U.S. Department of Homeland Security

United States Coast Guard

Marine Safety Center
Technical Note

MARINE SAFETY CENTER TECHNICAL NOTE (MTN) 01-01, CH-1

Subj: TOWLINE PULL CRITERIA FOR VESSELS EQUIPPED WITH AZIMUTH THRUSTERS (Z-DRIVES)

Ref: (a) 46 CFR 173.095
(b) Marine Safety Manual, Vol. IV, Chap. 6, Section 6.E.2

1. Purpose: This change to MTN 01-01 provides clarification of the towline pull criteria requirements specified in 46 CFR 173.095 and corrects the 's' factor equation for determining the effective thrust of Z-Drives. Additionally, the variable 'theta' was changed to 'zeta' to reduce confusion as theta is used to represent the heel angle in the equation for determining the heeling arm (46 CFR 173.095(d)). Changes also reflect our Coast Guard Headquarters reorganization.

2. Applicability: The guidelines provided in this MTN apply to all U.S. flag towing vessels that are equipped with Z-Drive propulsion units.

3. Discussion:

a. Reference (a) established the stability criteria for vessels with conventional rudders and propellers equipped to tow. Advancements in propulsion technology required modification to the factors associated with calculating the effective thrust of these propulsion systems. Reference (b) modified the formulas for Voith-Schneider type propulsion units using cycloidal drives and Kort nozzles, which are shrouded propellers with conventional rudders.

b. Z-Drive azimuth thrusters are fully directional shrouded propellers that eliminate rudders altogether, making it difficult to use reference (a) since there is no way to calculate the fraction of the propeller circle that is intercepted by the rudder at 45° from centerline (represented by 's'). Reference (b) was used until a more accurate method was developed. The method presented in this MTN more accurately reflects the bollard pull produced by the Z-Drive configuration.

4. Action: For vessels equipped with the Z-Drive propulsion units, the formulas outlined in reference (a) will be used with a modification to the 's' factor. The 's' factor will be calculated as follows:

$$s = \frac{1 + \cos \zeta}{2}$$

ζ is the offset angle between Z-Drive units that occurs when one unit is thrusting directly transverse and the other is directed so that its thrust flow tangentially intersects the nozzle of the first Z-Drive. (See Enclosure (1))

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5.   <u>Disclaimer</u>: 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.
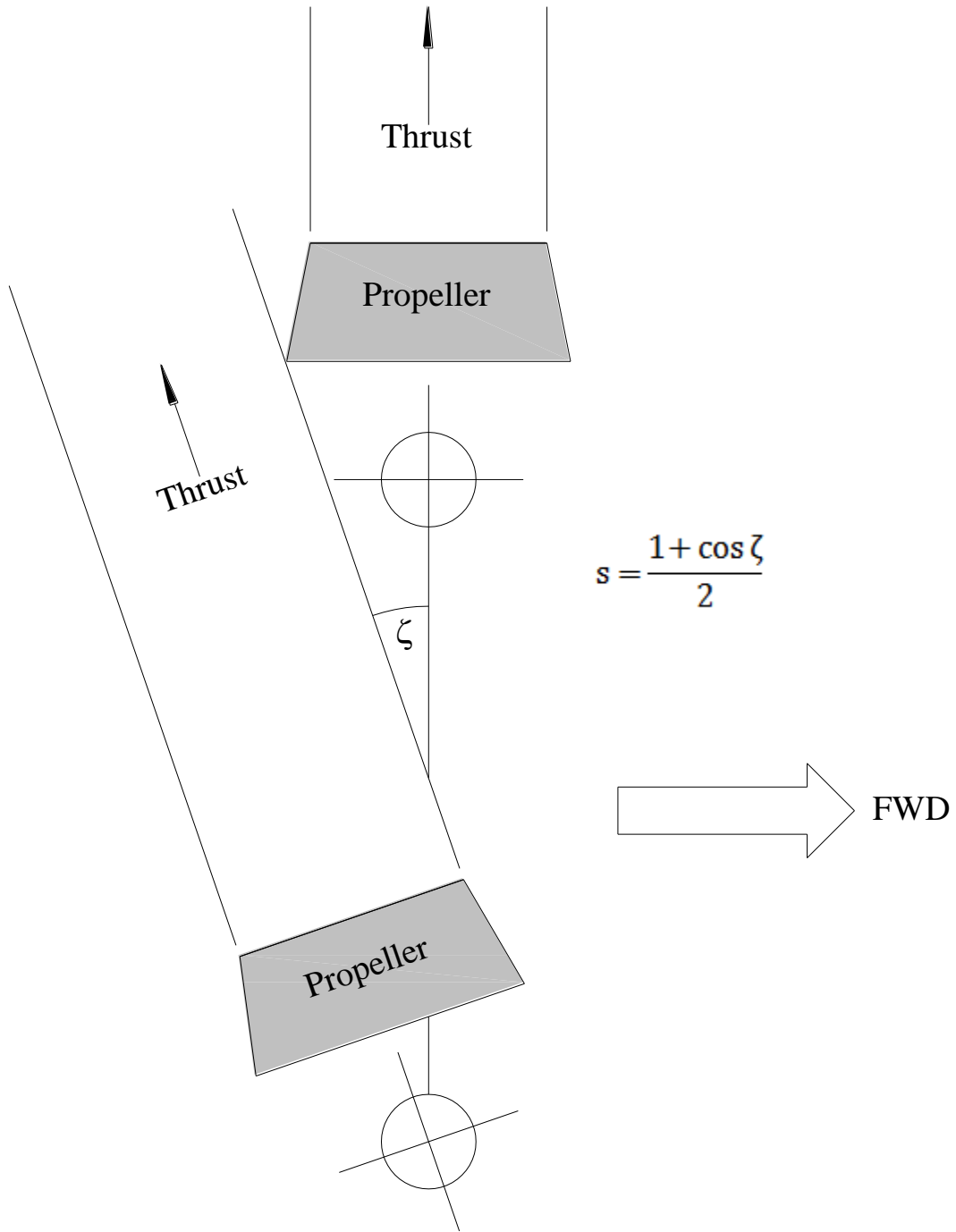
P. E. LITTLE

Encl: (1) Z-Drive configuration

Copy: ABS Americas (Stability/Loadline Group)

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Thrust

Propeller

Thrust

ζ

$$s = \frac{1 + \cos \zeta}{2}$$

FWD

Propeller

Z-Drive Configuration