

damage assumption. The machinery space is calculated as a single floodable compartment.

(3) For a vessel 150 meters or less in length, anywhere in the vessel's length between adjacent transverse bulkheads except the machinery space.

(b) The extent and the character of the assumed side or bottom damage, as defined in section 2 of Appendix A of this part, must be applied except longitudinal bottom damage within 0.3L from the forward perpendicular must be assumed to be the same as that for side damage. If any damage of lesser extent results in a more severe condition, such damage must be assumed.

(c) If damage involves transverse bulkheads as specified in paragraphs (a)(1) and (2) of this section, transverse watertight bulkheads must be spaced at least at a distance equal to the longitudinal extent of the assumed damage specified in paragraph (b) of this section in order to be considered effective. Where transverse bulkheads are spaced at a lesser distance, one or more of these bulkheads within such extent of damage must be assumed as nonexistent for the purpose of determining flooded compartments.

(d) If the damages between adjacent transverse watertight bulkheads is within the definition contained in paragraph (a)(3) of this section, no main transverse bulkhead or a transverse bulkhead bounding side tanks or double bottom tanks is to be assumed damaged, unless:

(1) the spacing of the adjacent bulkheads is less than the longitudinal extent of assumed damage defined in paragraph (b) of this section; or

(2) there is a step or a recess in a transverse bulkhead of more than 3.05 meters in length, located within the extent of penetrations of assumed damage. The step formed by the after peak bulkhead and after peak tank top is not regarded as a step for these calculations.

(e) If pipes, ducts, or tunnels are situated within the assumed extent of damage, there must be arrangements so that progressive flooding may not thereby extend to compartments other than those assumed to be floodable for each case of damage.

(f) For oil tankers of 20,000 DWT and above, the damage assumptions must be supplemented by the following assumed bottom raking damage:

- (1) Longitudinal extent:
 - (i) For ships of 75,000 DWT and above, 0.6L measured from the forward perpendicular.
 - (ii) For ships of less than 75,000 DWT, 0.4L measured from the forward perpendicular.
- (2) Transverse extent: B/3 anywhere in the bottom.
- (3) Vertical extent: Breach of the outer hull.

4. *Characteristic and Condition Assumption for Calculations.*

(a) Account must be taken of any empty or partially filled tanks, the specific gravity of cargoes carried, and any outflow of liquids from damaged compartments.

(b) The permeabilities are assumed as follows:

Intended space use	Permeability
Stores	0.60
Accommodation	0.95
Machinery	0.85
Voids	0.95
Consumable liquids	¹ 0 or 0.95
Other liquids	² 10 or 0.95

¹Whichever results in the more severe requirements.
²The permeability of partially filled compartments must be consistent with actual density and the amount of liquid carried.

(c) The buoyancy of any superstructure directly above the side damage is to be disregarded. The unflooded parts of superstructures beyond the extent of damage may be taken into consideration if they are separated from the damaged space by watertight bulkheads and no progressive flooding of these intact spaces takes place. Class I doors are allowed in watertight bulkheads in the superstructure.

(d) The free surface effect is to be calculated:

- (1) at an angle of heel of 5 degrees for each individual compartment; or
- (2) by assessing the shift of liquids by moment of transference calculations.

(e) In calculating the effect of free surfaces of consumable liquids, it is to 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 to be taken into account is to be those where the effect of free surface is the greatest.

[CGD 74-32, 40 FR 48283, Oct. 14, 1975, as amended by USCG-2000-7641, 66 FR 55573, Nov. 2, 2001; USCG-2008-0179, 73 FR 35015, June 19, 2008]

APPENDIX C TO PART 157—PROCEDURE FOR DETERMINING DISTRIBUTION OF SEGREGATED BALLAST TANKS TO PROVIDE PROTECTION AGAINST OIL OUTFLOW IN THE EVENT OF GROUNDING, RAMMING, OR COLLISION

1. *Source.* The procedure for determining the distribution of segregated ballast tanks contained in this appendix conforms to Regulation 18, paragraphs 12-15 of the MARPOL Protocol.

2. *Procedure.* Protective location of segregated ballast tanks, voids, and other spaces that do not carry cargo which are within the cargo tank length is determined from the following:

$$\Sigma PA_c + \Sigma PA_s = J[L_c(B + 2D)]$$

Where:

PA_c=the side shell area in square meters based on projected molded dimensions for each segregated ballast tank, void, or other space that does not carry cargo and which complies with paragraph 2(b) of this appendix;

PA_s=the bottom shell area in square meters based on projected molded dimensions for each segregated ballast tank, void, or other space that does not carry cargo and which complies with paragraph 2(b) of this appendix;

L_r=the length in meters between the forward and after extremities of the cargo tanks;

B=the maximum breadth of the ship in meters measured amidship to the molded line of the frame; and

D=the molded depth in meters measured vertically from the top of the keel plate to the top of the freeboard deck beam at the side amidships. In tank vessels having rounded gunwales, the molded depth is measured from the top of the keel plate to the point of intersection of the molded lines of the deck and side shell plating, the lines being extended as though the gunwale were of angular design.

(a) *Method of determining a value for J.*

(1) For tank vessels for 20,000 DWT, J=0.45.

(2) For tank vessels of 200,000 DWT or more:

(i) J=0.30; or

(ii) J=the greater of 0.20, or

$$0.30 - \left[a - \frac{(O_c + O_s)}{40 A} \right],$$

where:

a=0.25 for tank vessels of 200,000 DWT.

a=0.40 for tank vessels of 300,000 DWT.

a=0.50 for tank vessels of 420,000 DWT.

For values of DWT between 200,000 and 300,000 DWT, 300,000 and 420,000 DWT, and greater than 420,000 DWT, the value of "a" is determined by linear interpolation.

O_c = as calculated in Appendix A of this part.

O_s = as calculated in Appendix A of this part.

O_A = the allowable oil outflow meeting §157.19(b)(1) of this part.

(3) For values of DWT between 20,000 and 200,000 DWT, the value of "J" is determined by linear interpolation between 0.45 and 0.30 respectively.

(b) PA_c and PA_s: *Criteria for determining the segregated ballast tanks, voids, and other spaces that do not carry cargo.*

The following criteria are to be met for a segregated ballast tank, void, or space that does not carry cargo, to be used in determining PA_c and PA_s:

(1) The minimum width of each wing tank or space, either of which extends for the full depth of the vessel's side or from the main deck to the top of the double bottoms is 2

meters or more. The width is measured inboard from the vessel's side shell plating at right angles to the vessel's center line. If a wing tank or space has a width anywhere within it that is less than 2 meters, that wing tank or space is not used when calculating PA_c.

(2) The minimum vertical depth of each double bottom tank or space is B/15 or 2 meters, whichever is smaller. If a double bottom tank or space has a depth less than B/15 or 2 meters, whichever is smaller, anywhere within it, the double bottom or space is not to be used when calculating PA_s.

(3) The minimum width of a wing tank or space is not measured in the way of—

(i) the turn of the bilge area; or

(ii) a rounded gunwale area.

(4) The minimum depth of a double bottom tank or space is not measured in the way of the turn of the bilge area.

[CGD 77-058b, 45 FR 43716, June 30, 1980, as amended by USCG-2008-0179, 73 FR 35015, June 19, 2008]

APPENDIX D TO PART 157—EXAMPLE OF A PROCEDURE FOR DEDICATED CLEAN BALLAST TANKS OPERATIONS

1. *Source.* The example procedure for dedicated clean ballast tanks operation contained in this appendix conforms to the Annex of Resolution 14 of the MARPOL Protocol.

2. *Example Procedure.* Dedicated clean ballast tanks operational procedure:

(a) Before arrival at the loading port:

(1) Transfer all remaining oily mixtures to a cargo tank.

(2) Ensure that the pumping and piping designated for clean ballast operation have been properly cleaned to accommodate simultaneous discharge of clean ballast while loading.

(3) Ensure that all valves to the slop tank and the cargo tanks are closed.

(4) Perform visual inspection of all dedicated clean ballast tanks and their contents, if any, for signs of contamination.

(5) Discharge a sufficient amount of clean ballast water to ensure that remaining ballast water and cargo to be loaded will not exceed the permissible deadweight or draft. Leave a sufficient amount of water for flushing the piping, and as a minimum, a quantity equal to 10 times the volume of the affected piping.

(6) Ensure that all valves to the dedicated clean ballast tanks are closed.

(7) If no further ballast discharge is anticipated, drain the clean ballast piping.

(b) In the loading port:

(1) Perform normal loading operations of cargo tanks.