Marine Protection Rules

Part 121A – Ship Design and Construction – Oil Tankers

MNZ Consolidation

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Part objective

The technical standards contained in the International Convention for the Prevention of Pollution from Ships 1973/78 (MARPOL), are being incorporated into New Zealand law by means of marine protection rules. These rules enable New Zealand to be party to the Convention.

Specifically, Part 121A applies the requirements of regulations 13, 14, 15, 22, 23, 24, and 25 of Annex 1 of MARPOL. These regulations concern the design and construction of New Zealand ships which are oil tankers. The issues dealt with include:

- Requiring carriage of water ballast in tanks segregated from the oil cargo tanks and prohibiting the carriage of water ballast in oil fuel tanks. This is to prevent ballast water contaminated with oil being discharged into the sea.
- Minimising oil pollution due to side and bottom damage in existing oil tankers and specifying protection requirements for the cargo tank portion of the hull of new oil tankers to prevent oil pollution in the event of collision and stranding. The latter requirements for new oil tankers to be phased in for existing oil tankers within stipulated periods.
- Provisions for retaining oily water mixtures resulting from tank cleaning onboard until they can be discharged without causing pollution of the sea.
- Stopping fuel oil being carried forward of the collision bulkhead – the area of the ship most prone to damage.
- Minimising oil pollution from oil tankers due to side and bottom damage by limiting size and arrangement of cargo tanks and specifying damage stability criteria which are to be met.

The basis for Part 121A is found in sections 386 and 388 of the Maritime Transport Act 1994.

Rules subject to Regulations (Disallowance) Act 1989

Marine Protection rules are subject to the Regulations (Disallowance) Act 1989. Under that Act, the rules are required to be tabled in the House of Representatives. The House of Representatives may, by resolution, disallow any rules. The Regulations Review Committee is the select committee responsible for considering rules under the Regulations (Disallowance) Act 1989.

History of Part 121A

Part 121A first came into force on 20 August 1998 and now incorporates the following amendments:

Amendment	Effective date
Amendment 1	14 December 2006
Amendment 2	14 December 2006
Amendment 3	4 August 2008
Amendment 4	30 July 2009
Amendment 5	1 October 2010
Amendment 6	1 January 2015
Amendment 7	1 April 2015
Amendment 8	1 April 2015
Amendment 9	1 November 2016
Amendment 10	1 February 2018
Amendment 11	13 December 2019

Summary of amendments

Amendment 1	
Marine Protection Amendment (Parts 120, 121A, 123A, 132 & 170)	Part objective, 121A.18
Amendment 2	
Marine Protection Amendment (Parts 121A & 123A)	121A.2, 121A.10–121A,10B
Amendment 3	
Marine Protection Amendment Rules – Marpol Annex 1	121A10C–121A.10D, Schedule
Amendment 4	
Marine Protection Amendment Rules 2009	121A.2, 121A.3(1), 121A.19–121A.21
Amendment 5	
Marine Protection Various Amendments 2010	121A.10B(3)(a), 121A.10D(2)(c)(iii)(bb), 121A.10D(4)(a)(i), 121A.10D(4)(a)(ii), 121A.16(6), 121A.17(4), Schedule: Clause 1(1), Schedule: Clause 5(2)(a), Schedule table
Amendment 6	
Marine Protection Rules Various Amendments 2014	121A.2, 121A.16(4)(c)(1), 121A.16(4)(c)(2), Schedule
Amendment 7	
Marine Protection Rules Various Amendments 2015	121A.2, 121A.13(3)(b), 121A.16(3)
Amendment 8	
Marine Protection Rules Various IMO-related Amendments 2015	121A.2, 121A.17
Amendment 9	
Marine Protection Rules Various Amendments 2016	121A.9, 121A.21

Amendment 10	
Marine Protection Rules Various Amendments [Changes Related to Conventions] 2017	121A.2, 121A.10E (New Rule), 121A.18A (New Rule), 121A.19A (New Rule)
Amendment 11	
Marine Protection Rules Various Amendments 2019	121A.2, 121A.5, 121A.8, 121A.9, 121A.10A, 121A.10C, 121A.10D, 121A.14, 121A.15, 121A.16, 121A.17, 121A.18, Schedule

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https://www.maritimenz.govt.nz/Rules/

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General

121A.1 Entry into force

Part 121A entered into force on 20 August 1998.

121A.2 Definitions

In Part 121A –

Act means the Maritime Transport Act 1994:

Amidships means the middle of the Length (L):

Antarctic area means the sea area south of latitude 60ºS:

Arctic waters means those waters which are located north of a line from the latitude 58º00´.0 N and longitude 042º00´.0 W to latitude 64º37´.0 N, longitude 035º27´.0 W and thence by a rhumb line to latitude 67º03´.9 N, longitude 026º33´.4 W and thence by a rhumb line to the latitude 70º49´.56 N and longitude 008º59´.61 W (Sørkapp, Jan Mayen) and by the southern shore of Jan Mayen to 73º31'.6 N and 019º01'.0 E by the Island of Bjørnøya, and thence by a great circle line to the latitude 68º38´.29 N and longitude 043º23´.08 E (Cap Kanin Nos) and hence by the northern shore of the Asian Continent eastward to the Bering Strait and thence from the Bering Strait westward to latitude 60º N as far as Il'pyrskiy and following the 60th North parallel eastward as far as and including Etolin Strait and thence by the northern shore of the North American continent as far south as latitude 60º N and thence eastward along parallel of latitude 60º N, to longitude 056º37´.1 W and thence to the latitude 58º00´.0 N, longitude 042º00´.0 W:

Breadth (B) means the maximum breadth of the ship, measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material. The breadth (B) shall be measured in metres:

CAS means the Condition Assessment Scheme adopted by the Marine Environment Protection Committee of the International Maritime Organization by resolution MEPC.94(46) as amended by that organisation from time to time:

category 1 oil tanker means an existing oil tanker of –

(a) 20,000 tonnes deadweight or more carrying crude oil, fuel oil, heavy diesel oil, or lubricating oil as cargo; or

(b) 30,000 tonnes deadweight or more carrying oil as cargo:

category 2 oil tanker means a new oil tanker of –

(a) 20,000 tonnes deadweight or more carrying crude oil, fuel oil, heavy diesel oil or lubricating oil as cargo; or

(b) 30,000 tonnes deadweight or more carrying oil as cargo:

category 3 oil tanker means an oil tanker of 5,000 tonnes deadweight or more that is not category 1 or 2 oil tanker:

category A ship means a ship designed for operation in polar waters in at least medium first-year ice, which may include old ice inclusions:

category B ship means a ship not included in category A, designed for operation in polar waters in at least thin first-year ice, which may include old ice inclusions:

category C ship means a ship designed for operation in open water or in ice conditions less severe than those included in categories A and B:

Centre tank means any tank inboard of a longitudinal bulkhead:

Clean ballast means ballast carried in a tank which, since it was last used to carry oil, has been cleaned so that the outflow from that tank if it were discharged from a ship which is stationary into clean calm water on a clear day would not produce visible traces of oil on the surface of the water or on adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines. If the ballast is discharged through an oil discharge monitoring and control system approved by the Director under Part 122, evidence based on such a system to the effect that the oil content of the outflow did not exceed 15 parts per million shall be determinative that the ballast was clean, notwithstanding the presence of visible traces:

Clean ballast tank (CBT) is a tank in which clean ballast is carried:

Combination carrier means a ship designed to carry either oil or solid cargoes in bulk:

Crude oil means any liquid hydrocarbon mixture occurring naturally in the earth whether or not treated to render it suitable for transportation and includes –

(a) crude oil from which certain distillate fractions may have been removed; and

(b) crude oil to which certain distillate fractions may have been added:

Crude oil tanker or carrier means an oil tanker engaged in the trade of carrying crude oil:

date of build means the date on which the keel is laid or on which the ship is at a similar stage of construction or on which a ship undergoes modifications of a major character:

Deadweight (DW) means the difference in tonnes between the displacement of the ship in water of specific gravity of 1.025 at the load waterline corresponding to the assigned summer freeboard and the lightweight of the ship:

Director means the person who is for the time being the Director of Maritime Safety under section 439 of the Maritime Transport Act 1994:

Existing oil tanker means –

(a) for the purposes of rules 121A.4, 121A.6, 121A.7, 121A.10, and 121A.13, an oil tanker which is not a new oil tanker; and

(b) for the purposes of rule 121A.16:

  (i) an oil tanker the delivery of which was after 1 January 1977; or

  (ii) an oil tanker to which both the following conditions apply:

    (aa) delivery was not later than 1 January 1977; and

    (bb) the builder contract was placed after 1 January 1974, or in cases where no building contract had previously been placed, the keel was laid or the tanker was at a similar stage of construction after 30 June 1974:

Existing ship means a ship which is not a new ship:

first-year ice means sea ice of not more than one winter growth developing from young ice with thickness from 30 cm to 200 cm:

Forward and after perpendiculars shall be taken at the forward and after ends of the length (L). The forward perpendicular shall coincide with the foreside of the stem on the waterline on which the length is measured:

fuel oil means heavy distillates or residues from crude oil, or blends of such material, intended for use as a fuel for the production of heat or power and of a quality equivalent to the specification acceptable to the International Maritime Organization:[1]

heavy diesel oil means diesel oil, other than those distillates of which more than 50 percent by volume distils at a temperature not exceeding 340°C when tested by the method acceptable to the International Maritime Organization:[2]

heavy grade oil means –

(a) crude oil having a density higher than 900 kg/m^3 at 15°C;

(b) oils, other than crude oils, having –

  (i) a density higher than 900 kg/m^3 at 15°C; or

  (ii) a kinematic viscosity higher than 180 mm^2/s at 50°C; or

(c) bitumen;

(d) tar;

(e) bitumen or tar emulsion:

International Bulk Chemical Code means the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk* adopted by the Marine Environment Protection Committee of the International Maritime Organization by resolution MEPC.19(22), as amended by that organisation from time to time:

Length (L) means 96 percent of the total length on a waterline at 85 percent of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that be greater. In ships designed with a rake of keel the waterline on which this length is measured shall be parallel to the designed waterline. The length (L) shall be measured in metres:

Lightweight means the displacement of a ship in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feed water in tanks, consumable stores, and passengers and crew and their effects:

Major conversion means a conversion of an existing ship –

(a) which substantially alters the dimensions or carrying capacity of the ship; or

(b) which changes the type of the ship; or

(c) the intent of which in the opinion of the Director is substantially to prolong its life; or

(d) which otherwise so alters the ship that, if it were a new ship, it would become subject to relevant provisions of Part 121A not applicable to it as an existing ship;

provided that:

  (i) conversion of an existing oil tanker of 20,000 tonnes deadweight or more to meet the requirements of rule 121A.4 does not constitute a major conversion for the purposes of Part 121A; and

  (ii) conversion of an existing oil tanker to meet the requirements of rules 121A.9 and 121A.10 does not constitute a major conversion for the purpose of Part 121A:

MARPOL means the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto; and includes any subsequent protocol or amendment to, or revision of, that convention accepted or ratified by New Zealand:

medium first-year ice means first-year ice of 70 cm to 120 cm thickness:

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1 American Society for Testing and Material's Specification for Number Four Fuel Oil (Designation D396) or heavier.

2 American Society for Testing and Material's Standard Test Method (Designation D86).

New oil tanker, notwithstanding the definition of "new ship" in rule 121A.2, means for the purposes of rules 121A.4, 121A.8, 121A.10, 121A.16 and 121A.17 an oil tanker –

(a) for which the building contract was placed after 1 June 1979; or

(b) in the absence of a building contact, the keel of which was laid or which was at a similar stage of construction after 1 January 1990; or

(c) the delivery of which was after 1 June 1982; or

(d) which has undergone a major conversion:

  (i) for which the contract was placed after 1 June 1979; or

  (ii) in the absence of a contract, the construction work of which was begun after 1 January 1980; or

  (iii) which was completed after 1 June 1982:

New ship means a ship –

(a) for which the building contract was placed after 31 December 1975; or

(b) in the absence of a building contract, the keel of which was laid or which was at a similar stage of construction after 30 June 1976; or

(c) the delivery of which was after 31 December 1979; or

(d) which has undergone a major conversion:

  (i) for which the contract was placed after 31 December 1975; or

  (ii) in the absence of a contract, the construction work of which was begun after 30 June 1976; or

  (iii) which was completed after 31 December 1979:

New Zealand Defence Force has the same meaning as the term "Defence Force" in section 2(1) of the Defence Act 1990:

New Zealand jurisdiction means –

(a) the internal waters of New Zealand; and

(b) the territorial sea of New Zealand; and

(c) the exclusive economic zone of New Zealand; and

(d) those waters under or about any ship or offshore installation constructed, erected, placed or used in, on, or above the continental shelf of New Zealand but beyond the outer limits of the exclusive economic zone of New Zealand in connection with the exploration of the continental shelf or the exploitation of its natural resources:

New Zealand ship means a ship that is registered under the Ship Registration Act 1992; and includes a ship that is not registered under that Act but is required or entitled to be registered under that Act:

Offshore installation or **installation** includes any artificial structure (including a floating structure other than a ship) used or intended to be used in or on, or anchored or attached to, the seabed for the purpose of the exploration for, or the exploitation or associated processing of, any mineral; but does not include a pipeline:

Offshore terminal means any place in the sea where cargo is loaded or unloaded:

Oil for the purposes of the marine protection rules and section 222 of the Maritime Transport Act 1994 means petroleum in any form including crude oil, fuel oil, sludge, oil refuse and refined products (other than petrochemicals that are subject to the provisions of Part 140). Without limiting the generality of the foregoing, "oil" includes the substances declared to be oil in the appendix to Part 120, and any oil mixture. "Oil" as defined here is a "harmful substance" for the purpose of section 225 of the Maritime Transport Act 1994:

Oil fuel means any oil used as fuel in connection with the propulsion and auxiliary machinery of the ship in which such oil is carried:

Oil tanker means a ship constructed or adapted primarily to carry oil in bulk in its cargo spaces; and includes combination carriers and any "chemical tanker" as defined in rule 141.2 when it is carrying a cargo or part cargo of oil in bulk:

Oily mixture means a mixture with any oil content:

old ice means sea ice which has survived at least one summer's melt:

open water means a large area of freely navigable water in which sea ice is present in concentrations less than 1/10 and no ice of land origin is present:

Owner in relation to any ship includes –

(a) any person who is the legal or equitable owner, or both, of the ship; and

(b) any person in possession of the ship; and

(c) any charterer, manager, or operator of the ship, or any other person (other than a pilot) responsible for the navigation or management of the ship:

Part means a group of rules made under the Maritime Transport Act 1994:

polar waters means any of the following:

(a) Arctic waters:

(b) the Antarctic area:

Product carrier means an oil tanker engaged in the trade of carrying oil other than crude oil:

Rules includes maritime rules and maritime protection rules:

Segregated ballast means the ballast water introduced into a tank which is completely separated from the cargo oil and oil fuel system and which is permanently allocated to the carriage of ballast or to the carriage of ballast or cargoes other than oil or noxious liquid substances as defined in the marine protection rules:

Segregated ballast tank (SBT) means a tank in which segregated ballast is carried:

Slop Tank means a tank specifically designated for the collection of tank drainings, tank washings, and other oil mixtures:

Tank means an enclosed space which is formed by the permanent structure of a ship and which is designed for the carriage of liquid in bulk:

thin first-year ice means first-year ice 30 cm to 70 cm thick:

type AA oil tanker means an oil tanker –

(a) that complies with –

  (i) rules 121A.9(3)(a) and 121A.9(3)(b); or

  (ii) rules 121A.9(3)(a) and 121A.9(4); or

  (iii) rule 121A.9(5),

except that the requirements for minimum distances between the cargo tank boundaries and the ship side and bottom plating need not be met in all respects; and

(b) who side protection distances are not less than those specified in the International Bulk Chemical Code for type 2 cargo tank location; and

(c) whose bottom protection distances comply with rule 121A.8(4)(b):

Wing tank means any tank adjacent to the side shell plating.

121A.3 Application

(1) Rules 121A.4 to 121A.17 inclusive and rules 121A.19 to 121A.21 inclusive apply to –

(a) every New Zealand ship that is an oil tanker of 150 tons gross tonnage or more; and

(b) every warship and every other ship of the New Zealand Defence Force that is an oil tanker of 150 tons gross tonnage or more.

(2) Rules 121A.4(6), 121A.11(2), 121A.12(2), 121A.13(6), 121A.14, 121A.15, 121A.16(4) and 121A.17 also apply to –

(a) every New Zealand ship that is an oil tanker of less than 150 tons gross tonnage; and

(b) every warship and every other ship of the New Zealand Defence Force that is an oil tanker of less than 150 tons gross tonnage.

Control of operational oil pollution

121A.4 Segregated ballast tanks

(1) Subject to rules 121A.6 and 121A.7, the owner of any oil tanker to which this rule applies must ensure that if the tanker is –

(a) a new oil tanker which is either a crude oil tanker of 20,000 tonnes deadweight or more, or a product carrier of 30,000 tonnes deadweight or more; or

(b) a new ship which is an oil tanker of 70,000 tonnes deadweight or more;

segregated ballast tanks are provided which comply with rule 121A.4(2) or rule 121A.4(3).

(2) The capacity of the segregated ballast tanks must –

(a) allow the ship to operate safely on ballast voyage without needing to use its cargo tanks for water ballast, except as provided for in Part 120; and

(b) allow the ship's draughts and trim to meet each of the following requirements, in any ballast condition at any part of the voyage, including the conditions consisting of lightweight plus segregated ballast only:

(i) the moulded draught amidships (*dm*) in metres (without taking into account any ship's deformation) is not to be less than:

$dm = 2.0 + 0.02L$:

(ii) the draughts at the forward and after perpendiculars correspond to those determined by the draught amidships (*dm*) as specified in rule 121A.4(2)(b)(i), in association with the trim by the stern of not greater than 0.015L:

(iii) the draught at the after perpendicular is enough to keep the propeller/s fully immersed.

(3) If the oil tanker is less than 150 metres in length, in lieu of rule 121A.4(2), the segregated ballast draught and trim conditions for the tanker must be to the satisfaction of the surveyor, such as to allow the ship to operate safely on ballast voyages without the use of its cargo tanks for water ballast.

(4) Subject to rule 121A.4(5), the owner of any oil tanker to which this rule applies must ensure that if the tanker is an existing oil tanker which is a crude oil tanker of 40,000 tonnes deadweight or more, segregated ballast tanks are provided which comply with the requirements of rule 121A.4(2).

(5) An existing oil tanker which is a crude oil tanker of 40,000 tonnes deadweight or more carrying only crude oil which is suitable for crude oil washing, may, in lieu of being provided with segregated ballast tanks, operate with a cargo tank cleaning procedure using crude oil washing in accordance with rule 122.15(2).

(6) The owner of any existing oil tanker to which this rule applies and which is a product carrier of 40,000 tonnes deadweight or more must ensure that either –

(a) the tanker is provided with segregated ballast tanks and complies with the requirements of rule 121A.4(2); or

(b) the tanker operates with dedicated clean ballast tankers in accordance with the provisions of rule 121A.5.

(7) Any oil tanker which is not required to have segregated ballast tanks in accordance with rules 121A.4(2), 121A.4(4), and 121A.4(6) may be qualified as a segregated ballast tanker, provided that it complies with the requirements of rule 121A.4(2) or rule 121A.4(3).

121A.5 Dedicated clean ballast tanks

(1) The owner of any oil tanker operating with dedicated clean ballast tanks in accordance with rule 121A.4(6)(b) must ensure that it has adequate tank capacity dedicated solely to the carriage of clean ballast as defined in rule 121A.2, to meet the requirements of rule 121A.4(2).

(2) For the purposes of rule 121A.5(1), the arrangements for dedicated clean ballast tanks must comply with the requirements of the International Maritime Organization Assembly Resolution A.495(XII) Revised Specification for Oil Tankers with Dedicated Clean Ballast Tanks, as amended by that organisation from time to time.

121A.6 Existing oil tankers engaged only in New Zealand coastal trade

Rules 121A.4(4) to 121A.4(6) inclusive do not apply to existing oil tankers solely engaged in trade –

(a) between ports; or

(b) to or from offshore terminals; or

(c) to or from offshore installations;

within New Zealand jurisdiction, so long as the port or offshore terminal or offshore installation where cargo is loaded for the particular voyage has reception facilities which in the opinion of the Director are adequate for the reception and treatment of all the ballast and tank washing water from tankers using that port, terminal, or offshore installation.

121A.7 Existing oil tankers having special ballast arrangements

An existing oil tanker complies with the segregated ballast tank requirements referred to in rule 121A.4(4), if it is constructed or operates in a manner that complies with the draught and trim requirements in rule 121A.4(2) without using ballast water, provided that –

(a) operational procedures and ballast arrangements are approved by the Director; and

(b) agreement is reached between the Director and the Governments of the port States which are parties to MARPOL and which may be concerned when the draught and trim requirements are achieved through an operational procedure; and

(c) the International Oil Pollution Certificate required by Part 123A is endorsed to the effect that the oil tanker is operating with special ballast arrangements.

121A.8 Protective location of segregated ballast tanks

(1) The owner of any new oil tanker which is –

(a) a crude oil tanker of 20,000 tonnes deadweight or more; or

(b) a product carrier of 30,000 tonnes deadweight or more;

must ensure that the segregated ballast tanks required to provide the capacity to comply with rule 121A.4 which are located within the cargo tank length, are arranged in

accordance with rule 121A.8(2) to 121A.8(4) inclusive to provide a measure of protection against oil outflow in the event of grounding or collision.

(2) Segregated ballast tanks and spaces other than oil tanks within the cargo tank length (L_t) must be so arranged as to comply with the following requirement –

$\sum PA_c + \sum PA_s \geq J\,[L_t\,(B + 2D)]$

Where:

PA_c = the side shell area in square metres for each segregated ballast tank or space other than an oil tank based on projected moulded dimensions

PA_s = the bottom shell area in square metres for each such tank or space based on projected moulded dimensions

L_t = length in metres between the forward and after extremities of the cargo tanks

B = maximum breadth of the ship in metres as defined in rule 121A.2

D = moulded depth in metres measured vertically from the top of the keel to the top of the freeboard deck beam at side amidships. In ships having rounded gunwales, the moulded depth is measured to the point of intersection of the moulded lines of the deck and side shell plating, the lines extending as though the gunwale were of angular design

J = 0.45 for oil tankers of 20,000 tonnes deadweight, 0.30 for oil tankers of 200,000 tonnes deadweight or more, subject to the provisions of rule 121A.8(3).

For intermediate values of deadweight the value of J shall be determined by linear interpolation.

Whenever symbols given in this paragraph appear in this rule, they have the meaning as defined in this paragraph.

(3) For tankers of 200,000 tonnes deadweight and above the value of J may be reduced as follows:

$$J \text{ reduced } = \left[J - \left(a - \frac{O_c + O_s}{4O_A} \right) \right] \text{ or 0.2 whichever is greater}$$

Where:

a = 0.25 for oil tankers of 200,000 tonnes deadweight
= 0.40 for oil tankers of 300,000 tonnes deadweight
= 0.50 for oil tankers of 420,000 tonnes deadweight or more.

For intermediate values of deadweight the value of a is determined by linear interpolation

O_c = as defined in rule 121A.15

O_s = as defined in rule 121A.15

O_A = the allowable oil outflow as required by rule 121A.16(2).

(4) In the determination of P_{AC} and P_{AS} for segregated ballast tanker and spaces other than oil tanks the following applies –

(a) the minimum width of each wing tank or space either of which extends for the full depth of the ship's side or from the deck to the top of the double bottom must not be less than 2 metres. The width must be measured inboard from the ship's side at right angles to the centreline. Where a lesser width is provided the wing tank or space must not be taken into account when calculating the protecting area P_{AC}; and

(b) the minimum vertical depth of each double bottom tank or space must be *B*/15 or 2 metres, whichever is the lesser. Where a lesser depth is provided the bottom tank or space must not be taken into account when calculating the protecting area P_{AS}.

The minimum width and depth of wing tanks and double bottom tanks must be measured clear of the bilge area and, in the case of minimum width, measured clear of any rounded gunwale area.

Prevention of pollution in the event of collision or stranding

121A.9 Protection of cargo tank length

(1) Rule 121A.9 applies to oil tankers of 600 tonnes deadweight or more –

(a) for which the building contract was placed on or after 6 July 1993; or

(b) in the absence of a building contract, the keels of which were laid or which were at a similar stage of construction on or after 6 January 1994; or

(c) the deliivery of which was on or after 6 July 1996; or

(d) which have undergone a major conversion:

(i) for which the contract was placed after 6 July 1993; or

(ii) in the absence of a contract, the construction work of which was begun after 6 January 1994; or

(iii) which was completed after 6 July 1996.

(2) The owner of any tanker of 5,000 tonnes deadweight or more to which this rule applies must ensure that the tanker complies –

(a) in lieu of rule 121A.8, with the requirements of rule 121A.9(3) unless it is subject to rules 121A.9(4) and 121A.9(5); and

(b) if applicable, with the requirements of rule 121A.9(6).

(3) The owner must ensure that the entire cargo tank length is protected by ballast tanks or spaces other than cargo and fuel oil tanks as follows –

(a) wing tanks or spaces –

Wing tanks or spaces must extend either for the full depth of the ship's side or from the top of the double bottom to the uppermost deck, disregarding a rounded gunwale where fitted. They must be arranged so that the cargo tanks are located inboard of the moulded line of the side shell plating, nowhere less than the distance *w* (shown in Figure 1) which is measured at any cross-section at right angles to the side shell, as specified below:

$$w = 0.5 + \frac{DW(metres)}{20{,}000}, \text{or}$$

20,000

w = 2.0 metres, whichever is the lesser.

The minimum value of *w* = 1.0 metre.

(b) double bottom tanks or spaces –

At any cross-section the depth of each double bottom tank or space must be such that the distance *h* between the bottom of the cargo tanks and the moulded line of the bottom shell plating measured at right angles to the bottom shell plating as shown in Figure 1 is not less than specified below:

h = *B*/15 metres, or

h = 2.0 metres, whichever is lesser.

The minimum value of *h* = 1.0 metre.

(c) turn of bilge area –

When the distances *h* and *w* are different, the distance *w* must have preference at levels exceeding 1.5*h* above the baseline, as shown in Figure 1.

(d) the aggregate capacity of ballast tanks –

On crude oil tankers of 20,000 tonnes deadweight or more and product carriers of 30,000 tonnes deadweight or more, the aggregate capacity of wing tanks, double bottom tanks, forepeak tanks and afterpeak tanks must not be less than the capacity of segregated ballast tanks necessary to meet the requirements of rule 121A.4. Wing tanks or spaces and double bottom tanks used to meet the requirements of rule 121A.4 must be located as uniformly as practicable along the cargo tank length. Additional segregated ballast capacity, provided for purposes such as reducing longitudinal hull girder bending stress or trim may be located anywhere within the ship.

(e) suction wells in cargo tanks –

Suction wells in cargo tanks may protrude into the double bottom below the boundary line defined by the distance *h*, provided that such wells are as small as practicable and the distance between the well bottom and bottom shell plating is not less than 0.5*h*.

(f) ballast and cargo piping –

Ballast piping and other piping, such as sounding and vent piping to ballast tanks, must not pass through cargo tanks. Cargo piping and similar piping to cargo tanks must not pass through ballast tanks.

(4) The owner is not required to fit double bottom tanks or spaces as required by rule 121A.9(3)(b) where –

(a) the design of the tanker is such that the cargo and vapour pressure exerted on the bottom shell plating forming a single boundary between the cargo and the sea does not exceed the external hydrostatic water pressure, as expressed by the following formula:

$$f \times h_c \times \rho_c \times g + 100\Delta\rho \leq d_n \times \rho_s \times g$$

where:

h_c = height of cargo in contact with the bottom shell plating in metres

ρ_c = maximum cargo density in tonnes per cubic metre

d_n = minimum operating draught under any expected loading condition in metres

ρ_s = density of seawater in tonnes per cubic metre

Δ_ρ = maximum set pressure of pressure/vacuum valve provided for the cargo tank in bars

f = safety factor = 1.1

g = standard acceleration of gravity (9.81 metre/second^2); and

(b) any horizontal partition necessary to fulfil the requirements set out in rule 121A.9(4)(a) is located at a height of not less than B/6 or 6 metres, (whichever is the lesser) but not more than 0.6*D*, above the baseline, where *D* is the moulded depth amidships; and

(c) the location of wing tanks or spaces is as defined in rule 121A.9(3)(a) except that, below a level 1.5*h* above the baseline, where *h* is as defined in rule 121A.9(3)(b), the cargo tank boundary line may be vertical down to the bottom plating, as shown in Figure 2.

(5) The Director may, by exemption granted in accordance with section 395 of the Act, approve other methods of design and construction of oil tankers as alternative to the requirements prescribed in rule 121A.9(3), provided that such methods ensure at least the same level of protection against oil pollution in the event of collision or stranding and

are approved in principle by the Marine Environmental Protection Committee based on guidelines developed by the International Maritime Organization.

(6) The owner of any oil tanker of 20,000 tonnes deadweight or more must ensure that the damage assumptions prescribed in rule 121A.17(2)(b) are supplemented by the following assumed bottom raking damage –

(a) longitudinal extent:

(i) ships of 75,000 tonnes deadweight or more: 0.6L measured from the forward perpendicular; and

(ii) ships of less than 75,000 tonnes deadweight: 0.4L measured from the forward perpendicular; and

(b) transverse extent: *B*/3 anywhere in the bottom; and

(c) vertical extent: breach of the outer hull.

(7) The owner of any oil tanker of less than 5,000 tonnes deadweight must ensure that it is –

(a) at least fitted with double bottom tanks or spaces having such a depth that the distance *h,* specified in rule 121A.9(3)(b), complies with the following:

$h = B/15$ (metres)

with a minimum value of $h = 0.76$ metres;

in the turn of the bilge area and at locations without a clearly defined turn of the bilge, the cargo tank boundary line must run parallel to the line of the midship flat bottom, as shown in Figure 3; and

(b) provided with cargo tanks arranged so that the capacity of each cargo tank does not exceed 700 cubic metres, unless wing tanks or spaces are arranged in accordance with rule 121A.9(3)(a) complying with the following:

$$w = 0.4 + \frac{2.4DW}{20{,}000}(metres)$$

with a minimum value of $w = 0.76$ metres.

(8) The owner must ensure that the design and construction of the oil tanker does not –

(a) provide for oil to be carried in any space extending forward of a collision bulkhead located in accordance with Part 40E; and

(b) where there is no collision bulkhead in accordance with Part 40E, provide for oil to be carried in any space extending forward of the transverse plane perpendicular to the centreline that is located as if it were a collision bulkhead located in accordance with Part 40E.

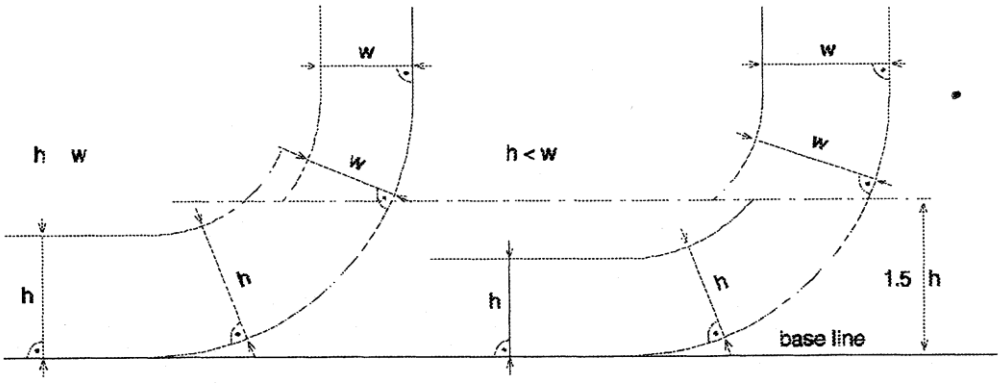

Figure 1 – *Cargo tank boundary lines for the purpose of paragraph (3)*

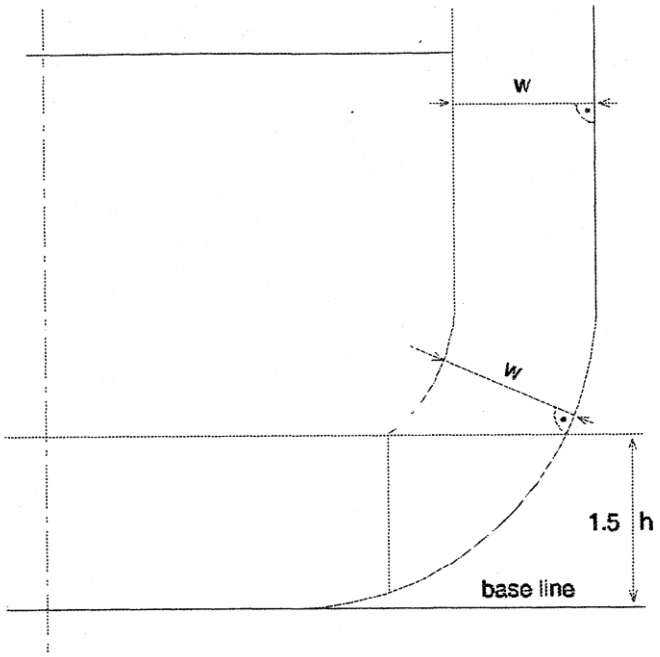

Figure 2 – *Cargo tank boundary lines for the purpose of paragraph (4)*

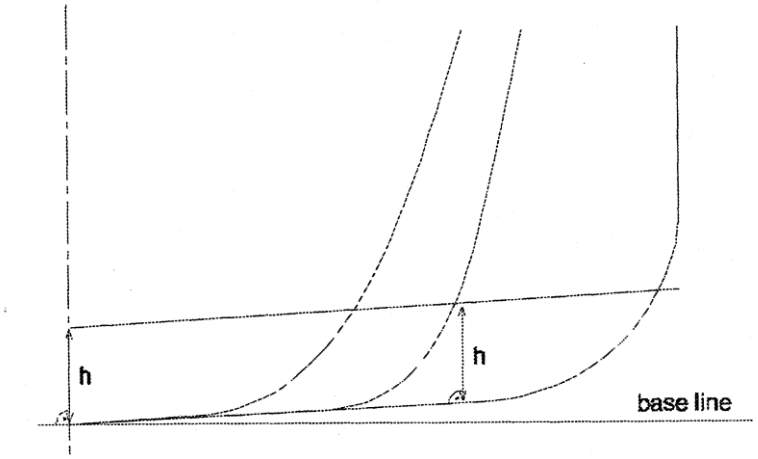

Figure 3 – *Cargo tank boundary lines for the purpose of paragraph (7)*

121A.10 Oil tankers built before the dates specified in rule 121A.9

(1) This rule –

(a) applies to oil tankers of 5,000 tonnes deadweight or more; but

(b) does not apply to –

(i) type AA oil tankers;

(ii) tankers to which rule 121A.9(1) applies:

(2) The owner of a category 1 oil tanker must ensure that the tank complies with rule 121A.9.

(3) The owner of a category 2 or 3 oil tanker delivered on or before 14 December 1978 must ensure that the tanker complies with rule 121A.9.

(4) The owner of a category 2 or 3 oil tanker delivered after 14 December 1978 must ensure that the tanker complies with rule 121A.9 no later than the anniversary date of the delivery of the ship in –

(a) 2006, for ships delivered in 1978 and 1979;

(b) 2007, for ships delivered in 1980 and 1981;

(c) 2008, for ships delivered in 1982;

(d) 2009, for ships delivered in 1983; or

(e) 2010, for ships delivered in 1984 or later.

(5) The continued operation of a category 2 or category 3 oil tanker beyond the 15th anniversary date of the delivery of the ship is subject to that tanker complying with CAS.

(6) The Director may exempt a tanker that complies with CAS from the requirements of subrule (3) or (4) until the 25th anniversary date of the delivery of the ship or the anniversary date of the ship in 2015 whichever is the earlier date.

(7) The Director may exempt a tanker from the requirements of subrule (3) or (4) until the 25th anniversary date of the delivery of the ship if the tanker –

(a) was in service on 1 July 2001; and

(b) is fitted with double bottoms or double sides that extend to the entire cargo tank length and are not used for carrying oil.

(8) The Director may relax the requirements of rule 121A.9(2) or (3) until the 25th anniversary date of the delivery of the ship if the tanker –

(a) is a category 2 or category 3 oil tanker;

(b) was in service on 1 July 2001; and

(c) is fitted with wing tanks or spaces and double bottom tanks or spaces that extend to the entire cargo tank length and are not used for carrying oil but do not comply with rule 121A.9(2) or (3) in all respects.

121A.10A Oil Tankers of 5000 Tonnes Deadweight or More that Carry Heavy Grade Oil as Cargo

(1) This rule –

(a) applies to oil tankers of 5,000 tonnes deadweight or more that carry heavy grade oil as cargo (in addition to any applicable requirements of rule 121A.10); but

(b) does not apply to type AA oil tankers.

(2) The owner of any oil tanker to which this rule applies must ensure that the tanker complies with rule 121A.9.

(3) The Director may exempt a tanker from the requirements of subrule (2) –

(a) if it operates as a floating storage unit or undertakes voyages only within –

(i) New Zealand jurisdiction; or

(ii) An area in the jurisdiction of another state party to MARPOL provided the Administration of that state party also allows such operation;

(b) until the 25th anniversary date of the delivery of the ship, if it –

(i) was in service on 4 December 2003 and is fitted with double bottoms or doubles sides that extend to the entire cargo tank length and are not used for carrying oil; or

(ii) carries crude oil having a density at 15°C higher than 900 kg/m^3 but lower than 945 kg/m^3 and complies with CAS.

(4) The Director may relax the requirements of rule 121A.9(2) or (3) until the 25th anniversary date of the delivery of the ship if a tanker –

(a) was in service on 4 December 2003; and

(b) is fitted with wing tanks or spaces and double bottom tanks or spaces that do not comply with rule 121A.9(2) or (3) in all respects.

121A.10B Oil Tankers of 600 to 5000 Tonnes Deadweight that Carry Heavy Grade Oil as Cargo

(1) This rule –

(a) applies to oil tankers of 600 tonnes deadweight or more but less than 5,000 tonnes deadweight that carry heavy grade oil as cargo; but

(b) does not apply to type AA oil tankers.

(2) The owner of any oil tanker to which this rule applies must ensure that before the anniversary date, of the delivery of the tanker, in 2008, the tanker is fitted with –

(a) double bottom tanks or spaces that comply with rule 121A.9(7)(a); and

(b) wing tanks or spaces that –

(i) are arranged in accordance with rule 121A.9(3)(a); and

(ii) comply with the distance requirement for w in rule 121A.9(7)(b).

(3) The Director may exempt a tanker from the requirements of subrule (2) –

(a) if it operates as a floating storage unit or undertakes voyages entirely within –

(i) New Zealand jurisdiction; or

(ii) An area in the jurisdiction of another state party to MARPOL provided the Administration of that state party also allows such operation;

(b) until the 25th anniversary date of the delivery of the ship, if the Director is satisfied that the ship is fit to continue operation having regard to its size, age, area(s) of operation and structural conditions.

121A.10C Pump-room bottom protection

(1) This rule applies to oil tankers of 5,000 tonnes deadweight or more the keel of which was laid or which was at a similar stage of construction on or after 1 January 2007.

(2) Except as provided in subrule (4), the owner must ensure that the distance between the bottom of the pump-room and the ship's base line, measured at right angles to the ship's base line, is not less than –

(a) 2 m, if *B*/15 is more than 2 m;

(b) 1 m, if *B*/15 is less than 1 m; or

(c) *B*/15 (where *B*/15 is between 1 m and 2 m).

(3) Compliance with subrule (2) may be met by fitting double bottom tanks or spaces.

(4) A pump-room need not comply with subrule (2), if the flooding of the pump room would not render the ballast or cargo pumping system inoperative.

(5) The owner must ensure that ballast pumps are provided with suitable arrangements to ensure efficient suction from pump-room double bottom tanks.

121A.10D Accidental oil outflow performance

(1) This rule applies to oil tankers of 5,000 tonnes deadweight or more –

(a) delivered on or after 1 January 2010; or

(b) for which the building contact is placed on or after 1 January 2007; or

(c) in the absence of a building contract, the keel of which was laid or which was at a similar stage of construction on or after 1 July 2007; or

(d) which undergoes a major conversion –

(i) for which the contract was placed on or after 1 January 2007; or

(ii) in the absence of a contract, the conversion of which begun on or after 1 July 2007; or

(iii) that was completed on or after 1 January 2010.

(2) To provide adequate protection against oil pollution in the event of collision or stranding, the owner must –

(a) ensure that the ship's mean oil outflow parameter is –

(i) $O_M \leq 0.015$ for $C \leq 200{,}000$ m^3

(ii) $O_M \leq 0.012 + (0.003/200{,}000)\ (400{,}000\text{-}C)$ for $200{,}000\ \text{m}^3 < C < 400{,}000\ \text{m}^3$

(iii) $O_M \leq 0.012$ for $C \geq 400{,}000$ m^3;

Where:

O_M = mean oil outflow parameter:

C = total volume of cargo oil, in m^3, at 98% tank filling.

(b) if the ship is a combination carrier of less than 200,000 m^3 capacity, submit calculations to the Director demonstrating, to the Director's satisfaction, that, after accounting for its increased structural strength, the carrier has at least the equivalent oil outflow performance of a standard double hull tanker, of the same size, having a mean oil outflow parameter of –

(i) $O_M \leq 0.015$;

(ii) $O_M \leq 0.021$ for $C \leq 100{,}000$ m^3;

(iii) $O_M \leq 0.015 + (0.006/100{,}000)\ (200{,}000\text{-}C)$ for $100{,}000\ \text{m}^3 < C \leq 200{,}000\ \text{m}^3$;

Where:

O_M = mean oil outflow parameter:

C = total volume of cargo oil, in m^3, at 98% tank filling.

(c) ensure that no cargo tank length exceeds 10 m or one of the following values, whichever is the greater –

(i) if no longitudinal bulkhead is provided inside the cargo tanks:

$(0.5\frac{b_1}{B}+0.1)$L if less than 0.2L, or 0.2L;

(ii) if a centre line longitudinal bulkhead is provided inside the cargo tanks:

$(0.25\frac{b_1}{B}+0.15)$L;

(iii) 0.2L, if two or more longitudinal bulkheads are provided inside –

(aa) a wing cargo tank; or

(bb) a centre cargo tank, and $\frac{b_1}{B} \geq 0.2$L;

(iv) $(0.5\frac{b_1}{B}+0.1)$L, if –

(aa) $\frac{b_1}{B} < 0.2$L; and

(bb) two or more longitudinal bulkheads are provided inside a centre cargo tank; and

(cc) no centre line longitudinal bulkhead is provided;

(v) $(0.25\frac{b_1}{B}+0.15)L$, if –

(aa) $\frac{b_1}{B} < 0.2L$; and

(bb) two or more longitudinal bulkheads are provided inside a centre cargo tank; and

(cc) a centre line longitudinal bulkhead is provided;

Where b_1 = minimum distance from the ship's side to the outer longitudinal bulkhead of the tank in question measured inboard at right-angles to the centreline at the level corresponding to the assigned summer freeboard.

(3) Mean oil outflow parameter must be calculated in accordance with the provisions of the Schedule.

(4) The owner must ensure that –

(a) lines of piping that run through cargo tanks in a position –

(i) less than $0.30B_s$ from the ship's side; or

(ii) less than $0.30D_s$ from the ship's bottom,

are fitted with valves, or similar closing devices, at the point(s) at which the valves or devices open into any cargo tank; and

(b) such valves are kept closed at all times when –

(i) the ship is at sea; and

(ii) the tanks contain cargo oil,

except that valves may be opened for cargo transfers needed for essential cargo operations.

(5) For the purpose of subrule (4) –

B_S means the greatest moulded breadth of the ship, in metres, at or below the distance d_S;

d_S means the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to the summer freeboard to be assigned to the ship; and

D_S means the moulded depth, in metres, measured at mid-length to the upper deck at side.

121A.10E Oil tankers less than 5000 tonnes deadweight in polar waters

(1) This rule applies to an oil tanker—

(a) that is a category A or category B ship; and

(b) that is in polar waters; and

(c) of less than 5,000 tonnes deadweight; and

(d) the keel of which was laid or which was at a similar stage of construction on or after 1 February 2018.

(2) The owner of an oil tanker to which this rule applies must ensure that the entire cargo tank length is protected with—

(a) double bottom tanks or spaces meeting the applicable standards of regulation 19.6.1 of Annex I of MARPOL; and

(b) wing tanks or spaces—

(i) arranged in accordance with regulation 19.3.1 of Annex I of MARPOL; and

(ii) meeting the applicable standards for distance in regulation 19.6.2 of Annex I of MARPOL.

Carriage of oil fuel and water ballast

121A.11 Segregation of oil fuel and water ballast

(1) The owner of any new ship (as defined in rule 121A.2) which is an oil tanker of 150 tons gross tonnage or more, must ensure that the ship's design and construction does not provide for the carriage of water ballast in any oil fuel tank.

(2) The owner of any new ship (as defined in rule 121A.2) which is an oil tanker of less than 150 tons gross tonnage, and the owner of any existing ship (as defined in rule 121A.2) which is an oil tanker, must comply with rule 121A.11(1) unless an exemption is granted under section 395 of the Act.

121A.12 Carriage of oil in the forepeak

(1) The owner of any oil tanker of 400 tons gross tonnage or more, for which the building contract was placed after 1 January 1982 or, in the absence of a building contract, the keel of which was laid or which was at a similar stage of construction after 1 July 1982, must ensure that the design and construction of the tanker does not provide for the carriage of oil in –

(a) any forepeak tank; or

(b) any tank forward of the collision bulkhead.

(2) The owner of any oil tanker to which this rule applies, other than one required to comply with rule 121A.12(1), must comply with rule 121A.12(1) unless an exemption is granted under section 395 of the Act.

Retention of oil onboard

121A.13 Slop tanks

(1) Subject to rule 121A.13(7), the owner of any oil tanker of 150 tons gross tonnage or more must ensure that it is provided with arrangements in accordance with rules 121A.13(2), 121A.13(3), 121A.13(4), and 121A.13(5).

(2) Adequate means must be provided for cleaning the cargo tanks and transferring the dirty ballast residue and tank washing from the cargo tanks into a slop tank approved by the Director. In an existing oil tanker, any cargo tank may be designated as a slop tank.

(3) The slop tanks must have –

(a) a capacity necessary to retain the slop generated by tank washings, oil residues and dirty ballast residues; and

(b) a total capacity of not less than 3 percent of the oil carrying capacity of the ship, except that the Director may accept:

(i) 2 per cent for such oil tankers where tank washing arrangements are such that once the slop tank or tanks are charged with washing water, this water is sufficient for tank washing and, where applicable, for providing the driving fluid for eductors, without the introduction of additional water into the system; and

(ii) 2 percent where segregated ballast tanks or dedicated clean ballast tanks are provided in accordance with rule 121A.4(2), or where a cargo tank cleaning system using crude oil washing is fitted in accordance with rule 122.16. This capacity may be further reduced to 1.5 percent for oil tankers where the tank washing arrangements are such that once the slop tank or tanks are charged with washing water, this water is sufficient for tank washing and, where applicable, for providing the driving fluid for eductors, without the introduction of additional water into the system; and

(iii) 1 percent for combination carrier where oil cargo is only carried in tanks with smooth walls. This capacity may be further reduced to 0.8 percent where the tank washing arrangement are such that once the slop tank or tanks are charged with washing water, this water is sufficient for tank washing and, where applicable, for providing the driving fluid for eductors, without the introduction of additional water into the system.

(4) Any new ship (as defined in rule 121A.2) which is an oil tanker of 70,000 tonnes deadweight or more must be provided with at least two slop tanks.

(5) Slop tanks must be such as to avoid excessive turbulence and entrainment of oil or emulsion with the water, particularly in respect of the position of inlets, outlets, baffles, or weirs.

(6) Rules 121A.13(1) to 121A.13(5) inclusive do not apply to any oil tanker of less than 150 tons gross tonnage, for which the control of oil discharge under rule 120.10 must be effected by the retention of oil on board with subsequent discharge of all contaminated washings to reception facilities.

(7) The Director may waive the requirements of rule 121A.13(1), 121A.13(2), 121A.13(3), 121A.13(4) and 121A.13(5) for any oil tanker which engages exclusively in voyages which are –

(a) of 72 hours or less in duration; and

(b) within 50 nautical miles from the nearest land;

subject to two conditions:

(i) the tanker must be engaged in trade between ports or to offshore terminals or offshore installations within New Zealand jurisdiction, or within a State party to MARPOL; and

(ii) the tanker must retain on board all oily mixtures for discharge to reception facilities approved by the Director.

(8) Rules 121A.13(1) to 121A.13(5) inclusive do not apply to any oil tanker subject to the provisions of Part 120 carrying asphalt or other products which through their physical properties inhibit effective product/water separation and monitoring. For such an oil tanker the owner must ensure that the control of discharge is effected by the retention of residues on board with discharge of all contaminated washings to reception facilities.

Minimising oil pollution from oil tankers due to side and bottom damage

121A.14 Damage assumptions

(1) For the purpose of calculating hypothetical oil outflow from an oil tanker, three dimensions of the extent of damage of a parallelepiped on the side and bottom of the ship are to be assumed as follows. If the bottom of the oil tanker is damaged, two conditions must be applied individually to the stated portions of the oil tanker –

(a) Side damage

(i)	Longitudinal extent (l_c)	$1/3L^{2/3}$ or 14.5 metres, whichever is less
(ii)	Transverse extent (t_c) (inboard from the ship's side at right angle to the centreline at the level corresponding to the assigned summer freeboard)	*B*/5 or 11.5 metres, whichever is less
(iii)	Vertical extent (v_c)	From the base line upwards without limit

(b) Bottom damage

	For 0.3L from the forward perpendicular of the ship	*Any other part of the ship*
(i)	*L*/10	*L*/10 or 5 metres, whichever is less
(ii)	*B*/6 or 10 metres which ever is less but not less than 5 metres	5 metres
(iii)	*B*/15 or 6 metres, which ever is less	*B*/15 or 6 metres, whichever is less

(2) Wherever the symbols given in rule 121A.14 appear in rules 121A.15, 121A.16, and 121A.17, they have the meaning as defined in rule 121A.14.

121A.15 Hypothetical outflow of oil

(1) The hypothetical outflow of oil in the case of side damage (O_c) and bottom damage (O_s) is to be calculated by the following formulae with respect to compartments breached by damage to all conceivable locations along the length of the ship to the extent as defined in rule 121A.14 –

(a) For side damages:
$O_c = \sum W_i + \sum K_i C_i$ **(I)**

(b) For bottom damages:
$O_s = 1/3(\sum Z_i W_i + \sum Z_i C_i)$ **(II)**

Where: W_i = volume of a wing tank in cubic metres assumed to be breached by the damage as specified in rule 121A.14; W_i for a segregated ballast tank may be taken equal to zero.

C_i = volume of a centre tank in cubic metres assumed to be breached by the damage as specified in rule 121A.14; C_i for a segregated ballast tank may be taken equal to zero.

$K_i = 1 - b_i/t_c$ when b_i is equal to or greater than t_c, K_i will be equal to zero.

$Z_i = 1 - h_i/v_s$ when h_i is equal to or great than v_s, Z_i will be taken equal to zero.

b_i = width of wing tank in metres under consideration measure inboard from the ship's side at right angles to the centreline at the level corresponding to the assigned summer freeboard.

h_i = minimum depth of the double bottom in metres under consideration; where no double bottom is fitted h_i will be taken equal to zero.

Whenever symbols given in this paragraph appear in rules 121A.15 and 121A.16, they have the meaning as defined in this paragraph.

(2) If a void space or segregated ballast tank of a length less than l_c is located between wing oil tanks, O_c in formula **(I)** may be calculated on the basis of volume W_i being the actual volume of one such tank (where they are of equal capacity) or the smaller of the two tanks (if they differ in capacity) adjacent to such space, multiplied by S_i (as defined below) and taking for all other wing tanks involved in such a collision the value of the actual full volume.

$S_i = 1 - l_i/l_c$

Where l_i = length in metres of void space or segregated ballast tank under consideration.

(3) (a) Credit is only to be given for double bottom tanks which are either empty or carrying clean water when cargo is carried in the tanks above.

(b) Where the double bottom does not extend for the full length and width of the tank involved, the double bottom is considered non-existent. The volume of the tanks above the area of the bottom damage are included in formula **(II)** even if the tank is not considered breached because of the installation of a partial double bottom.

(c) Suction wells may be excluded in the determination of the value h_i provided they are not excessive in area and do not extend below the tank for more then half the height of the double bottom. If the depth of a well exceeds half the height of the double bottom, h_i will be taken equal to the double bottom height minus the well height.

(4) In the case where bottom damage simultaneously involves four centre tanks, the value of O_S may be calculated according to the formula -

$O_S = 1/4\ (\sum Z_i W_i + \sum Z_i C_i)$ **(III)**

121A.16 Limitation of size and arrangement of cargo tanks

(1) The owner of –

(a) any new oil tanker; or

(b) any existing oil tanker;

must ensure that the tanker complies with rule 121A.16.

(2) Cargo tanks of the oil tanker must be of such size and arrangement that the hypothetical outflow O_c or O_s, calculated in accordance with rule 121A.15 anywhere in the length of the ship, does not exceed 30,000 cubic metres or $400(DW)^{1/3}$, whichever is the greater, but subject to a maximum of 40,000 cubic metres.

(3) The volume of any one wing cargo oil tank of an oil tanker must not exceed 75 percent of the limits of the hypothetical oil outflow referred to in rule 121A.16(2). The volume of any on centre cargo oil tank must not exceed 50,000 cubic metres. However, in an oil tanker having segregated ballast tanks as required by rule 121A.4, the permitted volume of a wing cargo oil tank situated between two segregated ballast tanks, each exceeding l_c in length, may be increased to the maximum limit of hypothetical oil outflow provided that the width of the wing tanks exceeds t_c.

(4) The length of each cargo tank must not exceed 10 metres or one of the following values, whichever is greater –

(a) where no longitudinal bulkhead is provided inside the cargo tanks:

$(0.5b_i / B + 0.1)L$

but not to exceed 0.2L; and

(b) where a centreline longitudinal bulkhead is provided inside the cargo tanks:

$(0.25b_i / B + 0.15)L$; and

(c) where two or more longitudinal bulkheads are provided inside the cargo tanks:

(i) for wing tanks: 0.2L;

(ii) for centre tanks

(aa) if b_i/B is equal to or greater than 1/5: 0.2L

(bb) if b_i/B is less than 1/5:

- where no centreline longitudinal bulkhead is provided:

$(0.5\ b_i/B + 0.1)L$

- where a centreline longitudinal bulkhead is provided:

  $(0.25\ b_i/B + 0.15)L$; and

(d) b_i is the minimum distance from the ship's side to the outer longitudinal bulkhead of the tank in question measured inboard at right angles to the centreline at the level corresponding to the assigned summer freeboard.

(5) In order not to exceed the volume limits established by rules 121A.16(2), 121A.16(3), and 121A.16(4) and irrespective of the accepted type of cargo transfer system installed, when such system interconnects two ore more cargo tanks, valves or other similar closing devices must be provided for separating the tanks from each other.

(6) Lines of piping which run through cargo tanks in a position less than t_c from the ship's side of less than v_c from the ship's bottom must be fitted with valves or similar closing devices at the point at which they open into any cargo tank.

121A.17 Subdivision and stability

(1) The owner of any new ship (as defined in rule 121A.2) which is an oil tanker must ensure that it complies with –

(a) the subdivision and damage stability criteria specified in rule 121A.17(3); and

(b) the assumed side or bottom damage specified in rule 121A.17(2), at any operating draught reflecting actually, partial or full load conditions consistent with the trim and strength of the ship as well as the specific gravities of the cargo. Such damage must be applied to all conceivable locations along the length of the ships as follows:

(i) in any tanker of more than 225 metres in length, anywhere in the ship's length; and

(ii) in any tanker of more than 150 metres, but not exceeding 225 metres in length, anywhere in the ship's length except involving either after or forward bulkhead bounding the machinery space located aft. The machinery space is treated as a single floodable compartment; and

(iii) in any tanker not exceeding 150 metres in length, anywhere in the ship's length between adjacent transverse bulkheads with the exception of the machinery space.

Ballast conditions where the tanker is not carrying oil in cargo tanks, excluding any oil residues, must not be taken in account.

(2) The following provisions, regarding the extent and the character of the assumed damage must be applied –

(a) Side damage

(i)	Longitudinal extent:	$1/3(L^{2/3})$ or 14.5 metres, whichever is less
(ii)	Transverse extent (inboard from the ship's side at right angles to the centre-line at the level of the summer load line)	$B/5$ or 11.5 metres, whichever is less
(iii)	Vertical extent	From the moulded line of the bottom shell plating at centreline, upward without limit

and

(b) Bottom damage

	For 0.3L from the forward perpendicular of the ship	*Any other part of the ship*
(i) Longitudinal extent:	$1/3(L^{2/3})$ or 14.5 metres, whichever is less	$1/3(L^{2/3})$ or 5 metres, whichever is less
(ii) Transverse extent:	*B*/6 or 10 metres whichever is less	*B*/6 or 5 metres whichever is less
(iii) Vertical extent:	*B*/15 or 6 metres, whichever is less, measured from the moulded line of the bottom shell plating at centreline	*B*/15 or 6 metres, whichever is less, measured from the moulded line of the bottom shell plating at centreline

and

(c) if any damage of a lesser extent than the maximum extent specified in rules 121A.17(2)(a) and 121A.17(2)(b) would result in a more sever condition, such damage is to be taken in account; and

(d) where the damage involving transverse bulkheads is envisaged as specified in rules 121A.17(1)(a) and 121A.17(1)(b), transverse watertight bulkheads must be spaced at least at a distance equal to the longitudinal extent of assumed damage specified in rule 121A.17(2)(a)(i) in order to be considered effective. Where transverse bulkheads are spaced at lesser distance, one or more of these bulkheads within such extent of damage must be assumed non-existent for the purpose of determining flooded compartments; and

(e) where the damage between adjacent transverse watertight bulkheads is envisaged as specified in rule 121A.17(1)(c), no main transverse bulkhead or a transverse bulkhead bounding side tanks or double bottom tanks is assumed to be damaged, unless.

(i) the spacing of the adjacent bulkheads is less than the longitudinal extent of assumed damage specified in rule 121A.17(2)(a)(i); or

(ii) there is a step or recess in a transverse bulkhead or more than 3.05 metres in length, located within the extent or penetration of assumed damage. The step formed by the after peak bulkhead and after peak tank top must not be regarded as a step for the purpose of this rule; and

(f) if pipes, duct or tunnels are situated within the assumed extent of damage, arrangements must be made so that progressive flooding cannot extend to compartments other than those assumed to be floodable for each case of damage.

(3) Subject to rule 121A.17(4), an oil tanker is to be regarded as complying with the damage stability criteria if the following requirements are met –

(a) the final waterlines, taking into account sinkage, heel and trim, is below the lower edge of any opening through which progressive flooding can take place. Such openings include air pipes and those which are closed by means of weathertight

doors or hatch covers and excludes those openings closed by means of watertight manhole covers and flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck remotely operated watertight sliding doors, and sidescuttles of the non-opening type; and

(b) in the final stage of flooding, the angle of heel due to unsymmetrical flooding does not exceed 25 degrees. This angle may be increased up to 30 degrees is not deck edge immersion occurs; and

(c) in the final stage of flooding the righting lever curve has at least a range of 20 degrees beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 metre within the 20 degrees range and the area under curve within this range is not less than 0.0175 metre radians. Unprotected opening must not be immersed within this range unless the space concerned in assumed to be flooded. The immersion of any of the openings listed in rule 121A.17(3)(a) and other openings capable of being closed weatheright may be permitted within this range; and

(d) the surveyor before approving the stability calculations for the ship for the purposes of the initial survey as required by rule 101A.4(2)(a) is satisfied that the stability is sufficient during intermediate stages of flooding.

(4) Equalisation arrangements requiring mechanical aids such as valves or cross-levelling pipes, if fitted, must not be considered for the purpose of reducing an angle of heel or attaining the minimum range of residual stability to meet the requirements of rules 121A.17(3)(a), 121A.17(3)(b) and 121A.17(3)(c), and sufficient residual stability must be maintained during all stages where equalisation is used. Spaces which are linked by ducts of a large cross-sectional area may be considered to be common.

(5) For tankers of 100 metres or less in length where all the requirements of rule 121A.17(3) cannot be fulfilled without impairing the operation of the ship, an exemption may be granted in accordance with section 395 of the Act.

(6) The surveyor undertaking the initial survey required by rule 101A.4(2)(a) must be satisfied that the requirements of rule 121A.17(1) have been complied with by means of calculations which take into consideration the design characteristics of the ship, the arrangements, configuration and contents of the damaged compartments; and the distribution, specific gravities and the free surface effect of liquids. The calculations must be based on the following –

(a) account must be taken of any empty or partially filled tank, the specific gravity of cargoes carried, as well as any outflow of liquids from damaged compartments; and

(b) the permeabilities assumed for spaces flooded as a result of damage must be as follows:

Spaces	**Permeability**
Appropriated to stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Voids	0.95
Intended for consumable liquids	0 to 0.95*
Intended for other liquids	0 to 0.95*

* The permeability of partially filled compartments shall be consistent with the amount of liquid carried in the compartment. Whenever damage penetrates a tank containing liquids, it shall be assumed that the contents are completely lost from that compartment and replaced by salt water up to the level of the final plane of equilibrium.

and

(c) the buoyancy of any superstructure directly above the side damage must be disregarded. The unflooded parts of superstructures beyond the extent of damage, however, may be taken into consideration provided that they are separated from the damaged space by watertight bulkheads and the requirements of rule 121A.17(3)(a) in respect of these intact spaces are complied with. Hinged watertight doors may be acceptable in watertight bulkheads in the superstructure; and

(d) the free surface effect is calculated at an angle of heel of 5 degrees for each individual compartment. The Director may require or allow the free surface corrections to be calculated at an angle of heel greater than 5 degrees for partially filled tanks; and

(e) in calculating the effect of free surfaces of consumable liquids it is assumed that, for each type of liquid at least one transverse pair or a single centreline tank has a free surface and the tank or combination of tanks to be taken into account are those where the effect of free surfaces is the greatest.

(7) The owner of –

(a) any new oil tanker; or

(b) any new non-self-propelled oil tanker;

to which Part 121A applies, must supply, in an approved form, to the master or to the person in charge of that tanker:

(i) information relating to loading and distribution of cargo necessary to ensure compliance with the provisions of rule 121A.17; and

(ii) data on the ability of the ship to comply with damage stability criteria as determined by rule 121A.17, including the effect of relaxations that may have been allowed under rule 121A.17(1)(c).

(8) All oil tankers shall be fitted with a stability instrument, capable of verifying compliance with intact and damage stability requirements that is approved by the Director as follows, having regard to the performance standards and guidelines developed by the IMO:

(a) oil tankers with a date of build before 1 January 2016 shall comply with this subrule (8) at the first scheduled renewal survey of the ship after 1 January 2016 or, if there is no scheduled renewal survey of the ship within 5 years from that date, not later than 1 January 2021:

(b) notwithstanding the requirements of subrule (a), a stability instrument fitted on an oil tanker with a date of build before 1 January 2016 need not be replaced provided it is capable of verifying compliance with intact and damage stability requirements, to the satisfaction of the Director:

(c) for oil tankers undertaking an international voyage, the Director shall issue a document of approval for the stability instrument.

(9) The Director may waive the requirements of 121A.17(8) for the following oil tankers if loaded in accordance with the conditions approved by the Director taking into account the guidelines developed by the IMO:

(a) oil tankers that are on a dedicated service, with a limited number of permutations of loading such that all anticipated conditions have been approved in the stability information provided to the master in accordance with rule 121A.17(7):

(b) oil tankers where stability verification is made remotely by a means approved by the Director:

(c) oil tankers that are loaded within an approved range of loading conditions:

(d) oil tankers with a date of build before 1 January 2016 provided with approved limiting KG/GM curves covering all applicable intact and damage stability requirements.

121A.18 Intact stability

(1) Rule 121A.18 applies to any oil tanker of 5,000 tonnes deadweight or more –

(a) for which the building contract was placed on or after 1 February 1999; or

(b) in the absence of a building contract, the keel of which was laid or which was a at a similar stage of construction on or after 1 August 1999; or

(c) the delivery of which was on or after 1 February 2002; or

(d) that has undergone a major conversion:

(i) for which the contract was placed after 1 February 1999; or

(ii) in the absence of a contract, the construction work of which begun after 1 August 1999; or

(iii) which was completed after 1 February 2002.

(2) The owner and the master of any oil tanker to which this rule applies must ensure that the tanker complies with the following intact stability criteria, calculated for all conditions as if the ballast tanks are slack:

(a) in port, the initial metacentric height GM_O, corrected for free surface effect measured at 0 degrees heel, must be not less than 0.15 metres; and

(b) at sea:

(i) the area under the righting lever curve ("**GZ**" curve) must be not less than 0.055 metre radians up to Θ = 30 degrees angle of heel and not less than 0.09 metre radians up to Θ = 40 degrees or other angle of flooding Θf[3] if this angle is less than 40 degrees. Additionally, the area under the righting lever curve between the angles of heel of 30 degrees and 40 degrees or between 30 degrees and Θf, if this angle is less than 40 degrees, must not be less than 0.03 metre radians; and

(ii) the righting lever GZ must be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees; and

(iii) the maximum righting arm must occur at an angle of heel preferably exceeding 30 degrees but not less than 25 degrees; and

(iv) the initial metacentric height GM_O, corrected for free surface effect measured at 0 degrees heels, must be not less than 0.15 metres.

(3) The requirements of paragraph (2) must be met through design measures except, in the case of any combination carrier, the requirements may be met through simple written supplementary operational procedures for liquid transfers operations.

(4) The operational procedures referred to in paragraph (3) must:

(a) be approved by the Director; and

(b) indicated those cargo and ballast tanks that may, under any specific condition of liquid transfer and possible range of cargo densities, be slack[4] and still allow the stability criteria to be met; and

(c) be readily understandable to the officer in charge of liquid transfer operations; and

(d) provide for planned sequences of cargo and ballast transfer operations; and

(e) allow comparisons of attained and required stability using stability performance criteria in graphical or tabular form; and

(f) not require extensive mathematical calculations by the officer in charge of liquid transfer operations; and

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[3] Θf is the angle of heel at which openings in the hull, superstructures or deck-houses, which cannot be closed weathertight, immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

[4] The slack tanks may vary during the liquid transfer operations and be of any combination provided they satisfy the criteria.

(g) provide for corrective actions to be taken by the officer in charge of liquid transfer operations in case of departure from recommended values and in case of emergency situations; and

(h) be appropriately displayed –

(i) in approved trim and stability booklet; and

(ii) at the cargo and ballast transfer control station; and

(iii) in any computer software by which stability calculations are performed.

121A.18A Oil residue (sludge) tanks and oily bilge water holding tanks in polar waters

(1) This rule 121A.18A applies to an oil tanker—

(a) that is a category A or category B ship; and

(b) with an oil residue (sludge) tank or oily bilge water holding tank with a maximum individual capacity of more than 30 m^3; and

(c) that is in polar waters; and

(d) the keel of which was laid or which was at a similar stage of construction on or after 1 February 2018.

(2) The owner of an oil tanker to which this rule applies must ensure that each oil residue (sludge) tank and oily bilge water holding tank that has a maximum individual capacity of more than 30 m^3 is separated from the outer shell by a distance of not less than 0.76 m.

Oil fuel tank protection

121A.19 Application of oil fuel tank protection requirements

(1) Rule 121A.21 applies to every oil tanker with an aggregate oil fuel capacity of 600 m^3 and above –

(a) for which the building contract is placed on or after 1 August 2007; or

(b) in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 February 2008; or

(c) the delivery of which is on or after 1 August 2010; or

(d) which has undergone a major conversion –

(i) for which the contract is placed on or after 1 August 2007; or

(ii) in the absence of contract, the construction work of which is begun on or after 1 February 2008; or

(iii) which is completed on or after 1 August 2010.

(2) The application of rule 121A.21 in determining the design, location and construction of tanks used to carry oil fuel does not affect the requirements of 121A.9 (dealing with cargo tank protection).

(3) These rules apply to the design, location and construction of all oil fuel tanks except small oil fuel tanks provided that the aggregate capacity of such excluded tanks is not greater than 600 m3.

121A.19A Oil fuel tank protection in polar waters

(1) This rule 121A.19A applies to an oil tanker—

(a) that is a category A or category B ship; and

(b) with an aggregate oil fuel capacity of less than 600 m^3, excluding oil fuel tanks with a maximum individual capacity of 30 m^3 or less; and

(c) that is in polar waters; and

(d) the keel of which was laid or which was at a similar stage of construction on or after 1 February 2018.

(2) The owner of a ship to which this rule applies must ensure that each oil fuel tank is separated from the outer shell by a distance of not less than 0.76 m.

121A.20 Definitions for oil fuel tank protection rules

For the purposes of rules 121A.19 to 121A.21, the following definitions apply –

Breadth (B) means the maximum breadth of the ship, in metres, measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material:

Breadth (B_S) is the greatest moulded breadth of the ship, in metres, at or below the deepest load line draught (d_S):

Breadth (B_B) is the greatest moulded breadth of the ship, in metres, at or below the waterline (d_B):

C is the ship's total volume of oil fuel, including that of the small oil fuel tanks, in m^3, at 98% tank filling:

Depth (D_S) is the moulded depth, in metres, measured at mid-length to the upper deck at side. For the purpose of the application, "upper deck" means the highest deck to which the watertight transverse bulkheads except aft peak bulkheads extend:

Length (L) means 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that be greater.

In ships designed with a rake of keel the waterline on which this length is measured shall be parallel to the designed waterline. The length (L) shall be measured in metres:

Load line draught (d_S) is the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to the summer freeboard draught to be assigned to the ship:

Light ship draught is the moulded draught amidships corresponding to the Lightweight:

Oil fuel means any oil used as fuel oil in connection with the propulsion and auxiliary machinery of the ship in which such oil is carried:

Oil fuel capacity means the volume of a tank in m^3, at 98% filling:

Oil fuel tank means a tank in which oil fuel is carried, but excludes those tanks which would not contain oil fuel in normal operation, such as overflow tanks:

Partial load line draught (d_P) is the light ship draught plus 60% of the difference between the light ship draught and the load line draught d_S. The partial load line draught (d_p) shall be measured in metres:

Waterline (d_B) is the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to 30% of the depth D_S:

Small oil fuel tank is an oil fuel tank with a maximum individual capacity not greater than 30 m^3.

121A.21 Oil fuel tank protection

(1) Oil fuel tanks shall be located above the moulded line of the bottom shell plating nowhere less than the distance h as specified below–

h = B/20 m or,

h = 2.0 m, whichever is the lesser.

The minimum value of h = 0.76 m

(2) In the turn of the bilge area and at locations without a clearly defined turn of the bilge, the oil fuel tank boundary line shall run parallel to the line of the midship flat bottom as shown in Figure 1.

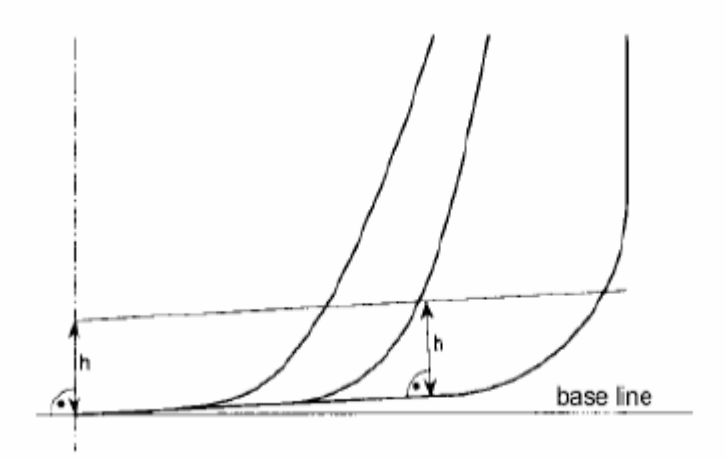

Figure 1 – Oil fuel tank boundary lines for oil tankers with oil fuel capacity of 600 m^3 or more but less than 5,000 m^3

(3) For ships having an aggregate oil fuel capacity of 600 m^3 or more but less than 5,000 m^3, oil fuel tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance w which, as shown in Figure 2, is measured at any cross-section at right angles to the side shell, as specified below:

w = 0.4 + 2.4 C/20,000 m

The minimum value of w = 1.0 m, however for individual tanks with an oil fuel capacity of less than 500 m^3 the minimum value is 0.76 m.

(4) For ships having an aggregate oil fuel capacity of 5,000 m^3 or more, oil fuel tanks shall be located inboard of the moulded line of the side shell plating, nowhere less than the distance w which, as shown in Figure 2, is measured at any cross-section at right angles to the side shell, as specified below:

w = 0.5 + C/20,000 m or

w = 2.0 m, whichever is the lesser.

The minimum value of w = 1.0 m

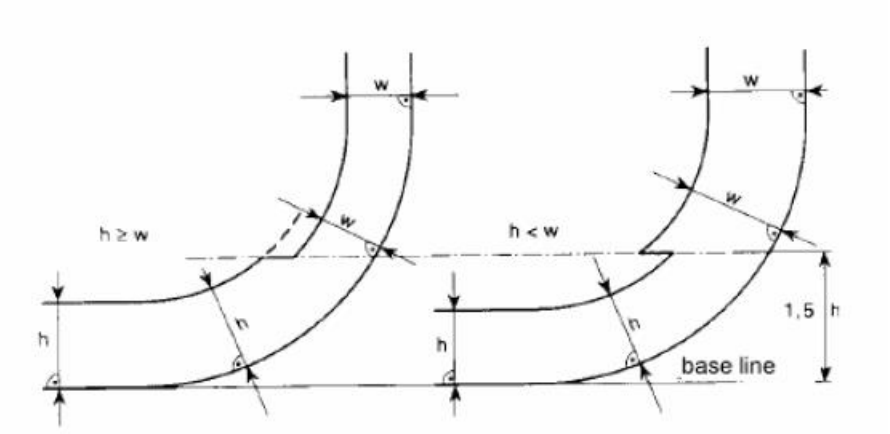

Figure 2 – Oil fuel tank boundary lines for the purposes of subrules (3) and (4)

(5) Lines of oil fuel piping located at a distance from the ship's bottom of less than h, as defined in subrule (1), or from the ship's side less than w, as defined in subrules (3) and (4) shall be fitted with valves or similar closing devices within or immediately adjacent to the oil fuel tank. These valves shall be capable of being brought into operation from a readily accessible enclosed space the location of which is accessible from the navigation bridge or propulsion machinery control position without traversing exposed freeboard or superstructure decks. The valves shall close in case of remote control system failure (fail in a closed position) and shall be kept closed at sea at any time when the tank contains oil fuel except that they may be opened during oil fuel transfer operations.

(6) Suction wells in oil fuel tanks may protrude into the double bottom below the boundary line defined by the distance h provided that such wells are as small as practicable and the distance between the well bottom and the bottom shell plating is not less than 0.5 h.

(7) Alternatively to subrules (1) and either (3) or (4), ships shall comply with the accidental oil fuel outflow performance standard specified below:

(a) The level of protection against oil fuel pollution in the event of collision or grounding shall be assessed on the basis of the mean oil outflow parameter as follows–

$O_M < 0.0157\text{-}1.14E\text{-}6 \cdot C$ $\quad 600\ m^3 \leq C < 5{,}000\ m^3$

$O_M < 0.010$ $\quad C \geq 5{,}000\ m^3$

Where:

O_M = mean oil outflow parameter;

C = total oil fuel volume.

(b) The following general assumption shall apply when calculating the mean oil outflow parameter –

(i) the ship shall be assumed loaded to the partial load line draught d_P without trim or heel;

(ii) all oil fuel tanks shall be assumed loaded to 98% of their volumetric capacity;

(iii) the nominal density of the oil fuel (ρ_n) shall generally be taken as 1,000 kg/m^3. If the density of the oil fuel is specifically restricted to a lesser value, the lesser value may be applied; and

(iv) for the purpose of these outflow calculations, the permeability of each oil fuel tank shall be taken as 0.99, unless proven otherwise.

(c) The following assumptions shall be used when combining the oil outflow parameters –

(i) The mean oil outflow shall be calculated independently for side damage and for bottom damage and then combined into a non-dimensional oil outflow parameter OM, as follows –

$O_M = (0.4\ O_{MS} + 0.6\ O_{MB}) / C$

where –

O_{MS} = mean outflow for side damage, in m^3
O_{MB} = mean outflow for bottom damage, in m^3
C = total oil fuel volume.

(ii) For bottom damage, independent calculations for mean outflow shall be done for 0 m and 2.5 m tide conditions, and then combined as follows –

$O_{MB} = 0.7\ O_{MB}(0) + 0.3\ O_{MB}(2.5)$

where –

O_{MB} (0) = mean outflow for 0 m tide condition, and
O_{MB} (2.5)= mean outflow for minus 2.5 m tide condition, in m^3.

(d) The mean outflow for side damage O_{MS} shall be calculated as follows:

$$O_{MS} = \sum_{i}^{n} P_{S(i)}\ O_{S(i)}\ [m^3]$$

where –

i = represents each oil fuel tank under consideration;
n = total number of oil fuel tanks;
$P_{S(i)}$ = the probability of penetrating oil fuel tank i from side damage, calculated in accordance with subrule (7)(f);
$O_{S(i)}$ = the outflow, in m^3, from side damage to oil fuel tank i, which is assumed equal to the total volume in oil fuel tank i at 98% filling.

(e) The mean outflow for bottom damage shall be calculated for each tidal condition as follows:

(i) $$O_{MB}(0) = \sum_{i}^{n} P_B(i)\ O_B(i)\ C_{DB}(i)\ [m^3]$$

where –

i = represents each oil fuel tank under consideration;
n = total number of oil fuel tanks;
$P_B(i)$ = the probability of penetrating oil fuel tank i from bottom damage, calculated in accordance with subrule (7)(g)
$O_{B(i)}$ = the outflow from oil fuel tank i, in m^3, calculated in accordance with subrule (7)(e)(iii) of this rule; and
$C_{DB(i)}$= factor to account for oil capture as defined in subrule (7)(e)(iii)(dd).

(ii) $$O_{MB}(2.5) = \sum_{i}^{n} P_B(i)\ O_B(i)\ C_{DB}(i)\ [m^3]$$

where –

i, n, $P_{B(i)}$ and $C_{DB(i)}$ = as defined in this subrule

$O_{B(i)}$ = the outflow from oil fuel tank i, in m^3, after tidal change.

(iii) The oil outflow $O_{B(i)}$ for each oil fuel tank shall be calculated based on pressure balance principles, in accordance with the following assumptions –

(aa) The ship shall be assumed stranded with zero trim and heel, with the stranded draught prior to tidal change equal to the partial load line draught d_P.

(bb) The oil fuel level after damage shall be calculated as follows:

$hF = \{(d_P + tC - Zl)(\rho S)\}/\rho n$

where:

hF = the height of the oil fuel surface above Zl, in m;

tC = the tidal change, in m. Reductions in tide shall be expressed as negative values;

Zl = the height of the lowest point in the oil fuel tank above the baseline, in m;

ρS = density of seawater, to be taken as 1,025 kg/ m^3; and,

ρn = nominal density of the oil fuel, as defined in subrule (7)(b)(iii).

(cc) The oil outflow OB(i) for any tank bounding the bottom shell plating shall be taken to be not less than the sum of the following formula, but no more than the tank capacity:

$O_B(i) = H_W \ A$

where –

H_W = 1.0 m, when $Y_B = 0$

H_W = $B_B/50$ but not greater than 0.4 m, when Y_B is greater than $B_B/5$ or 11.5 m, whichever is less

"H_W" is to be measured upwards from the midship flat bottom line. In the turn of the bilge area and at locations without a clearly defined turn of the bilge, H_W is to be measured from a line parallel to the midship flat bottom, as shown for distance "h" in Figure 1.

For Y_B values outboard $B_B/5$ or 11.5 m, whichever is less, H_W is to be calculated by linear interpolation.

Y_B = the minimum value of Y_B over the length of the oil fuel tank, where at any given location, Y_B is the transverse distance between the side shell at waterline d_B and the tank at or below waterline d_B.

A = the maximum horizontal projected area of the oil fuel tank up to the level of HW from the bottom of the tank.

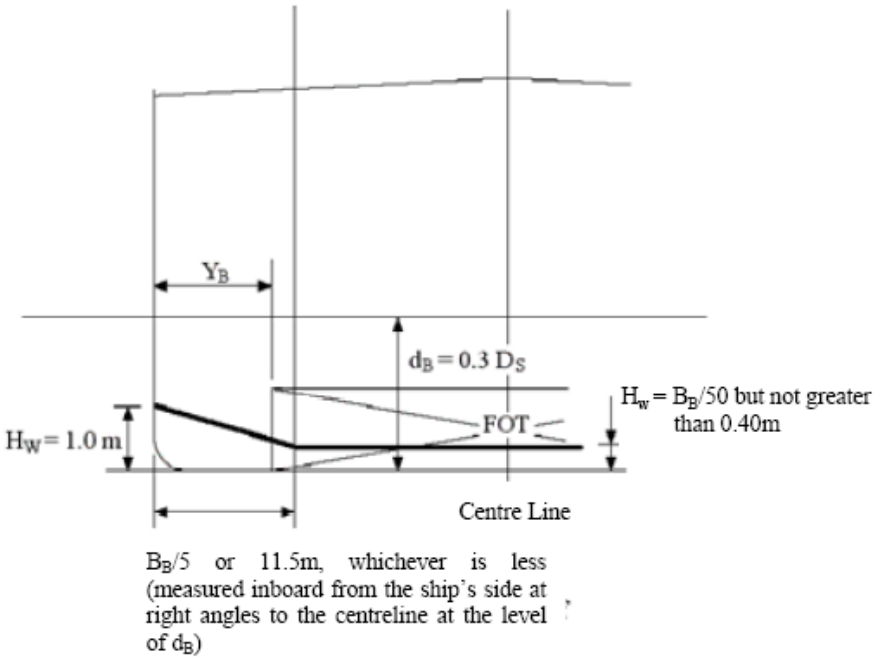

Figure 3 – Dimensions for calculation of the minimum oil outflow for the purpose of subrule (7)(e)(iii)(cc)

(dd) In the case of bottom damage, a portion from the outflow from an oil fuel tank may be captured by non-oil compartments. This effect is approximated by application of the factor $C_{DB(i)}$ for each tank, which shall be taken as follows–

$C_{DB(i)}$ = 0.6 for oil fuel tanks bounded from below by non-oil compartments;

$C_{DB(i)}$ = 1 otherwise.

(f) The probability PS of breaching a compartment from side damage shall be calculated as follows–

(i) $PS = P_{SL} \cdot P_{SV} \cdot P_{ST}$

where –

PSL = $(1 – P_{Sf} – P_{Sa})$ = probability the damage will extend into the longitudinal zone bounded by X_a and X_f;

P_{SV} = $(1 – P_{Su} – P_{Sl})$ = probability the damage will extend into the vertical zone bounded by Z_l and Z_u;

P_{ST} = $(1 – P_{Sy})$ = probability the damage will extend transversely beyond the boundary defined by y;

(ii) P_{Sa}, P_{Sf}, P_{Su} and P_{Sl} shall be determined by linear interpolation from the table of probabilities for side damage provided in subrule (7)(f)(iii), and P_{Sy} shall be calculated from the formulas provided in that subrule,

where –

P_{Sa} = the probability the damage will lie entirely aft of location X_a/L;

P_{Sf} = the probability the damage will lie entirely forward of location Xf/L;

P_{Sl} = probability the damage will lie entirely below the tank;

P_{Su} = probability the damage will lie entirely above the tank; and

P_{Sy} = probability the damage will lie entirely outboard the tank.

Compartment boundaries X_a, X_f, Z_l, Z_u and y shall be developed as follows –

X_a = the longitudinal distance from aft terminal of L to the aft most point on the compartment being considered, in m;

X_f = the longitudinal distance from aft terminal of L to the foremost point on the compartment being considered, in m;

Z_l = the vertical distance from the moulded baseline to the lowest point on the compartment being considered, in m. Where Z_l is greater than D_S, Z_l shall be taken as D_S;

Z_u = the vertical distance from the moulded baseline to the highest point on the compartment being considered, in m. Where Z_u is greater than D_S, Z_u shall be taken as D_S; and,

y = the minimum horizontal distance measured at right angles to the centreline between the compartment under consideration and the side shell, in m.[5]

In way of the turn of the bilge, y need not to be considered below distance h above baseline, where h is lesser of B/10, 3 m or the top of the tank.

[5] For symmetrical tank arrangements, damages are considered for one side of the ship only, in which case all "y" dimensions are to be measured from that side. For asymmetrical arrangements reference is made to the explanatory notes on matters related to the accidental oil outflow performance, adopted by the Organization by resolution MEPC.122(52).

(iii) Table of probabilities for side damage

X_a /L	P_{Sa}
0.00	0.000
0.05	0.023
0.10	0.068
0.15	0.117
0.20	0.167
0.25	0.217
0.30	0.267
0.35	0.317
0.40	0.367
0.45	0.417
0.50	0.467
0.55	0.517
0.60	0.567
0.65	0.617
0.70	0.667
0.75	0.717
0.80	0.767
0.85	0.817
0.90	0.867
0.95	0.917
1.00	0.967

X_f /L	P_{Sf}
0.00	0.967
0.05	0.917
0.10	0.867
0.15	0.817
0.20	0.767
0.25	0.717
0.30	0.667
0.35	0.617
0.40	0.567
0.45	0.517
0.50	0.467
0.55	0.417
0.60	0.367
0.65	0.317
0.70	0.267
0.75	0.217
0.80	0.167
0.85	0.117
0.90	0.068
0.95	0.023
1.00	0.000

Z_1/D_S	P_{Sl}
0.00	0.000
0.05	0.000
0.10	0.001
0.15	0.003
0.20	0.007
0.25	0.013
0.30	0.021
0.35	0.034
0.40	0.055
0.45	0.085
0.50	0.123
0.55	0.172
0.60	0.226
0.65	0.285
0.70	0.347
0.75	0.413
0.80	0.482
0.85	0.553
0.90	0.626
0.95	0.700
1.00	0.775

Z_u/D_s	P_{Su}
0.00	0.968
0.05	0.952
0.10	0.931
0.15	0.905
0.20	0.873
0.25	0.836
0.30	0.789
0.35	0.733
0.40	0.670
0.45	0.599
0.50	0.525
0.55	0.452
0.60	0.383
0.65	0.317
0.70	0.255
0.75	0.197
0.80	0.143
0.85	0.092
0.90	0.046
0.95	0.013
1.00	0.000

P_{Sy} shall be calculated as follows:

$P_{Sy} = (24.96 – 199.6\ y/B_S)\ (y/B_S)$ for $y/B_S \leq 0.05$

$P_{Sy} = 0.749 + \{5 – 44.4\ (y/B_S – 0.05)\}\ \{(y/B_S) – 0.05\}$ for $0.05 < y/B_S < 0.1$

$P_{Sy} = 0.888 + 0.56\ (y/B_S - 0.1)$ for $y/B_S \geq 0.1$

P_{Sy} is not to be taken greater than 1.

(g) The probability PB of breaching a compartment from bottom damage shall be calculated as follows:

(i) PB = PBL . PBT . PBV where –

PBL = (1 – PBf – PBa) = probability the damage will extend into the longitudinal zone bounded by Xa and Xf;

PBT = (1 – PBp – PBS) = probability the damage will extend into transverse zone bounded by Yp and Ys; and

PBV = (1 – PBz) = probability the damage will extend vertically above the boundary defined by z;

(ii) PBa, PBf, PBp and PBS shall be determined by linear interpolation from the table of probabilities for bottom damage provided in subrule (7)(g)(iii), and PBz shall be calculated from the formulas provided in that subrule, where –

PBa = the probability the damage will lie entirely aft of location Xa/L;

PBf = the probability the damage will lie entirely forward of location Xf/L;

PBp = probability the damage will lie entirely to port of the tank;

PBs = probability the damage will lie entirely to starboard the tank; and

PBz = probability the damage will lie entirely below the tank.

Compartment boundaries Xa, Xf, Yp, Ys and z shall be developed as follows –

X_a and X_f as defined in subrule(7)(f)(ii);

Y_p = the transverse distance from the port-most point on the compartment located at or below the waterline dB, to a vertical plane located BB/2 to starboard of the ship's centreline;

Y_s = the transverse distance from the starboard-most point on the compartment located at or below thewaterline dB, to a vertical plane located BB/2 tostarboard of the ship's centreline; and

z = the minimum value of z over the length of the compartment, where, at any given longitudinal location, z is the vertical distance from the lower point of the bottom shell at that longitudinal location to the lower point of the compartment at that longitudinal location.

(iii) Table of probabilities for bottom damage

X_a /L	P_{Ba}
0.00	0.000
0.05	0.002
0.10	0.008
0.15	0.017
0.20	0.029
0.25	0.042
0.30	0.058
0.35	0.076
0.40	0.096
0.45	0.119
0.50	0.143
0.55	0.171
0.60	0.203
0.65	0.242
0.70	0.289
0.75	0.344
0.80	0.409
0.85	0.482
0.90	0.565
0.95	0.658
1.00	0.761

X_f /L	P_{Bf}
0.00	0.969
0.05	0.953
0.10	0.936
0.15	0.916
0.20	0.894
0.25	0.870
0.30	0.842
0.35	0.810
0.40	0.775
0.45	0.734
0.50	0.687
0.55	0.630
0.60	0.563
0.65	0.489
0.70	0.413
0.75	0.333
0.80	0.252
0.85	0.170
0.90	0.089
0.95	0.026
1.00	0.000

Y_p B_B	P_{Bp}
0.00	0.844
0.05	0.794
0.10	0.744
0.15	0.694
0.20	0.644
0.25	0.594
0.30	0.544
0.35	0.494
0.40	0.444
0.45	0.394
0.50	0.344
0.55	0.297
0.60	0.253
0.65	0.211
0.70	0.171
0.75	0.133
0.80	0.097
0.85	0.063
0.90	0.032
0.95	0.009
1.00	0.000

Y_s/B_B	P_{Bs}
0.00	0.000
0.05	0.009
0.10	0.032
0.15	0.063
0.20	0.097
0.25	0.133
0.30	0.171
0.35	0.211
0.40	0.253
0.45	0.297
0.50	0.344
0.55	0.394
0.60	0.444
0.65	0.494
0.70	0.544
0.75	0.594
0.80	0.644
0.85	0.694
0.90	0.744
0.95	0.794
1.00	0.844

P_{Bz} shall be calculated as follows–

$P_{Bz} = (14.5 – 67\ z/D_S)\ (z/D_S)$ for $z/D_S \leq 0.1$

$P_{Bz} = 0.78 + 1.1\ \{(z/D_S - 0.1)\}$ for $z/D_S > 0.1$

P_{Bz} is not to be taken greater than 1.

(h) For the purpose of maintenance and inspection, any oil fuel tanks that do not border the outer shell plating shall be located no closer to the bottom shell plating than 0.76 m and no closer to the side shell plating than the applicable value of *w* in subrule (3) or (4).

(8) Individual oil fuel tanks must not have a capacity of over 2,500m^3.

(9) Before approving the design and construction of ships to be built in accordance with this rule, the Director must be satisfied that the design—

(a) has due regard to the need for maintenance and inspection of wing and double bottom tanks or spaces; and

(b) is such to ensure that the ship is seaworthy in all respects.

Rule 121A.10D	**SCHEDULE**	

Calculation and assumptions for the determination of mean oil outflow parameter (OM)

1 Interpretation

(1) For the purpose of this Schedule and rule 121A.10D(2) and (3) –

B_B means the greatest moulded breadth of the ship, in metres, at or below the waterline;

b_i means the minimum distance from the ship's side to the outer longitudinal bulkhead of the tank in question measured inboard at right angles to the centre line at the level corresponding to the assigned summer freeboard;

B_S means the greatest moulded breadth of the ship, in metres, at or below d_S;

C means total volume of cargo oil, in m^3, at 98% tank filling;

C_3 is equal to –

(a) 0.77, for ships having two longitudinal bulkheads inside the cargo tanks, if these bulkheads are continuous over the cargo block and $P_{S(i)}$ is calculated in accordance with this Schedule;

(b) 1.0 for all other ships or when $P_{s(i)}$ is calculated in accordance within clause 7(2);

$C_{DB(i)}$ is the factor to account for oil capture and is equal to –

(a) 0.6 for cargo tanks bounded from below by non-oil compartments;

(b) 1.0 for cargo tanks bounded by the bottom shell;

deadweight or **DWT** has the meaning given to it in rule 121A.2;

depth or **D_S** means the moulded depth, in metres, measured at mid-length to the upper deck at side;

d_B means waterline;

d_S means the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to the summer freeboard assigned to the ship;

g means the acceleration of gravity and is to be taken to be 9.81 m/s^2;

i represents the particular cargo tank under consideration;

length or **L** has the meaning given to it in rule 121A.2;

load line draught has the same meaning as **d_s**

m means metres;

n means the total number of cargo tanks;

$O_{B(i)}$ means the outflow from cargo tank i, in m^3, calculated in accordance with clause 5(2);

O_M means the mean oil outflow parameter;

$O_{MB(0)}$ means the mean outflow for 0 m tide condition;

$O_{MB(2.5)}$ means the mean outflow for minus 2.5 m tide condition, in m^3;

O_{MB} means the mean outflow for bottom damage, in m^3;

O_{MS} means the mean outflow for side damage, in m^3;

$O_{S(i)}$ –

(a) means the outflow, in m^3, from side damage to cargo tank i;

(b) must be assumed to be equal to the total volume in cargo tank i at 98% filling, unless it is proven, through the application of the guidelines developed by the IMO for the approval of alternative methods of design and construction of oil tankers, that any significant cargo volume will be retained;

ρ_n means –

(a) the nominal density of the cargo oil; and

(b) is equal to 1000 (DWT)/C (kg/m^3);

ρ_s means the density of seawater, to be taken as 1,025 kg/m^3;

p means overpressure and if an inert gas system is –

(a) fitted, the normal overpressure, in kPa, is to be taken as not less than 5 kPa;

(b) not fitted, the overpressure may be taken as 0;

$P_{B(i)}$ means the probability of penetrating cargo tank i from bottom damage, calculated in accordance with clause 7;

P_{Ba} means the probability the damage will lie entirely aft of location Xa/L determined by linear interpolation from the table of probabilities for bottom damage provided in clause 7(2);

P_{Bf} means the probability the damage will lie entirely forward of location Xf/L determined by linear interpolation from the table of probabilities for bottom damage provided in clause 7(2);

P_{BL} –

(a) means probability the damage will extend into the longitudinal zone bounded by X_a and X_f; and

(b) is equal to 1 - P_{Bf} - P_{Ba};

P_{Bp} means the probability the damage will lie entirely to port of the tank determined by linear interpolation from the table of probabilities for bottom damage provided in clause 7(2);

P_{Bs} means the probability the damage will lie entirely to starboard of the tank determined by linear interpolation from the table of probabilities for bottom damage provided in clause 7(2); and

P_{BT} –

(a) means the probability the damage will extend into the transverse zone bounded by Y_p and Y_s; and

(b) is equal to 1 - P_{Bp} - P_{Bs};

P_{BV} –

(a) means the probability the damage will extend vertically above the boundary defined by z; and

(b) is equal to 1 - P_{Bz};

P_{Bz} –

(a) means the probability the damage will lie entirely below the tank; and

(b) is equal to –

(i) $(14.5 - 67\ z/D_S)\ (z/D_S)$ if $z/D_S \leq 0.1$;

(ii) $0.78 + 1.1\ (z/D_S - 0.1)$ if $z/D_S > 0.1$.

except that P_{Bz} must not be taken as greater than 1;

$P_{S(i)}$ means the probability of penetrating cargo tank i from side damage, calculated in accordance with clause 6(1);

P_{Sa} means the probability the damage will lie entirely aft of location X_a/L determined by linear interpolation from the table of probabilities for side damage provided in clause 6(2);

P_{Sf} means the probability the damage will lie entirely forward of location X_f/L determined by linear interpolation from the table of probabilities for side damage provided in clause 6(2);

P_{SL} –

(a) means the probability the damage will extend into the longitudinal zone bounded by X_a and X_f; and

(b) is equal to 1 - P_{Sf} - P_{Sa};

P_{S1} –

(a) means the probability the damage will lie entirely below the tank and shall be determined by linear interpolation from the table of probabilities for side damage provided in clause 6(2); and

(b) is equal to 1 - P_{Sy};

P_{ST} means the probability the damage will extend transversely beyond the boundary defined by y;

P_{Su} means the probability the damage will lie entirely above the tank determined by linear interpolation from the table of probabilities for side damage provided in clause 6(2); and

P_{SV} –

(a) means the probability the damage will extend into the vertical zone bounded by Z_l and Z_u; and

(b) is equal to 1 - P_{Su} - P_{S1};

P_{Sy} –

(a) means the probability the damage will lie entirely outboard of the tank; and -

(b) if $y/B_S \leq 0.05$ then $P_{Sy} = (24.96 - 199.6\ y/B_S)\ (y/B_S)$;

(c) if $0.05 < y/B_S < 0.1$ then $P_{Sy} = 0.749 + \{5 - 44.4\ (y/B_S - 0.05)\}\ (y/B_S - 0.05)$;

(d) if $y/B_S \geq 0.1$ then $P_{Sy} = 0.888 + 0.56\ (y/B_S - 0.1)$;

but P_{Sy} must not be taken as greater than 1.

side and bottom damage probabilities means $P_{S(i)}$, P_{Sa}, P_{Sf}, P_{SL}, P_{S1}, P_{ST}, P_{Su}, P_{SV}, P_{Sy}, $P_{B(i)}$, P_{Ba}, P_{Bf}, P_{BL}, P_{Bp}, P_{Bs}, P_{BT}, P_{BV}, P_{Bz};

t_c means tidal change, in metres and reductions in tide shall be expressed as negative values;

waterline or **d_B** means the vertical distance, in metres, from the moulded baseline at mid-length to the waterline corresponding to 30% of the depth (D_S);

X_a means the longitudinal distance from the aft terminal of L to the aftmost point on the compartment being considered, in metres;

X_f means the longitudinal distance from the aft terminal of L to the foremost point on the compartment being considered, in metres;

y means the minimum horizontal distance measured at right angles to the centreline between the compartment under consideration and the side shell in metres;[6]

Y_p means the transverse distance from the port-most point on the compartment located at or below the waterline d_B, to a vertical plane located $B_B/2$ to starboard of the ship's centreline, in metres;

Y_S means the transverse distance from the starboard-most point on the compartment located at or below the waterline d_B, to a vertical plane located $B_B/2$ to starboard of the ship's centreline, in metres;

z means the minimum value of z over the length of the compartment, where, at any given longitudinal location, z is the vertical distance from the lower point of the bottom shell at that longitudinal location to the lower point of the compartment at that longitudinal location, in metres;

Z_l means –

(a) in calculating cargo level after bottom damage, the height of the lowest point in the cargo tank above baseline, in metres;

(b) in calculating probability of breaching a compartment from side damage, the vertical distance from the moulded baseline to the lowest point on the compartment being considered, in metres;

Z_u means the vertical distance from the moulded baseline to the highest point on the compartment being considered, in metres except that Z_u must not to be taken as greater than D_s.

(2) Calculations in this Schedule and in rule 121A.10D should be based on draught d_S even if assigned draughts, such as the tropical loadline, exceed d_S.

2 Calculating mean oil flow parameter – general assumptions

When calculating the mean oil outflow parameter –

(a) the following must be assumed –

(i) the cargo block length extends between the forward and aft extremities of all tanks arranged for the carriage of cargo oil, including slop tanks;

(ii) reference in this Schedule to "cargo tanks" includes all cargo tanks, slop tanks and fuel tanks located within the cargo block length;

(iii) the ship is loaded to the load line draught (d_S) without trim or heel;

(iv) all cargo oil tanks are loaded to 98% of their volumetric capacity where the nominal density of the cargo oil (p_n) is = 1000 (DWT)/C (kg/m^3);

(v) the permeability of each space within the cargo block, including cargo tanks, ballast tanks and other non-oil spaces shall be taken to be 0.99, unless proven otherwise;

(b) suction wells may be disregarded in determining tank location, if –

(i) the well is as small as is practicable; and

(ii) the distance between the well bottom and bottom shell plating is not less than 0.5h.

[6] For symmetrical tank arrangements, damages are considered for one side of the ship only, in which case all "y" dimensions are to be measured from that same side. For asymmetrical arrangements refer to the explanatory notes on matters related to the accidental outflow performance, adopted by the International Maritime Organization in resolution MEPC.122(52).

3 Combining mean oil flow parameter – assumptions

When combining oil outflow parameters, the following assumptions must be used –

(a) the mean oil outflow must be calculated independently for side damage and for bottom damage and then combined into the non-dimensional oil outflow parameter OM, as follows –

$O_M = (0.4\ O_{MS} + 0.6\ O_{MB}) / C$

(b) for bottom damage, mean outflow must be calculated independently for 0 m and minus 2.5 m tide conditions, and then combined as follows –

$O_{MB} = 0.7\ O_{MB}\ (0) + 0.3\ O_{MB}\ (2.5)$

4 Mean outflow for side damage

The mean outflow for side damage O_{MS} must be calculated as follows –

$$O_{MS} = C_3 \sum_i^n P_{S(i)} O_{S(i)} \quad (m^3)$$

5 Mean outflow for bottom damage

(1) The mean outflow for bottom damage must be calculated for each tidal condition as follows –

(a) $$O_{MB(0)} = \sum_i^n P_{B(i)} O_{B(i)} C_{DB(i)} \quad (m^3)$$

(b) $$O_{MB(2.5)} = \sum_i^n P_{B(i)} O_{B(i)} C_{DB(i)} \quad (m^3)$$

where $O_{B(i)}$ is the outflow from cargo tank i, in m^3, after tidal change.

(2) Oil outflow $O_{B(i)}$ for each cargo oil tank must be calculated based on pressure balance principles, using the following assumptions –

(a) the ship shall be assumed stranded with zero trim and heel, with the stranded draught prior to tidal change equal to the load line draught (ds);

(b) the cargo level after damage shall be calculated as follows –

$h_c = \{(d_s + t_c – Z_l)\ (\rho_s) – (1000\ p) / g\ \}/\rho_n$

where h_c = the height of the cargo oil above Z_l, in metres;

(c) for cargo tanks bounded by the bottom shell, unless proven otherwise, oil outflow $O_{B(i)}$ must be taken to be not less than 1% of the total volume of cargo oil loaded in cargo tank i, to account for initial exchange losses and dynamic effects due to current and waves;

(d) in the case of bottom damage, a portion from the outflow from a cargo tank may be captured by non-oil compartments and this effect may be approximated by applying the factor $C_{DB(i)}$ for each tank.

6 Side damage probabilities

(1) The probability P_S of breaching a compartment from side damage must be calculated as follows $P_S = P_{SL}\ P_{SV}\ P_{ST}$.

(2) P_{Sa}, P_{Sf}, P_{Sl}, P_{Su} and P_{Sy} must be determined by linear interpolation from the table of probabilities for side damage –

Table of probabilities for side damage

X_a /L	P_{Sa}
0.00	0.000
0.05	0.023
0.10	0.068
0.15	0.117
0.20	0.167
0.25	0.217
0.30	0.267
0.35	0.317
0.40	0.367
0.45	0.417
0.50	0.467
0.55	0.517
0.60	0.567
0.65	0.617
0.70	0.667
0.75	0.717
0.80	0.767
0.85	0.817
0.90	0.867
0.95	0.917
1.00	0.967

X_f /L	P_{Sf}
0.00	0.967
0.05	0.917
0.10	0.867
0.15	0.817
0.20	0.767
0.25	0.717
0.30	0.667
0.35	0.617
0.40	0.567
0.45	0.517
0.50	0.467
0.55	0.417
0.60	0.367
0.65	0.317
0.70	0.267
0.75	0.217
0.80	0.167
0.85	0.117
0.90	0.068
0.95	0.023
1.00	0.000

Z_1/D_S	P_{Sl}
0.00	0.000
0.05	0.000
0.10	0.001
0.15	0.003
0.20	0.007
0.25	0.013
0.30	0.021
0.35	0.034
0.40	0.055
0.45	0.085
0.50	0.123
0.55	0.172
0.60	0.226
0.65	0.285
0.70	0.347
0.75	0.413
0.80	0.482
0.85	0.553
0.90	0.626
0.95	0.700
1.00	0.775

Z_u/D_S	P_{Su}
0.00	0.968
0.05	0.952
0.10	0.931
0.15	0.905
0.20	0.873
0.25	0.836
0.30	0.789
0.35	0.733
0.40	0.670
0.45	0.599
0.50	0.525
0.55	0.452
0.60	0.383
0.65	0.317
0.70	0.255
0.75	0.197
0.80	0.143
0.85	0.092
0.90	0.046
0.95	0.013
1.00	0.000

7 Bottom damage probabilities

(1) The probability P_B of breaching a compartment from bottom damage must be calculated as follows $P_B = P_{BL}\ P_{BT}\ P_{BV}$.

(2) P_{Ba}, P_{Bf}, P_{Bp}, P_{Bs}, and P_{Bz} must be determined by linear interpolation from the table of probabilities for bottom damage –

Table of probabilities for bottom damage

X_a /L	P_{Ba}
0.00	0.000
0.05	0.002
0.10	0.008
0.15	0.017
0.20	0.029
0.25	0.042
0.30	0.058
0.35	0.076
0.40	0.096
0.45	0.119
0.50	0.143
0.55	0.171
0.60	0.203
0.65	0.242
0.70	0.289
0.75	0.344
0.80	0.409
0.85	0.482
0.90	0.565
0.95	0.658
1.00	0.761

X_f /L	P_{Bf}
0.00	0.969
0.05	0.953
0.10	0.936
0.15	0.916
0.20	0.894
0.25	0.870
0.30	0.842
0.35	0.810
0.40	0.775
0.45	0.734
0.50	0.687
0.55	0.630
0.60	0.563
0.65	0.489
0.70	0.413
0.75	0.333
0.80	0.252
0.85	0.170
0.90	0.089
0.95	0.026
1.00	0.000

Y_p B_B	P_{Bp}
0.00	0.844
0.05	0.794
0.10	0.744
0.15	0.694
0.20	0.644
0.25	0.594
0.30	0.544
0.35	0.494
0.40	0.444
0.45	0.394
0.50	0.344
0.55	0.297
0.60	0.253
0.65	0.211
0.70	0.171
0.75	0.133
0.80	0.097
0.85	0.063
0.90	0.032
0.95	0.009
1.00	0.000

Y_s/B_B	P_{Bs}
0.00	0.000
0.05	0.009
0.10	0.032
0.15	0.063
0.20	0.097
0.25	0.133
0.30	0.171
0.35	0.211
0.40	0.253
0.45	0.297
0.50	0.344
0.55	0.394
0.60	0.444
0.65	0.494
0.70	0.544
0.75	0.594
0.80	0.644
0.85	0.694
0.90	0.744
0.95	0.794
1.00	0.844

8 Alternative designs

(1) Rule 121A.10D(3) and this Schedule utilise a simplified probabilistic approach where a summation is carried out over the contributions to the mean outflow from each cargo tank; more rigorous calculations may be appropriate for sloping bulkheads, a pronounced hull curvature and certain designs such as those characterised by the occurrence of steps or recesses in bulkheads or decks.

(2) In such cases, one of the following calculation procedures may be applied –

(a) side and bottom damage probabilities may be calculated with more precision through the application of hypothetical sub-compartments;[7]

(b) side and bottom damage probabilities may be calculated through direct application of the probability density functions contained in guidelines developed by the IMO for the approval of alternative methods of design and construction of oil tankers;[8] or

(c) oil outflow performance may be evaluated in accordance with the method described in the those guidelines.

9 Other piping arrangements

Credit, for reducing oil outflow, through the use of an emergency rapid cargo transfer system, or other system, arranged to mitigate oil outflow in the event of an accident, may be

[7] Refer to the explanatory notes on matters related to the accidental oil outflow performance, adopted by the International Maritime Organization by resolution MEPC.122(52).

[8] Refer to the Revised Interim Guidelines for the approval of alternative methods of design and construction of oil tankers adopted by the Marine Environment Protection Committee of the International Maritime Organization in resolution MEPC.110(49).

taken into account, only after the effectiveness and safety aspects of the system are approved by the International Maritime Organization.