TABLE 171.070(a)—STANDARD OF FLOODING

Passengers carried	Part of vessel	Standard of flooding (compartments)
400 or less	All	1
401 to 600	All of the vessel forward of the first MTWB aft of the collision bulkhead..	2
	All remaining portions of the vessel.	1
601 to 800	All of the vessel forward of the first MTWB that is aft of a point 40% of the vessel's LBP aft of the forward perpendicular.	2
	All remaining portions of the vessel.	1
801 to 1000	All of the vessel forward of the first MTWB that is aft of a point 60% of the vessel's LBP aft of the forward perpendicular.	2
	All remaining portions of the vessel.	1
More than 1000	All	2

Where for this table-
"MTWB" means main transverse watertight bulkhead; and "Standard of Flooding" is explained in § 171.017 of this subchapter.

TABLE 171.070(b)—STANDARD OF FLOODING FOR FERRY VESSELS

Vessel length	Part of vessel	Standard of flooding (compartments)
150 feet (46 meters) or less.	All	1
Greater than 150 feet (46 meters) and less than or equal to 200 feet (61 meters).	All of the vessel forward of the first MTWB aft of the collision bulkhead.	2
	All of the vessel aft of the first MTWB forward of the aft peak bulkhead.	2
	All remaining portions of the vessel.	1
Greater than 200 feet (61 meters).	All	2

Where for this table—
"MTWB" means main transverse watertight bulkhead; and "Standard of Flooding" is explained in § 171.017 of this subchapter.

[CGD 79–023, 48 FR 51017, Nov. 4, 1983, as amended by USCG–2007–0030, 75 FR 78085, Dec. 14, 2010; USCG–2014–0688, 79 FR 58287, Sept. 29, 2014]

§ 171.072 Calculation of permeability for Type II subdivision.

When doing calculations to show compliance with § 171.070, the following uniform average permeabilities must be assumed:

(a) 85 percent in the machinery space.

(b) 60 percent in the following spaces:

(1) Tanks that are normally filled when the vessel is in the full load condition.

(2) Chain lockers.

(3) Cargo spaces.

(4) Stores spaces.

(5) Mail or baggage spaces.

(c) 95 percent in all other spaces.

[CGD 79–023, 48 FR 51017, Nov. 4, 1983, as amended by USCG–2014–0688, 79 FR 58287, Sept. 29, 2014]

§ 171.073 Treatment of stepped and recessed bulkheads in Type II subdivision.

(a) A main transverse watertight bulkhead may not be stepped unless additional watertight bulkheads are located as shown in Figure 171.067(a) so that the distances A, B, C, and D illustrated in Figure 171.067(a) comply with the following:

(1) A and B must not exceed the maximum bulkhead spacing that permits compliance with § 171.070; and

(2) C and D must not be less than the minimum spacing specified in § 171.070(e).

(b) A main transverse watertight bulkhead may not be recessed unless all parts of the recess are inboard from the shell of the vessel as illustrated in Figure 171.067(c).

(c) If a main transverse watertight bulkhead is recessed or stepped, an equivalent plane bulkhead must be used in the calculations required by § 171.070.

§ 171.075 [Reserved]

§ 171.080 Damage stability standards for vessels with Type I or Type II subdivision.

(a) *Calculations.* Each vessel with Type I or Type II subdivision must be shown by design calculations to meet the survival conditions in paragraph (e), (f), or (g) of this section in each condition of loading and operation assuming the extent and character of damage specified in paragraph (b) of this section.

(b) *Extent and character of damage.* For the purpose of paragraph (a) of this section, design calculations must assume that the damage—

(1) Has the character specified in Table 171.080(a); and

(2) Consists of a penetration having the dimensions specified in Table 171.080(a) except that, if the most disabling penetration would be less than the penetration described in the table, the smaller penetration must be assumed.

(c) *Permeability.* When doing the calculations required in paragraph (a) of this section, the permeability of each space must be calculated in a manner approved by the Commanding Officer, Marine Safety Center or be taken from Table 171.080(c).

(d) *Definitions.* For the purposes of paragraphs (e) and (f) of this section, the following definitions apply:

(1) *New vessel* means a vessel—

(i) For which a building contract is placed on or after April 15, 1996;

(ii) In the absence of a building contract, the keel of which is laid, or which is at a similar stage of construction, on or after April 15, 1996;

(iii) The delivery of which occurs on or after January 1, 1997;

(iv) Application for the reflagging of which is made on or after January 1, 1997; or

(v) That has undergone—

(A) A major conversion for which the conversion contract is placed on or after April 15, 1996;

(B) In the absence of a contract, a major conversion begun on or after April 15, 1996; or

(C) A major conversion completed on or after January 1, 1997.

(2) *Existing vessel* means other than a new vessel.

(3) *Watertight* means capable of preventing the passage of water through the structure in any direction under a head of water for which the surrounding structure is designed.

(4) *Weathertight* means capable of preventing the penetration of water, even boarding seas, into the vessel in any sea condition.

(e) *Damage survival for all existing vessels except those vessels authorized to carry more than 12 passengers on an international voyage requiring a SOLAS Passenger Ship Safety Certificate.* An existing vessel is presumed to survive assumed damage if it meets the following conditions in the final stage of flooding:

(1) On a vessel required to survive assumed damage with a longitudinal extent of 10 feet (3 meters) plus 0.03L, the final angle of equilibrium must not exceed 7 degrees after equalization, except that the final angle may be as large as 15 degrees if—

(i) The vessel is not equipped with equalization or is equipped with fully automatic equalization; and

(ii) The Commanding Officer, Marine Safety Center approves the vessel's range of stability in the damaged condition.

(2) On a vessel required to survive assumed damage with a longitudinal extent of 20 feet (6.1 meters) plus 0.04L, the angle of equilibrium must not exceed 15 degrees after equalization.

(3) The margin line may not be submerged at any point.

(4) The vessel's metacentric height (GM) must be at least 2 inches (5 cm) when the vessel is in the upright position.

(f) *Damage survival for all new vessels except those vessels authorized to carry more than 12 passengers on an international voyage requiring a SOLAS Passenger Ship Safety Certificate.* A new vessel is presumed to survive assumed damage if it is shown by calculations to meet the conditions set forth in paragraphs (f) (1) through (7) of this section in the final stage of flooding and to meet the conditions set forth in paragraphs (f) (8) and (9) of this section in each intermediate stage of flooding. For the purposes of establishing boundaries to determine compliance with the requirements in paragraphs (f) (1) through (9), openings that are fitted with weathertight closures and that are not submerged during any stage of flooding will not be considered downflooding points.

(1) Each vessel must have positive righting arms for a minimum range beyond the angle of equilibrium as follows:

Vessel service	Required range (degrees)
Exposed waters, oceans, or Great Lakes winter ..	15
Partially protected waters or Great Lakes summer	10
Protected waters	5

(2) No vessel may have any opening through which downflooding can occur within the minimum range specified by paragraph (f)(1) of this section.

(3) Each vessel must have an area under each righting-arm curve of at least 0.015 meter-radians, measured from the angle of equilibrium to the smaller of the following angles:

(i) The angle at which downflooding occurs.

(ii) The angle of vanishing stability.

(4) Except as provided by paragraph (f)(5) of this section, each vessel must have within the positive range the greater of a righting arm (GZ) equal to or greater than 0.10 meter or a GZ as calculated using the formula:

$$GZ(m) = C\left(\frac{\text{Heeling Moment}}{\Delta} + 0.04\right)$$

where—

C=1.00 for vessels on exposed waters, oceans, or Great Lakes winter;

C=0.75 for vessels on partially protected waters or Great Lakes summer;

C=0.50 for vessels on protected waters;

Δ=intact displacement; and

Heeling moment=greatest of the heeling moments as calculated in paragraphs (f)(4) (i) through (iv) of this section.

(i) The passenger heeling moment is calculated using the formula:

Passenger Heeling Moment=0.5 (n w b)

where—

n=number of passengers;

w = passenger weight used for calculations as determined in accordance with §170.090(c) of this chapter; and

b=distance from the centerline of the vessel to the geometric center on one side of the centerline of the passenger deck used to leave the vessel in case of flooding.

(ii) The heeling moment due to asymmetric escape routes for passengers, if the vessel has asymmetric escape routes for passengers, is calculated assuming that—

(A) The weight of each passenger is the weight used for calculations as determined in accordance with §170.090(c) of this chapter;

(B) Each passenger occupies 0.25 square meter of deck area; and

(C) All passengers are distributed, on available deck areas unoccupied by permanently affixed objects, toward one side of the vessel on the decks where passengers would move to escape from the vessel in case of flooding, so that they produce the most adverse heeling moment.

(iii) The heeling moment due to the launching of survival craft is calculated assuming that—

(A) All survival craft, including davit-launched liferafts and rescue boats, fitted on the side to which the vessel heels after sustained damage, are swung out if necessary, fully loaded and ready for lowering;

(B) Persons not in the survival craft swung out and ready for lowering are distributed about the centerline of the vessel so that they do not provide additional heeling or righting moments; and

(C) Survival craft on the side of the vessel opposite that to which the vessel heels remain stowed.

(iv) The heeling moment due to wind pressure is calculated assuming that—

(A) The wind exerts a pressure of 120 Newtons per square meter;

(B) The wind acts on an area equal to the projected lateral area of the vessel above the waterline corresponding to the intact condition; and

(C) The lever arm of the wind is the vertical distance from a point at one-half the mean draft, or the center of area below the waterline, to the center of the lateral area.

(5) Each vessel whose arrangements do not generally allow port or starboard egress may be exempted, by the Commanding Officer, Marine Safety Center, from the transverse passenger heeling moment required by paragraph (f)(4)(i) of this section. Each vessel exempted must have sufficient longitudinal stability to prevent immersion of the deck edge during forward or aft egress.

(6) Each vessel must have an angle of equilibrium that does not exceed—

(i) 7 degrees for flooding of one compartment;

(ii) 12 degrees for flooding of two compartments; or

(iii) A maximum of 15 degrees for flooding of one or two compartments where—

(A) The vessel has positive righting arms for at least 20 degrees beyond the angle of equilibrium; and

(B) The vessel has an area under each righting-arm curve, when the equilibrium angle is between 7 degrees and 15 degrees, in accordance with the formula:

$$A \geq 0.0025(\theta - 1)$$

where—

A=Area required in m-rad under each righting-arm curve measured from the angle of equilibrium to the smaller of either the angle at which downflooding occurs or the angle of vanishing stability.

θ=actual angle of equilibrium in degrees

(7) The margin line of the vessel must not be submerged when the vessel is in equilibrium.

(8) Each vessel must have a maximum angle of equilibrium that does not exceed 15 degrees during intermediate stages of flooding.

(9) Each vessel must have a range of stability and a maximum righting arm during each intermediate stage of flooding as follows:

Vessel service	Required range (degrees)	Required maximum righting arm
Exposed waters, oceans, or Great Lakes winter	7	0.05 m
Partially-protected waters or Great Lakes summer	5	0.035 m
Protected waters	5	0.035 m

Only one breach in the hull and only one free surface need be assumed when meeting the requirements of this paragraph.

(g) *Damage survival for vessels constructed before January 1 2009 authorized to carry more than 12 passengers on an international voyage requiring a SOLAS Passenger Ship Safety Certificate.* A vessel is presumed to survive assumed damage if it is shown by calculations to comply with the damage stability required for that vessel by the International Convention for the Safety of Life at Sea, 1974, as amended, the applicable regulations of IMO Res. MSC.216(82) (incorporated by reference, see §171.012).

(h) *Equalization.* (1) Equalization systems on vessels of 150 gross tons or more in ocean service must meet the following:

(i) Equalization must be automatic except that the Commanding Officer, Marine Safety Center may approve other means of equalization if—

(A) It is impracticable to make equalization automatic; and

(B) Controls to cross-flooding equipment are located above the bulkhead deck.

(ii) Equalization must be fully accomplished within 15 minutes after damage occurs.

(2) Equalization on vessels under 150 gross tons in ocean service and on all vessels in other than ocean service must meet the following:

(i) Equalization must not depend on the operation of valves.

(ii) Equalization must be fully accomplished within 15 minutes after damage occurs.

(3) The estimated maximum angle of heel before equalization must be approved by the Commanding Officer, Marine Safety Center.

TABLE 171.080(a)—EXTENT AND CHARACTER OF DAMAGE

Vessel designator [1]	Longitudinal penetration [2]	Transverse penetration [3 4]	Vertical penetration	Character of Damage
Z	10 feet (3 meters) plus).03L or 35 feet (10.7 meters) whichever is less. [5]	B/5	from the baseline upward without limit.	Assumes no damage to any main transverse watertight bulkhead.
Y	10 feet (3 meters) plus)0.03L or 35 feet (10.7 meters) whichever is less.	B/5	From the baseline upward without limit.	Assumes damage to no more than one main transverse watertight bulkhead.
X	10 feet (3 meters) plus)0.03L or 35 feet (10.7 meters whichever is less.	B/5	from the baseline upward without limit.	Assumes damage to no more than one main transverse watertight bulkhead.
	20 feet (6.1 meters) plus 0.04L	B/5	From the top of the double bottom upward without limit.	Assumes damage to no more than one main transverse watertight bulkhead.

TABLE 171.080(a)—EXTENT AND CHARACTER OF DAMAGE—Continued

Vessel designator [1]	Longitudinal penetration [2]	Transverse penetration [3 4]	Vertical penetration	Character of Damage
W	20 feet (6.1 meters) plus 0.04L	B/5	From the baseline upward without limit.	Assumes damage to at least two main transverse watertight bulkheads.

[1] W,X,Y, and Z are determined from Table 171.080(b).
[2] L = LBP of the vessel in feet (meters).
[3] B = the beam of the vessel in feet (meters) measured at or below the deepest subdivision load line as defined in § 171.010(b) except that, when doing calculations for a vessel that operates only on inland waters or a ferry vessel, B may be taken as the mean of the maximum beam on the bulkhead deck and the maximum beam at the deepest subdivision load line.
[4] The transverse penetration is applied inboard from the side of the vessel, at right angles to the centerline, at the level of the deepest subdivision load line.
[5] .1L or 6 feet (1.8 meters) whichever is greater for vessels described in § 171.070(e)(2).

TABLE 171.080(b)

Vessel category	Vessel designator
Vessels with type I subdivision and a factor of subdivision as determined from § 171.065 (a) or (b) of 0.33 or less.	W.
Vessels with type I subdivision and a factor of subdivision as determined from § 171.065 (a) or (b) greater than 0.33 and less than or equal to 0.50.	X.
Vessels with Type II subdivision that are required to meet a two compartment standard of flooding.	Y.
All other vessels	Z.

TABLE 171.080(c)—PERMEABILITY

Spaces and tanks	Permeability (percent
Cargo, coal, stores	60.
Accommodations	95.
Machinery	85.
Tanks	o or 95. [1]

[1] Whichever value results in the more disabling condition.

[CGD 79–023, 48 FR 51017, Nov. 4, 1983, as amended by CGD 88–070, 53 FR 34537, Sept. 7, 1988; CGD 89–037, 57 FR 41826, Sept. 11, 1992; CGD 94–010, 60 FR 53713, Oct. 17, 1995; CGD 97–057, 62 FR 51049, Sept. 30, 1997; USCG–2007–29018, 72 FR 53968, Sept. 21, 2007; USCG–2007–0030, 75 FR 78085, Dec. 14, 2010; USCG–2012–0832, 77 FR 59788, Oct. 1, 2012; USCG–2014–0688, 79 FR 58287, Sept. 29, 2014]

Subpart D—Additional Subdivision Requirements

§ 171.085 Collision bulkhead.

(a) Paragraphs (b) through (g) of this section apply to each vessel of 100 gross tons or more and paragraphs (h) through (j) of this section apply to each vessel that is less than 100 gross tons.

(b) The portion of the collision bulkhead that is below the bulkhead deck must be watertight.

(c) Each portion of the collision bulkhead must be at least—

(1) 5 percent of the LBP from the forward perpendicular in a motor vessel; and

(2) 5 feet (1.52 meters) from the forward perpendicular in a steam vessel.

(d) The collision bulkhead must be no more than 10 feet (3 meters) plus 5 percent of the LBP from the forward perpendicular.

(e) The collision bulkhead must extend to the deck above the bulkhead deck if the vessel—

(1) Is in ocean service; and

(2) Has a superstructure that extends from a point forward of the collision bulkhead to a point at least 15 percent of the LBP aft of the collision bulkhead.

(f) The collision bulkhead required by paragraph (e) of this section must have the following characteristics:

(1) The portion of the collision bulkhead above the bulkhead deck must be weathertight.

(2) If the portion of the collision bulkhead above the bulkhead deck is not located directly above the collision bulkhead below the bulkhead deck, then the bulkhead deck between must be weathertight.

(g) Each opening in the collision bulkhead must—

(1) Be located above the bulkhead deck; and

(2) Have a watertight closure.

(h) Each collision bulkhead—

(1) Must extend to the deck above the bulkhead deck if in ocean service as defined in § 170.050(f) of this chapter or to the bulkhead deck if in service on other waters;

(2) May not have watertight doors in it; and