PART
5

CHAPTER 11 Vessels Intended for Towing

APPENDIX 1 Intact Stability Guidelines for Towing Vessels *(1998)*

1 General

The intact stability of each towing vessel is to be evaluated for the loading conditions indicated in 5-11-A1/7 for compliance with the intact stability criteria in Section 5-11-2, and the results are to be submitted.

For every loading condition, which is to be shown in the Trim and Stability Booklet, the righting arm curve (GZ curve) should be plotted using the VCG corrected for the free surface effects of liquid in tanks.

3 Submission of Plans

The following drawings are to be submitted with the Trim and Stability Booklet for our review:

i) General arrangement plan

ii) Capacity plan or table with centers of gravity

iii) Lines plan

iv) Hydrostatic curve or table

v) Cross curves of stability

vi) Downflooding angle versus draft curve. The downflooding angle is the first of the angle of heel at which openings in the hull, superstructures or deck houses which cannot be closed weathertight immerse.

5 Intact Stability Criteria

The following stability criteria are to be complied with:

i) The area under the righting lever curve (GZ curve) should not be less than 0.055 meter-radians (10.3 ft-degrees) up to $\theta = 30°$ angle of heel and not less than 0.09 meter-radians (16.9 ft-degrees) up to $\theta = 40°$ or the angle of flooding θ_f, if this angle is less than 40°. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and θ_f, if this angle is less than 40°, is not to be less than 0.03 meter-radians (5.6 ft-degrees).

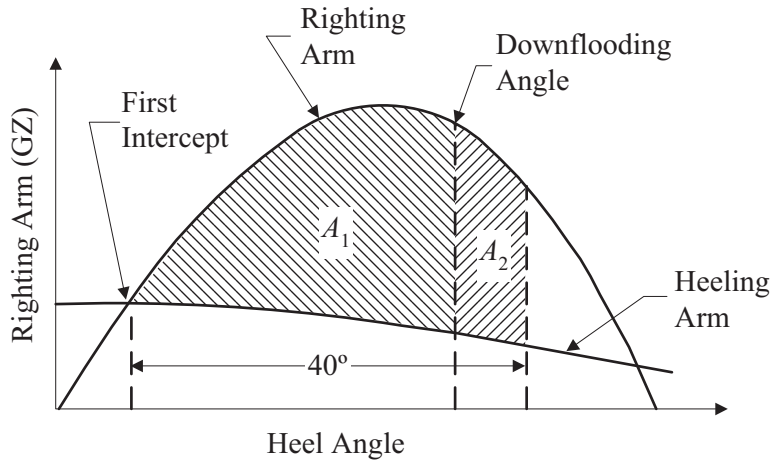
ii) The righting lever GZ is to be at least 0.20 m (0.66 ft) at an angle of heel equal to or greater than 30°.

iii) The maximum righting arm is to occur at an angle of heel not less than 25°.

iv) The initial metacentric height, GM_0, is not to be less than 0.15 m (0.49 ft).

v) The area of the residual dynamic stability (area between righting and heeling arm curves to the right of the first intercept) up to an angle of heel of 40° plus the angle of the first intercept ($A_1 + A_2$), or the angle of downflooding, if this angle is less than 40° plus the angle of the first intercept (A_1), should not be less than 0.09 meter-radians. (See 5-11-A1/Figure 1.)

FIGURE 1
Righting Arm and Heeling Arm Curves



7 Standard Loading Conditions

7.1 Loading Conditions

The following conditions of loading are to be examined in the Trim and Stability Booklet:

i) Vessel with full stores and fuel;

ii) Vessel with 10 percent stores and fuel remaining;

iii) Any other normal conditions, both departure and arrival that the Owner feels are appropriate or more suitable to the vessel's trade.

7.3 Load Considerations

The following are the assumptions for calculating loading conditions:

i) In Loading Condition 5-11-A1/7.1i) above, it should be assumed that the vessel is loaded to its assigned load line with water ballast tanks empty.

ii) If any loading condition water ballast is necessary, additional diagrams should be calculated, taking into account the water ballast. Its quantity and disposition should be stated.

iii) In calculating the free surface corrections, it should be assumed that for each type of liquid, at least one transverse pair or a single centerline tank has a free surface and the tank or combination of tanks that is to be taken into account should be those where the effect of free surface is the greatest.

9 Heeling Arm Curve

The heeling moment due to the towline pull should be calculated using the corresponding percentage of the maximum bollard pull, depending on the type of propulsion (see below), at right angles to the vessel's fore and aft axis. The resultant moment should be converted to a heeling arm and plotted on the same graph as the righting arm curve (GZ curve). The heeling arm curve can be taken to vary with the cosine of the heeling angle.

Regarding the bollard pull force, the value is usually requested as it is derived from the actual test at maximum RPM. However, in preliminary considerations, a calculated value would be accepted based on the corresponding value of pounds of bollard pull force per SHP, depending on the type of propulsion (see 5-11-A1/Table 1). The heeling arm should be taken from the top of the towing bitt to the VCB or for an approximation to $^1/_2$ the mean draft.

11 Trim and Stability Booklet

The Master of the vessel should receive information in the Trim and Stability Booklet regarding ballasting, towing, etc., to ensure that the stability is in compliance with the criteria given in 5-11-A1/5.

The Trim and Stability Booklet should also contain a table giving the free surface moments for all tanks designed for liquid. If any set of tanks are cross-connected, the free surface moment shall be calculated about the vessel's centerline.

TABLE 1
Towline Pull Force

Type of Propulsion	*Bollard Pull (lbs/SHP)*	*Percentage of Bollard Pull at 90°*
Twin screw with open propellers, or other types not listed below	30	50%
Twin screw with open propellers and flank rudders	30	50%
Twin screw with conventional non-movable nozzles	35	50%
Water Tractor Tug with twin propeller Z-drives (steerable propellers with nozzles)	35	70%
Water Tractor with twin cycloidal propellers (vertical axis)	30	70%