. Acceptance of Equilibrium Angle Greater Than 7 Degrees - For vessels required to meet 46 CFR 171.080(e)(1), a final angle of equilibrium that is greater than 7 degrees and less than or equal to 15 degrees may be accepted, provided that the vessel is not equipped with equalization or is equipped with automatic equalization, and the following stability criteria are met:

i. the range of stability after damage is at least 15 degrees; and

ii. the maximum positive righting arm within the 15 degree range is at least 0.1 meters (0.33 feet); and

iii. the positive area under the curve within the 15 degree range is at least 0.015 m-rad (2.8 ft-deg); and

iv. downflooding does not occur within the 15 degree range of positive stability.

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5. 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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