PART II RULES FOR THE CONSTRUCTION AND CLASSIFICATION OF SHIPS IDENTIFIED BY THEIR MISSIONS

TITLE 32 OIL TANKERS

SECTION 1 NAVAL ARCHITECTURE

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CHAPTER A
APPROACH

CHPATER CONTENTS

A1. APPLICATION

100. Cargo types

101. The requirements of the present Part II, Title 32 apply to all ships destined to the transportation of:

a. Oil or petroleum in bulk, Class 3, class notations K2 for flammable products having a flash point of 60°C, closed cup test, or below but not under 23°C;

b. Oil or petroleum products with class notation K3, having a flash point, closed cup test, exceeding 60°C but under 100°C;

Note: refer to Part II, Title 31

102. The requirements for which vessels K2 and K3 are to comply are explicit in each Chapter, Subchapter or Item.

103. The list of oils covered by this title is presented in Table T.A1.102.1 below, reproduced from Appendix I of MARPOL 73/78 as amended, with the exception of naphtha solvent substances regarded as being covered by Part II, Title 33 of these rules.

TABLE T.A1.102.1 - LIST OF OILS

Product
Asphalt solutions
Blending stocks
Roofers flux
Straight run residue
Oils
- Clarified
- Crude oil
- Mixtures containing crude oil
- Diesel oil
- Fuel oil no. 4
- Fuel oil no. 5
- Fuel oil no. 6
- Residual fuel oil
- Road oil
- Transformer oil
- Aromatic oil (excluding vegetable oil)
- Lubricating oils and blending stocks
- Mineral oil
Product
- Motor oil
- Penetrating oil
- Spindle oil
- Turbine oil
Gas oil
- Cracked
Gasoline blending stocks
- Alkylates - fuel
- Reformates
- Polymer - fuel
Gasolines
- Casinghead (natural)
- Automotive
- Aviation
- Straight run
- Fuel oil no. 1 (kerosene)
- Fuel oil no. 1-D
- Fuel oil no. 2
- Fuel oil no. 2-D
Distillates
- Straight run
- Flashed feed stocks
Jet fuels
- JP-1 (kerosene)
- JP-3
- JP-5 (kerosene, heavy)
- JP-4
- Turbo fuel
- Kerosene
- Mineral spirit

Guidance

Definition of products on the list of oils

Roofers flux *is an asphalt produced from the distillation of crude oil that is used specifically in the manufacture of roofing products.*

Jet A *is a kerosene grade fuel, normally only available in the U.S.A. It has the same flash point as Jet A-1 but a higher freeze point maximum (-40°C). It is supplied against the ASTM D1655 (Jet A) specification*

Jet A-1 *is a kerosene grade of fuel suitable for most turbine aircraft. It has a flash point minimum of 38 degrees C (100°F) and a freeze point maximum of -47 degrees C. The main specifications for Jet A-1 grade are the UK specification DEF STAN 91-91 (Jet A-1) Nato code F-35, (formerly DERD 2494) and the ASTM specification D1655 (Jet A-1)*

Jet B *is a distillate covering the naphtha and kerosene fractions. It can be used as an alternative to Jet A-1 but because it is more difficult to handle (higher flammability), there is only significant demand in very cold climates where its better cold weather performance is important. ASTM have a specification for Jet B but in Canada it is supplied against the Canadian Specification CAN/CGSB 3.23*

JP-4 *used to be the primary jet fuel for the USAF but was phased out in the 1990s because of safety problems. A few airforces around the world still use it but there is very little production.* ***JP-4 is the military equivalent of Jet B*** *with the addition of corrosion inhibitor and anti-icing additives; it meets the requirements of the U.S. Military Specification MIL-PRF-5624S Grade JP-4. The UK Military specification for this grade is DEF STAN 91-88 AVTAG/FSII (formerly DERD 2454),where FSII stands for Fuel Systems Icing Inhibitor. NATO Code F-40.*

JP-5 *is a high flash point kerosene meeting the requirements of the U.S. Military Specification MIL-PRF-5624S Grade JP-5. The UK Military specification for this grade is DEF STAN 91-86 AVCAT/FSII (formerly DERD 2452). This is primarily jet fuel for use in aircraft carriers. NATO Code F-44.*

JP-8 is the military equivalent of Jet A-1 *with the addition of corrosion inhibitor and anti-icing additives; it meets the requirements of the U.S. Military Specification MIL-T-83188D. It is the dominant military jet fuel grade for NATO air forces. The UK also have a specification for this grade namely DEF STAN 91-87 AVTUR/FSII (formerly DERD 2453). NATO Code F-34.*

White spirit *(UK) or* ***mineral spirits*** *(US), also known as mineral turpentine, turpentine substitute, petroleum spirits, solvent naphtha (petroleum) or Stoddard solvent, is a paraffin-derived clear, transparent liquid which is a common organic solvent used in painting and decorating. Flammable, Class 3, Auto-Ignition Temperature: 245°C (473°F), Flash Point closed cup = 38°C (100.4°F), Flammable Limits: lower: 1%*

End of guidance

A2. DEFINITIONS

100. Terms

101. In addition to the terms defined in Part II, Title 11, Section 1, Chapter A2.100, the following terms are defined in this Section:

102. **Cargo Area** - the cargo area is that part of the ship that contains cargo tanks as well as slop tanks, cargo pump rooms including pump rooms, cofferdams, ballast or void spaces adjacent to cargo tanks or slop tanks as well as deck areas throughout the entire length and breadth of the part of the ship above these spaces.

The cargo area above the deck is defined as follows:

Forward:

The area covered by a plane starting at the forward bulkhead of the foremost cofferdam and running aft at an angle of 45 degrees up to a height of 3 meters above the deck, limited at the sides by the side shell;

In case there is no cofferdam between the foremost cargo tank and the fore peak tank, the plane will start from the bow and encompass the deck area of the fore peak tank.

Aft

The area covered by a plane starting at the after bulkhead of the cofferdam between the Engine Room and the aft cargo tank running forward at an angle of 45 degrees up to 3 meters above the deck, limited at the sides by the side shell. The cargo pump room may be accepted as a cofferdam;

In case there is no cofferdam between the aftermost cargo tank and the Engine Room, the plane will start from the forward bulkhead of the Engine Room;

In case of a non-propelled oil tanker barge, the plane will start from the after bulkhead of the cofferdam (or pump room) between the aftermost cargo tank and the aft peak tank running forward at an angle of 45 degrees up to 3 metres above the deck, limited at the sides by the side shell; however, in case there is no cofferdam between the aftermost cargo tank and the aft peak tank, the plane will start from the stern and encompass the deck area of the aft peak tank.

At air vents, inlets and outlets:

Spheres with the following radius, counted from the following openings:

a. 1 meter from ventilation openings of cofferdams;

b. 1 metre from pump room entrances;

c. 2 metres from vents of cargo tanks; and

d. 3 metres from ventilation openings of cargo pump room space

e. transverse planes forming 45º angle forward with the deck, from the extreme aft bulkhead of cofferdam or pump room, and forming an angle of 45º afterward with the deck, from the extreme forward bulkhead of cofferdam or the forward pump room;

When independent tanks are installed in hold spaces, the cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forwardmost hold space are excluded from the cargo area.

103. **Cargo pump space** or **pump room** designates a compartment located in the cargo area, containing pumps and their accessories operating with products covered by this Title.

104. **Cargo service spaces** designate compartments located in the cargo area used as workshops, store rooms, of more than 2 m^2 of area, used for cargo handling equipment.

105. **Clean ballast** means the ballast in a tank which since oil was last carried therein, has been so cleaned that effluent therefrom 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 approved oil discharge monitoring and control system evidence based on such a system to the effect that the oil content of the effluent did not exceed 15 parts per million shall be determinative that the ballast was clean, notwithstanding the presence of visible traces;

106. **Cofferdam** means the spaces between two bulkheads or decks primarily designed as a safeguard against leakage of oil from one compartment to another .

107. **Control station** designates compartments into which the ship's radio equipment, or navigation equipment, or the emergency source of power is located or where the equipment or fire control is located. Are not included in this definition are special fire control equipment which may be located in the cargo area.

108. **Crude oil** means any liquid mixture of hydrocarbons occurring naturally on Earth, whether or not treated to render it suitable for carriage, and covers:

a. crude oil from which may have been set aside certain parts distilled; and

b. crude oil to which may have been added certain distilled parts.

109. **Crude oil tanker** means an oil tanker engaged in the trade of carrying crude oil.

110. **Flash point** means the temperature in degrees Celsius in which a product will vaporize to form an ignitable mixture. The values provided in this Title of the Rules are obtained from "closed cup test".

111. **Fuel oil** means any oil used as fuel for ignition of the propulsion and auxiliary machinery of the ship in which the oil is being carried

112**. Hazardous area:** area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus;

a. **Zone 0:** area in which an explosive gas atmosphere is present continuously or is present for long periods;

b. **Zone 1:** area in which an explosive gas atmosphere is likely to occur in normal operation;

c. **Zone 2:** area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only;

d. **Extended hazardous area**: area in which an explosive atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only (and comparable with zone 2 as defined in IEC 60092-502).

113. **Independent** means a line of pipe or ventilation system, for example, which is not in any way connected with any other system and where there are no provisions available for potential connection with other systems.

114. **Machinery space –** See Part II, Title 11, Section 1, Chapter A2., definition 11.

115. **Machinery space class A** See Part II, Title 11, Section 1, Chapter A2., definition 12.

116. **MARPOL** means the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (as amended).

117. **Non-sparking fan a** fan is considered as non-sparking if in either normal or abnormal conditions it is unlikely to produce sparks. For this purpose, the following criteria are to be met:

a. Design criteria

The air gap between the impeller and the casing is to be not less than 1/10 of the shaft diameter in way of the impeller bearing and in any case not less than 2 mm, but need not exceed 13 mm

Protective screens with square mesh of not more than 13 mm are to be fitted to the inlet and outlet of ventilation ducts to prevent objects entering the fan housing.

b. Materials

The impeller and the housing in way of the impeller are to be made of spark-proof materials which are recognised as such by means of an appropriate test to the satisfaction of the RBNA.

Electrostatic charges, both in the rotating body and the casing, are to be prevented by the use of antistatic materials. Furthermore, the installation on board of ventilation units is to be such as to ensure their safe bonding to the hull

c. Tests may not be required for fans having the following material combinations:

- impellers and/or housings of non-metallic material, due regard being paid to the elimination of static electricity

- impellers and housings of non-ferrous materials

- impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on

which a ring of suitable thickness of non-ferrous material is fitted in way of the impeller

- any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm design tip clearance.

d. The following impeller and housing combinations are considered as sparking and therefore are not allowed:

- impellers of an aluminium alloy or a magnesium alloy and a ferrous housing, regardless of tip clearance

- housings made of an aluminium alloy or a magnesium alloy and a ferrous impeller, regardless of tip clearance

- any combination of ferrous impeller and housing with less than 13 mm design tip clearance.

e. Complete fans are to be type-tested in accordance with either the RBNA's requirements or national or international standards accepted by the RBNA.

118**.** **Oil tanker** means a ship built or adapted primarily to carry mainly bulk oil in its cargo spaces, and includes ore-oil ships, any "NLS tanker", as defined in annex II to the MARPOL Convention, and any "gas carrier vessel", as defined in regulation 3.20 of Chapter II-1 of SOLAS 74 (as amended), when carrying a load, or a part of the loadbulk oil.

119. **Oily mixture** means a mixture with any oil content.

120. **Ore-bulk-oil tanker** means a ship engaged in the trade of carrying oil or solid cargoes in bulk.

121. **Products tanker** means an oil tanker engaged in the trade of carrying oil other than crude oil.

122. **Segregated ballast** Segregated ballast means the ballast water introduced into a tank which is completely separated from the cargo oil and fuel oil system and which is permanently allocated to the carriage of ballast or to the carriage of ballast or cargoes other than oil or noxious substances as defined in MARPOL Annex II.

123. **Slop tank** means a tank specifically designated for the collection of tank draining, tank washings and other oily mixtures.

124. **Void:** An enclosed empty space in a ship external to a cargo tank other than a cargo hold, ballast compartment, fuel oil tank, cargo pump room, pump room or any other space commonly used by the crew.

A3. BASIC PRINCIIPLES

100. Risk of fire

101. See Part II, Title 11, Section 3, Chapter E2 of these Rules for general requirements , and in the Part II, Title 32, Section 3, Chapter E2 for additional requirements for oil tankers. The recommendations of the SOLAS 74/78 Convention, as amended, having as objective:

a. Segregate cargo oil from its ignition sources;

b. Reduce the flammability of cargo oil vapor and mixtures;

c. Observe the safety of electrical equipment in hazardous areas;

d. Provide effective means of extinguishing fires which may break out.

200. Risks of pollution from the cargo

201. These requirements follow the recommendations of Annex I of MARPOL, aiming to:

a. segregate the ballast and the ballast pipes from contamination by the cargo in tanks or pipe lines;

b. provide effective means of tank cleaning;

c. provide means of processing and discharging of contaminated water tanks.

300. Spaces adjacent to tanks

301. Tanks and spaces separated from the cargo tanks by a single deck or bulkhead are at risk of being contaminated by vapour or cargo due to possible failures in their partition surfaces, as well as the pipes serving such spaces that, as such, are considered risk zones. These pipes shall not penetrate into the machinery spaces.

302. The fuel oil tanks of the ship's machinery and their pipes are excluded from these requirements.

CHAPTER B
DOCUMENTS, REGULATIONS AND STANDARDS

CHAPTER CONTENTS

B1. DOCUMENTS TO THE RBNA

100. Documents of reference
– See Title 11

200. Documents for approval

201. In addition to the information required in Part II, Title 11, Section 1 the documents shall contain the specifications of the products to be carried.

300. Documents for construction

301. In addition to the requirements of Part II, Title 11, Section 1, the following documents shall be presented for approval:

a. Booklet with details of standard parts of pipe lines;

b. General Arrangement showing the location of cargo pump room, the cargo pumps and the cargo tanks;

c. Pumping system and stripping of cargo tanks;

d. Cargo heating system;

e. Arrangement of the cargo pumps, including movers and seals of shafts that cross through bulkheads;

f. cargo spaces Ventilation

g. keel duct Ventilation;

h. gas detection System of the cargo space and duct keel;

i. Hull drainage system for cargo pump rooms and cofferdams

j. Segregated ballast system or ballast system, as applicable;

k. Ventilation system and gas freeing of cargo tanks including details of pressure and vacuum valves – PV;

l. Inert gas system including the generator unit, appliances for monitoring and control of distribution piping.

m. Vapou r emission control system;

n. Crude oil washing system – COW and operation manual;

o. Fixed system of foam for fire fighting on deck;

p. Fixed fire-extinguishing system in the cargo pump room; and

q. Plan of risk zones, electrical equipment, electrical systems and installations (see Part II, Title 32, Section 7).

B2. REGULATIONS

100. National RBNA for oil carriers with GT < 500

101. Ships under 500 GT are to comply with the requirements of NORMAM 01.

102. The RBNA can, by agreement, to certify compliance with other national regulations.

200. Regulation for ships with GT ≥ 500

201. These Rules are substantially in agreement with the IMO - SOLAS regulations, MARPOL as well as conventions and applicable codes.

300. – See Title 11

400. – See Title 11

CHAPTER E
CONFIGURATIONS

CHAPTER CONTENTS

E2. CARGO AREA OF TANKERS

Guidance
Items 101 to 105 applicable to ships having class notation K2.
End of guidance

100. Separation of cargo oil tanks [SOLAS II-2/5]

101. Cargo pump-rooms, cargo tanks, slop tanks and cofferdams shall be positioned forward of machinery spaces. However, oil fuel bunker tanks need not be forward of machinery spaces.

102. Cargo tanks and slop tanks shall be isolated from machinery spaces by cofferdams, cargo pump-rooms, oil bunker tanks or ballast tanks.

103. Pump-rooms containing pumps and their accessories for ballasting those spaces situated adjacent to cargo tanks and slop tanks and pumps for oil fuel transfer, shall be considered as equivalent to a cargo pump-room within the context of this regulation provided that such pump-rooms have the same safety standard as that required for cargo pump-rooms.

104. Pump-rooms intended solely for ballast or oil fuel transfer, however, need not comply with the requirements of Part II, Title 11, Section 3, E.10.800

105. The lower portion of the pump-room may be recessed into machinery spaces of category A to accommodate pumps, provided that the deck head of the recess is in general not more than one third of the moulded depth above the keel, except that in the case of ships of not more than 25,000 tonnes deadweight, where it can be demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, the RBNA may allow a recess in excess of such height, but not exceeding one half of the moulded depth above the keel.

106. Main cargo control stations, control stations, accommodation and service spaces (excluding isolated cargo handling gear lockers) shall be positioned aft of cargo tanks, slop tanks, and spaces which isolate cargo or slop tanks from machinery spaces, but not necessarily aft of the oil fuel bunker tanks and ballast tanks, and shall be arranged in such a way that a single failure of a deck or bulkhead shall not allow the entry of gas or fumes from the cargo tanks into an accommodation space, main cargo control stations, control station, or service spaces. A recess provided in accordance with paragraph E2.105 need not be taken into account when the position of these spaces is being determined.

107. However, where deemed necessary, the RBNA may allow main cargo control stations, control stations, accommodation and service spaces forward of the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces, but not necessarily forward of oil fuel bunker tanks or ballast tanks. Machinery spaces, other than those of category A, may be allowed forward of the cargo tanks and slop tanks provided they are isolated from the cargo tanks and slop tanks by cofferdams, cargo pump-rooms, oil fuel bunker tanks or ballast tanks, and have at least one portable fire extinguisher.

108. In cases where they contain internal combustion machinery, one approved foam-type extinguisher of at least 45 litres capacity or equivalent shall be arranged in addition to portable fire extinguishers. If operation of a semi-portable fire extinguisher is impracticable, this fire extinguisher may be replaced by two additional portable fire extinguishers. Accommodation spaces, main cargo control spaces, control stations and service spaces shall be arranged in such a way that a single failure of a deck or bulkhead shall not allow the entry of gas or fumes from the cargo tanks into such spaces. In addition, where deemed necessary for the safety or navigation of the ship, the RBNA may allow machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 kW to be located forward of the cargo area provided the arrangements are in accordance with the provisions of this paragraph.

109. In combination carriers only:

a. The slop tanks shall be surrounded by cofferdams except where the boundaries of the slop tanks, where slop may be carried on dry cargo voyages, are part of the hull, main cargo deck, cargo pump-room bulkhead or oil fuel bunker tank. These cofferdams shall not be open to a double bottom, pipe tunnel, pump-room or other enclosed space, nor shall they be used for cargo or ballast and shall not be connected to piping systems serving oil cargo or ballast. Means shall be provided for filling the cofferdams with water and for draining them. Where the boundary of a slop tank is part of the cargo pump-room bulkhead, the pump-room shall not be open to the double bottom, pipe tunnel or other enclosed space; however, open-

ings provided with gastight bolted covers may be allowed;

b. Means shall be provided for isolating the piping connecting the pump-room with the slop tanks referred to in paragraph E2.109 above. The means of isolation shall consist of a valve followed by a spectacle flange or a spool piece with appropriate blank flanges. This arrangement shall be located adjacent to the slop tanks, but where this is unreasonable or impracticable, it may be located within the pump-room directly after the piping penetrates the bulkhead. A separate permanently installed pumping and piping arrangement incorporating a manifold, provided with a shut-off valve and a blank flange, shall be provided for discharging the contents of the slop tanks directly to the open deck for disposal to shore reception facilities when the ship is in the dry cargo mode. When the transfer system is used for slop transfer in the dry cargo mode, it shall have no connection to other systems. Separation from other systems by means of removal of spool pieces may be accepted;

c. Hatches and tank cleaning openings to slop tanks shall only be allowed on the open deck and shall be fitted with closing arrangements. Except where they consist of bolted plates with bolts at watertight spacing, these closing arrangements shall be provided with locking arrangements under the control of the responsible ship' s officer; and

d. Where cargo wing tanks are provided, cargo oil lines below deck shall be installed inside these tanks. However, the RBNA may allow cargo oil lines to be placed in special ducts provided there are capable of being adequately cleaned and ventilated to the satisfaction of the RBNA. Where cargo wing tanks are not provided, cargo oil lines below deck shall be placed in special ducts.

110. Where the fitting of a navigation position above the cargo area is shown to be necessary, it shall be for navigation purposes only and it shall be separated from the cargo tank deck by means of an open space with a height of at least 2 m. The fire protection requirements for such a navigation position shall be that required for control stations, as specified in regulation Part II, Title 11, Chapter E, E9.500 and other provisions for tankers, as applicable.

111. Means shall be provided to keep deck spills away from the accommodation and service areas. This may be accomplished by provision of a permanent continuous coaming of a height of at least 300 mm, extending from side to side. Special consideration shall be given to the arrangements associated with stern loading.

201. Permanent approved gastight lighting enclosures for illuminating cargo pump-rooms may be allowed in bulkheads and decks separating cargo pump-rooms and other spaces provided they are of adequate strength and the integrity and gas-tightness of the bulkhead or deck is maintained.

202. The arrangement of ventilation inlets and outlets and other deckhouse and superstructure boundary space openings shall be such as to complement the provisions of E2.300. Such vents, especially for machinery spaces, shall be situated as far aft as practicable. Due consideration in this regard shall be given when the ship is equipped to load or discharge at the stern. Sources of ignition such as electrical equipment shall be so arranged as to avoid an explosion hazard.

300. Cargo tank venting

301. **General requirements:** The venting systems of cargo tanks are to be entirely distinct from the air pipes of the other compartments of the ship. The arrangements and position of openings in the cargo tank deck from which emission of flammable vapours can occur shall be such as to minimize the possibility of flammable vapours being admitted to enclosed spaces containing a source of ignition, or collecting in the vicinity of deck machinery and equipment which may constitute an ignition hazard. In accordance with this general principle, the criteria in paragraphs

302. **Venting arrangements**

a. The venting arrangements in each cargo tank may be independent or combined with other cargo tanks and may be incorporated into the inert gas piping.

b. Where the arrangements are combined with other cargo tanks, either stop valves or other acceptable means shall be provided to isolate each cargo tank. Where stop valves are fitted, they shall be provided with locking arrangements which shall be under the control of the responsible ship’s officer. There shall be a clear visual indication of the operational status of the valves or other acceptable means. Where tanks have been isolated, it shall be ensured that relevant isolating valves are opened before cargo loading or ballasting or discharging of those tanks is commenced. Any isolation must continue to allow the flow caused by thermal variations in a cargo tank.

c. If cargo loading and ballasting or discharging of a cargo tank or cargo tank group is intended, which is isolated from a common venting system, that cargo tank or cargo tank group shall be fitted with a means for over-pressure or under-pressure.

d. The venting arrangements shall be connected to the top of each cargo tank and shall be self-draining to the cargo tanks under all normal conditions of trim and list of the ship. Where it may not be possible to provide self-draining lines, permanent arrangements shall be provided to drain the vent lines to a cargo tank.

303. **Safety devices in venting systems**: The venting system shall be provided with devices to prevent the passage of flame into the cargo tanks. The design, testing and locating of these devices shall comply with the requirements estab-

lished by the RBNA based on the guidelines developed by the Organization*. Ullage openings shall not be used for pressure equalization. They shall be provided with self-closing and tightly sealing covers. Flame arresters and screens are not allowed in these openings.

Gu*ideline*

** Refer to the Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers (MSC/Circ.677), as amended by MSC/Circ.1009, and to the Revised factors to be taken into consideration when designing cargo tank venting and gas-freeing arrangements (MSC/Circ.731).*

End of guideline

400. Vent outlets for cargo handling and ballasting

401. Vent outlets for cargo loading, discharging and ballasting shall:

a. allow the free flow of vapour mixtures; or

b. allow the throttling of the discharge of the vapour mixtures to achieve a velocity of not less than 30 m/s;

402. Be so arranged that the vapour mixture is discharged vertically upwards;

403. Where the method is by free flow of vapour mixtures, be such that the outlet shall be not less than 6 m above the cargo tank deck or fore and aft gangway if situated within 4 m of the gangway and located not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard; and

404. where the method is by high-velocity discharge, be located at a height not less than 2 m above the cargo tank deck and not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard. T hese outlets shall be provided with high velocity devices of an approved type.

a. The arrangements for the venting of vapours displaced from the cargo tanks during loading and ballasting shall comply with E3.300 and regulation 11.6 and shall consist of either one or more mast risers, or a number of high-velocity vents. The inert gas supply main may be used for such venting.

405. **Isolation of slop tanks in combination carriers:** In combination carriers, the arrangements for isolating slop tanks containing oil or oil residues from other cargo tanks shall consist of blank flanges which will remain in position at all times when cargoes other than liquid cargoes are carried.

500. Ventilation

501. **Ventilation systems in cargo pump-rooms**
Cargo pump-rooms shall be mechanically ventilated and discharges from the exhaust fans shall be led to a safe place on the open deck. The ventilation of these rooms shall have sufficient capacity to minimize the possibility of accumulation of flammable vapours. The number of air changes shall be at least 20 per hour, based upon the gross volume of the space. The air ducts shall be arranged so that all of the space is effectively ventilated. The ventilation shall be of the suction type using fans of the non-sparking type.

502. **Ventilation systems in combination carriers**
In combination carriers, cargo spaces and any enclosed spaces adjacent to cargo spaces shall be capable of being mechanically ventilated. The mechanical ventilation may be provided by portable fans. An approved fixed gas warning system capable of monitoring flammable vapours shall be provided in cargo pump-rooms, pipe ducts and cofferdams, as referred to in E2.109, adjacent to slop tanks. Suitable arrangements shall be made to facilitate measurement of flammable vapours in all other spaces within the cargo area. Such measurements shall be made possible from the open deck or easily accessible positions.

E3. GENERAL ARRANGEMENT OF THE SHIP REGARDING FIRE PREVENTION AND CREW SAFETY

Guidance

Items E3.200 to E3.400 are applicable to ships having class notation K2.

In the case of ships having the service notations oil tanker K3, flash point > 60°C the items E3.200 to E3.400 apply except that the location and separation of spaces is not required to comply with the requirements E3.200 to E3.400.

However, the following provisions are to be complied with:

a. Tanks containing cargo or cargo residues are to be segregated from accommodation, service and machinery spaces, tanks containing drinking water and stores for human consumption by means of a cofferdam or similar space.

b. Double bottom tanks adjacent to cargo tanks are not to be used as fuel oil tanks.

c. Means are to be provided to keep deck spills away from accommodation and service areas.

End of guidance

100. Forward and aft peak tanks

101. The forward and aft peak tanks are not to be used as cargo tanks. Double bottom tanks adjacent to cargo tanks are not to be used as fuel tanks.

200. Cargo pump room

201. The cargo pump rooms are to be separated from the other spaces of the ship by cofferdams or A-60 oil-tight bulkheads and are not to have, in particular, any direct communications with the machinery spaces.

a. The pump room is to be fitted with a high level bilge alarm;

b. The pump room is to be fitted with a gas detection system located at the bottom of the compartment, triggering a visual and sound alarm on the bridge when the concentration of gases reaches 10% of the lower explosive limit, differing from other alarms;

300. Machinery spaces

301. Machinery spaces are to be positioned aft of cargo tanks and slop tanks; they are also to be situated aft of cargo pump rooms and cofferdams, but not necessarily aft of the fuel oil bunker tanks.

302. Any machinery space is to be isolated from cargo tanks and slop tanks by cofferdams, cargo pump rooms, fuel oil bunker tanks or ballast tanks

303. Pump rooms containing pumps and their accessories for ballasting those spaces situated adjacent to cargo tanks and slop tanks and pumps for fuel oil transfer are to be considered as equivalent to a cargo pump room provided that such pump rooms have the same safety standard as that required for cargo pump rooms.

304. However, the lower portion of the pump room may be recessed into machinery spaces of category A to accommodate pumps, provided that the deck head of the recess is in general not more than one third of the moulded depth above the keel, except that in the case of ships of not more than 25000 t deadweight, where it can be demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, the RBNA may allow a recess in excess of such height, but not exceeding one half of the moulded depth above the keel.

400. Accommodation spaces, service spaces and control stations

401. Accommodation spaces, main cargo control stations, control stations and service spaces (excluding isolated cargo handling gear lockers) are to be positioned aft of cargo tanks, slop tanks, and spaces which isolate cargo or slop tanks from machinery spaces but not necessarily aft of the fuel oil bunker tanks and ballast tanks, but be arranged in such a way that a single failure of a deck or bulkhead not allow the ingress of gas or fumes from the cargo tanks into an accommodation space, main cargo control stations, control station, or service spaces. A recess provided in accordance with E3.300 need not be taken into account when the position of these spaces is being determined.

402. However, where deemed necessary, the RBNA may allow accommodation spaces, main cargo control stations, control stations, and service spaces forward of the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces, but not necessarily forward of fuel oil bunker tanks or ballast tanks.

a. Machinery spaces, other than those of category A, may be allowed forward of the cargo tanks and slop tanks provided they are isolated from the cargo tanks and slop tanks by cofferdams, cargo pump rooms, fuel oil bunker tanks or ballast tanks.

b. All of the above spaces are to be subject to an equivalent standard of safety and appropriate availability of fire-extinguishing arrangements being provided to the satisfaction of the RBNA.

c. Accommodation spaces, main cargo control spaces, control stations and service spaces are to be arranged in such a way that a single failure of a deck or bulkhead not allow the entry of gas or fumes from the cargo tanks into such spaces.

d. In addition, where deemed necessary for the safety or navigation of the ship, the RBNA may allow machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 kW to be located forward of the cargo area provided the arrangements are in accordance with the provisions of this paragraph.

403. Where the fitting of a navigation position above the cargo area is shown to be necessary, it shall be for navigation purposes only and shall be separated from the cargo tank deck by means of an open space with a height of at least 2 m. The fire protection of such navigation position shall be in addition as required for control spaces in Ch 7, Sec 6 and other provisions, as applicable, of this Chapter.

404. Means be provided to keep deck spills away from the accommodation and service areas. This may be accomplished by provision of a permanent continuous coaming of a height of at least 300 mm, extending from side to side. Special consideration be given to the arrangements associated with stern loading.

Guidance

Note 1 : *The provisions of E3.404 above also apply to bow and stern cargo loading stations.*

End of guidance

405. Exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation, is to be constructed of steel and insulated to A-60 standard for the whole of the portions which face the cargo area and on the outward sides for a distance of 3 m from the end boundary facing the cargo area. The distance of 3 m is to be measured horizontally and parallel to the middle line of the ship from the boundary which faces the cargo area at each deck level. In the case of the sides of those superstructures and deckhouses, such insulation is to be carried up to the underside of the deck of the navigation bridge.

Guidance

Note 1 : *Service spaces and control stations (except the wheelhouse) located in superstructures and deckhouses enclosing accommodation are to comply with the provisions of E3.405.*

End of guidance

406. The location and arrangement of the room where foods are cooked are to be selected such as to minimize the risk of fire.

E4. ACCESSES AND OPENINGS

Guidance

For ships under 500 GT with notation K2 ESP, Subvhapter E4 , items E4.100 to E4.500 are applicable.

For ships with class notation K3 the access and openings are not required to comply with the provisions of E4.200 . However, the access doors, air inlets and openings to accommodation spaces, service spaces and control stations are not to face the cargo area.

For ships with notation ESP with GT equal to or over 500 Subchapter E4 , items E4.100, E4.300, E4.400 and E4.500 are applicable, and are to comply as well with the International Convention for Safety of Life at Sea (SOLAS) 1974/1988 as amended, Chapter II-1, Part A, Rules 3 a 6, for details and arrangements of openings and attachments to the hull structure.

End of guidance.

100. Access and openings to accommodation spaces, service spaces, control stations and machinery spaces

101. Except as allowed in E4.102 access doors, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces are not to face the cargo area. They are to be located on the transverse bulkhead not facing the cargo area or on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance need not exceed 5 m.

102. RBNA may allow access doors in boundary bulkheads facing the cargo area or within the 5 m limits specified in E4.101 to main cargo control stations and to such service spaces used as provision rooms, store-rooms and lockers, provided they do not give access directly or indirectly to any other space containing or providing for accommodation, control stations or service spaces such as galleys, pantries or workshops, or similar spaces containing sources of vapour ignition. The boundary of such a space is to be insulated to "A-60" class standard, with the exception of the boundary facing the cargo area. Bolted plates for the removal of machinery may be fitted within the limits specified in D5.501. Wheelhouse doors and windows may be located within the limits specified in E4.101 so long as they are designed to ensure that the wheelhouse can be made rapidly and efficiently gas tight and vapour tight..

Guidance

Note 1 : *An access to a deck foam system room (including the foam tank and the control station) can be allowed within the limits mentioned in E4.101 provided that the conditions listed in E4.102 are satisfied and that the door is located flush with the bulkhead.*

Note 2 :*The navigating bridge door and windows are to be tested for gas tightness. If a water hose test is applied, the following test conditions are deemed acceptable by the RBNA:*

nozzle diametre: minimum 12 mm

water pressure just before the nozzle: not less than 2 bar,

distance between the nozzle and the doors or windows: maximum 1,5 m.

End of guidance

103. Windows and side scuttles facing the cargo area and on the side of the superstructures and deckhouses within the limits specified in E4.101 are to be of the fixed (non-opening) type. Such windows and side scuttles, except wheelhouse windows, are to be constructed to "A-60" class standard.

104. Air intakes and air outlets of machinery spaces are to be located as far aft as practicable and, in any case, outside the limits stated in E4.101 above.

105. Where the ship is designed for bow or stern loading and unloading, entrance, air inlets and openings to accommodation, service and machinery spaces and control stations are not to face the cargo shore connection location of bow or stern loading or unloading arrangements. They are to be located on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship but not less than 3 m from the end of the deckhouse facing the cargo shore connection location of the bow or stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore connection location and on the sides of the superstructure or deckhouse within the distance mentioned above are to be of the fixed (non-opening) type. In addition, during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deckhouse side are to be kept closed.

106. The access and openings for ships of class service notation K3 are not required to comply with the provisions of E4.101. However, the access doors, air inlets and openings to accommodation spaces, service spaces and control stations are not to face the cargo area.

107. Where, in the case of small ships, compliance with the provisions of E4.105 is not possible, the RBNA may allow departures

200. Access to spaces in the cargo area

201. Access to cofferdams, ballast tanks, cargo tanks and other compartments in the cargo area is to be direct from the open deck and such as to ensure their complete inspection. Access to double bottom compartments may be through a cargo pump room, pump room, deep cofferdam, pipe tunnel or similar compartments, subject to consideration of ventilation aspects.

202. Safe access to cofferdams, ballast tanks, cargo tanks and other compartments in the cargo area is to be direct from the open deck and such as to ensure their complete inspection. Safe access to double bottom compartments or to forward ballast tanks may be from a pump-room, deep cofferdam, pipe tunnel, double hull compartment or similar compartment not intended for the carriage of oil or hazardous cargoes

203. Access manholes to forward gas dangerous spaces are allowed from an enclosed gas-safe space provided that:

a. their closing means are gastight and

b. a warning plate is provided in their vicinity to indicate that the opening of the manholes is only allowed after checking that there is no flammable gas inside the compartment in question.

204. Unless other additional arrangements provided to facilitate their access are considered satisfactory by the RBNA, the double bottom tanks are to be provided with at least two separate means of access complying with E1.201 above.

205. For access through horizontal openings, hatches or manholes, the dimensions are to be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also provide a clear opening to facilitate the hoisting of an injured person from the bottom of the compartment.

206. For access through vertical openings, or manholes, in swash bulkheads, floors, girders and web frames providing passage through the length and breadth of the compartment, the minimum opening is to be not less than 600 mm x 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other foot holds are provided.

FIGURE F.E1.206.1 – ACCESS THROUGH VERTICAL OPENINGS

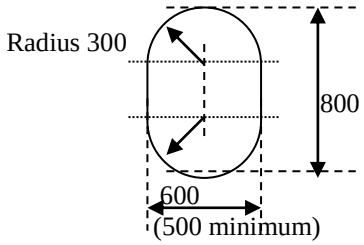
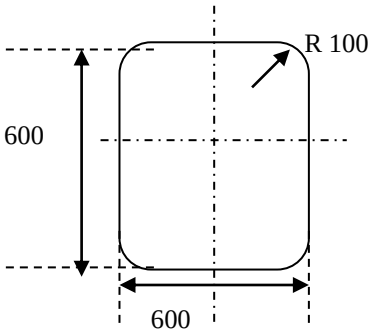


FIGURE F.E1.206.2 – ACCESS THROUGH HORIZONTAL OPENINGS



207. For oil tankers of less than 5000 t deadweight smaller dimensions may be approved by the RBNA in special circumstances, if the ability to traverse such openings or to remove an injured person can be proved to the satisfaction of the RBNA.

208. For oil tankers of less than 5,000 tonnes deadweight, the RBNA may approve, in special circumstances, smaller dimensions for the openings referred to in paragraphs a) and b), if the ability to traverse such openings or to remove an injured person can be proved to the satisfaction of the RBNA.

209. Access ladders of cargo tanks are to be fitted with handrails and to be securely attached to the tank structure. They are not to be fitted vertically, unless justified by the size of the tanks. Rest platforms are to be provided at suitable intervals of not more than 10 m.

300. Access to the pipe tunnels

301. The pipe tunnels in the double bottom are to comply with the following requirements:

a. they are not to communicate with the engine room,

b. provision is to be made for at least two exits to the open deck arranged at a maximum distance from each other. One of these exits fitted with a watertight closure may lead to the cargo pump room.

302. Where there is permanent access from a pipe tunnel to the main pump room, a watertight door is to be fitted and in addition with the following:

a. in addition to the bridge operation, the watertight door is to be capable of being manually closed from outside the main pump room entrance,

b. the watertight door is to be kept closed during normal operations of the ship except when access to the pipe tunnel is required.

303. A notice is to be affixed to the door to the effect that it may not be left open.

400. Other accesses

401. **Access to the forecastle spaces** containing sources of ignition may be allowed through doors facing cargo area provided the doors are located outside hazardous areas.

402. **Access to the bow** Every tanker is to be provided with the means to enable the crew to gain safe access to the bow even in severe weather conditions. Such means of access are to be approved by the RBNA.

601. **Tank cleaning openings** Ullage plugs, sighting ports and tank cleaning openings are not to be arranged in enclosed spaces. **[IACS UR F F3]**

500. Cofferdams

Guidance
Item 500 applicable to ships having class notation K2 and K3
End of guidance

501. Oil tight cofferdams adequately ventilated, having a width large enough for easy access, are to be fitted for the separation of all cargo tanks, of galleys below deck, accommodations, boiler compartments, general cargo compartments and machinery spaces containing propulsion machinery or wherever there is a source of ignition present.

502. Compartimentos de bombas destinados somente a lastro e tanques de óleo combustível podem ser considerados como coferdames em conformidade com estas Regras.

503. The cofferdam bulkheads adjacent to the cargo area shall be vertical, and shall extend up to the exposed deck in a single plane without any recesses.

504. Under specific conditions at RBNA discretion the pump room when located under deck may be considered as a cofferdam provied the requirements of E2.403above are complied with.

505. A cofferdam below deck shall have access only from the deck, and shall be watertight except for the ventilation openings.

507. In oil tankers engaged in the transportation of special cargo a cofferdam between a cargo tank and a fuel tank may be reruired at ERBNA discretion.

600. Compartments in hazardous zones

Guidance
Item 600 applicable to ships having class notation K2 and K3
End of guidance

601. The arrangement of cofferdams in the cargo area shall be designed to comply with the following requirements:

a. Ventilated;

b. Fitted with means to verify the presence of gases;

c. Accessible for inspection and cleaning;

700. Openings and passages in the bulkheads for piping, shafts and electric cables

Guidance
Item 700 applicable to ships having class notation K2 and K3
End of guidance

701. The boundary of cofferdams limiting cargo tanks are to be watertight.

702. No openings are allowed in the bulkheads limiting the cargo area and the cargo tanks.

703. Passage of shafts / cables through the bulkheads at the boundary of the Engine Room and a compartment in the cargo area or between the Engine Room and a compartment inside the cargo area are allowed provided the following conditions are complied with:

a. The sealing of the penetration of the shaft is gas tight, approved by RBNA;

b. Adequate operating instructions are posted;

c. Electric cable and pipe penetrations are to be gas tight and approved by RBNA;

d. Passages through an A-60 bulkhead as per SOLAS II.2 regulation 3 are equivalent to the bulkhead A-60 standard;

e. The bulkhead between the Engine Room and a service compartment in the cargo area may be penetrated by piping provided the piping has no opening inside the service compartment;

CHAPTER G
CAPACITIES AND COMPARTMENTING

CHAPTER CONTENTS

Guidance
Chapter G in its entirety is applicable to ships having class notation: K2 and K3.
End of guidance

G1. SUBDIVISION OF THE HULL
[MARPOL Annex 1, Chapter 4, Regulation 19]

100. Main transverse bulkheads
- See Title 11

200. Double-hull– protection of cargo tank in the event of stranding, collision or leak

201. The vessels covered by this Title with GT>500 and deadweight smaller 5000 TDW, shall be built with double bottom and double side shell in the region of the cargo tanks.

202. It is not allowed the carriage of oil in any space forward of the collision bulkhead Fwd or abaft of the Aft collision bulkhead.

G2. OIL TANKERS WITH 5000 T DEADWEGHT AND GREATER
[MARPOL ANNEX 1 REGULATION 19]

100. General

101. Every oil tanker with 5000 DWT tons deadweight and above the entire region of cargo tanks shall be protected by ballast tanks or by spaces not carrying fuel oil or oil cargo in accordance with the prescriptions that follow.

200. Wing tanks or spaces

201Wing tanks or spaces shall 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.

202. They shall be arranged such that the cargo tanks are located inboard of the moulded line of the side shell plating nowhere less than the distance w which, as shown in figure F.G2.301.1 is measured at any cross-section at right angles to the side shell, as specified below:
w = 0,5 + (TDW/20000) m

where TDW = deadweight
or
w = 2,0 m, whichever is lesser, with minimum value = 1,0 m.

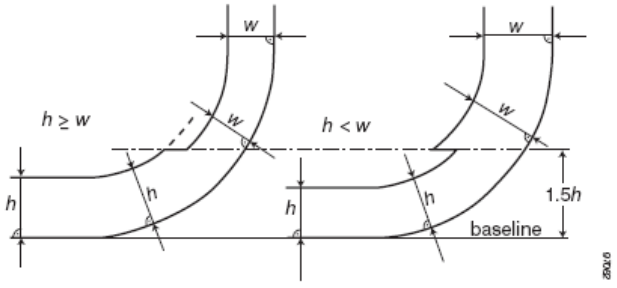
300. Tanks or spaces of the double bottom

301. At any cross-section, the height of a tank or double bottom space shall be such that the distance h between the bottom of the cargo tanks and the moulded line of the bottom plating, measured at right angles to the bottom plating as shown in Figure F.G2.301.1., is not less than the following value:

h = B/15 m
or
h = 2,0 m, whichever is lesser,

with minimum value = 1,0 m.

FIGUE F.G2.301.1 – BOUNDARY LINES OF THE-CARGO TANKS



302. The requirement of paragraph 301 above can be waived provided that the design of the tanker is such that the

cargo pressure plus the vapor exerted on the bottom plating forming a single boundary between the cargo and the sea does not exceed the external hydrostatic pressure as expressed in the following formula:

$$f * h_c * \rho_c * g + 100\Delta_p \leq d_n * \rho_s * g$$

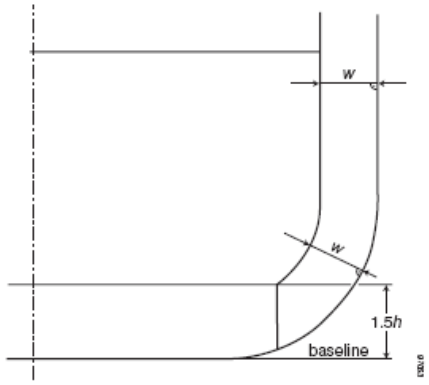
where:

f = safety factor = 1,1
h_c = cargo height in contact with the bottomplating, in metres
ρ_c = maximum density of the cargo, in t/m^3
g = standard acceleration gravity, 9,81 m/s^2
Δ_p = maximum pressure of regulation of the valve PV, in bars
d_n = minimum draft of operation under any conditions of cargo expected, in metres
ρ_s = water density, in t/m^3

303. Any horizontal partition necessary to fulfil the above requirement shall be situated at a height not less than B/6 or 6 m, whichever is less, but not more than 0,6 D above the baseline, where D is the moulded depth amidships.

304. The location of wing tanks or spaces shall be as defined in paragraph 301. above, except that, below the level of 1.5 h above the baseline where h is defined as in the formula above, the cargo tank boundary line can be vertical up to the bottom plating, as shown in Figure F.G2.304.1.

FIGURA F.G2.304.1 – BOUNDARY LINES OF THE-CARGO TANKS BELOW 1,5 h



305. When the distances h and w were different (Figure F.G.2.302.1), the distance w shall have preference at levels greater than 1.5 h above the baseline, as shown in Figure F.G2.301.1.

306. Small wells in cargo tanks may get into the double bottom below the boundary line set by the distance h provided that such small wells are so small as possible and that the distance between the bottom of the slump tank and the vessel bottom plating is not less than 0.5 h. L

307. The cargo pump rooms shall be fitted with double bottom with height h above the baseline not less than that required in G2.301. above.

400. Size limitation of the tanks to ships with 5000 T deadweight or greater

401. For ships delivered in 1 January 2010 or after, as defined in Regulation 1.28.8 of the Annex I of the MARPOL 73/78, the maximum tank length and the accidental oil-spills shall be calculated in accordance with Regulation 23 of that Annex.

402. For ships delivered before 1 January 2010, as defined in Rule 1.28.8 of the Annex I of the MARPOL 73/78, the maximum tank length and the accidental spill of oil shall be calculated in accordance with Rules 25 and 26 of that Annex.

G3. OIL TANKERS WITH LESS THEN 5000 T DEADWEGHT AND GT ≥ 500

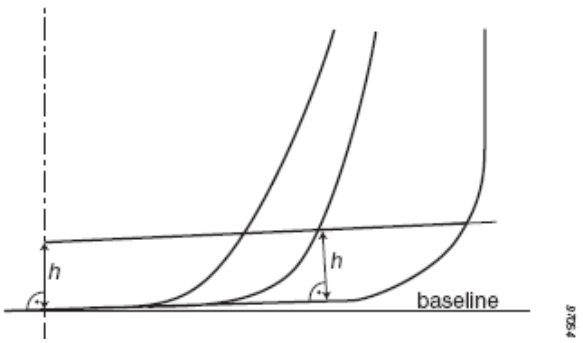
100. General

101. There shall be endowed of at least of tanks or double bottom spaces having height such that the distance h specified in G2.301. is not less than the following value:

h = B/15 m
with minimum value = 0,76 m;

102. In the region of the bilge curvature and in locations without bilge curvature clearly defined, the boundary line of the cargo tank shall be parallel to the flat bottom line amidships, as shown in figure F.G3.102.1. below:

FIGURE F.G3.102.1 – BOUNDARY LINE OF THE CARGO TANKS PARALLEL TO THE BOTTOM



200. Size limitation of tanks to ships with 5000 T DWT

201. The capacity of each cargo tank in ships of less than 5000 tons deadweight shall not exceed 700 m^3 unless wing tanks or cofferdams comply with the item G2.200., i.e. spacing related to side shell is not less than the following value:

$$w = 0{,}4 + \frac{2{,}4 * DW}{20\,000}\ \text{m}$$

With minimum value = 0,76 m

CHAPTER H
CONDITIONS OF LOADING, BUOYANCY AND STABILITY

CONTEÚDO DO CAPÍTULO

Guidance

Chapter H in its entirety is applicable to ships having class notation: K2 and K3.

End of guidance

H5. STABILITY

100. Intact Stability

101. All new ships, with a length of 24 metres and greater the class notation will be assigned after it has been shown that its intact stability is adequate for the intended mission.

102. Sufficient stability means compliance with the International Code on Intact Stability of IMO adopted by resolution IMO resolution. MSC. 267 (85) of 04.12.2008, taking into account the ship type and size.

103. Ships with GT <500 under the Brazilian Flag shall comply with the requirements of NORMAN 01. For ships under foreign flags, RBNA may accept National Regulations and, in the absence of those, compliance with IMO instruments as far as possible.

104. Special requirements for oil tankers: Oil tankers with GT equal to or larger than 5000 TDW shall comply with the regulations of MARPOL Annex I Regulation 27, as per IMO IS Code Part A Section 3.1.

105. Evidence of approval by the RBNA concerned may be accepted for the purposes of classification.

106. In addition to the requirements of items H5.101 to 104 above, the requirements of the Convention MARPOL 73/88 Annex I, rule 27 shall be met.

107. The intact stability calculations shall be based on the following loading conditions:

a. All the loading conditions are intended to be included in trim and stability booklet for examination.

b. New cases are subject to prior examination by the RBNA before loading, Alternatively, an approved loading instrument capable of performing damage stability calculations, in accordance with the requirements of this subchapter H5 may be used.

c. For ships covered by this chapter the following loading cases shall be included in the trim and stability booklet:

c.1. Ship in the departure condition fully loaded at the summer load water line, with evenly distributed load for all cargo tanks and bunkers and consumables to 100%;

c.2. Same condition above, but with 10% stores in bunkers and fuel;

c.3. Ship in the departure condition loaded with a cargo density such that filling all cargo tanks, with bunkers and consumables to 100%, the ship reaches a depth less than the summer load water line

c.4. Same condition above, but with 10% stores in bunkers and fuel;

c.5. Ship in the departure condition fully loaded at the summer load water line, with cargo tanks not completely filled and with bunkers and consumables to 100%;

c.6. Same condition above, but with 10% stores in bunkers and fuel;

c.7. Two load conditions corresponding to the load segregates different situations in order to have handily tanks and bunkers and consumables to 100%. When it is impossible to segregate, these conditions shall be replaced by load conditions with the same specific weight and clearance of loading of cargo tanks;

c.8. Same condition above, but with 10% stores in bunkers and fuel;

d. For oil tankers with segregated ballast tanks, the light ship condition with segregated ballast is also to be included in the stability and trim.

108. Liquid transfer operations: ships with certain subdivisions may be subject to instability (lolling) during liquid transfer operations such as loading, unloading and ballasting. To prevent the effect of lolling during these operations, the design of ships with deadweight greater than 5000 T shall be such as to meet the following criteria:

a. the intact stability criteria reported above shall be met in order for the worst condition possible of cargo and ballast and establish, consistent with good operating practice, including intermediate stages of liquid transfer operations. In all conditions the ballast tanks shall be assumed to be taking clearance in the loading;

b. the initial metacentric height GM_0 in metres, corrected for the free surface effect measured with 0° heel , shall not be less than 0.15. For the purposes of calculating of GM_0, free surface corrections shall be based on the moment of inertia of adequate free surface

c. the ship is to be loaded with:

c.1. all the cargo tanks filled to a level corresponding to the maximum combined total of vertical moment of volume added to the moment of inertia of free surface in 0° heel, for each individual tank;

c.2. load density corresponding to the deadweight available in displacement in which transversal KM cross reaches a minimum value

c.3. 100% consumables in the departure

c.4. 1% of the total ballast water capacity. The effect of maximum free surface shall be assumed in all the ballast tanks.

200. – See Title 11

300. – See Title 11

400. Damage stability

401. The damage stability shall be calculated based on Rule 28 of Annex I to MARPOL 73/78. Extent of damage: see tables T.H5.402.1, T.H5.402.2 and T.H5.402.3.

TABLE T.H5.402.1 – SIDE SHELL DAMAGE:

1 Longitudinal extension:	1/3 ($L^{2/3}$), or 14,5 m whichever is less
2 Transverse extension (inside of the ship from the side shell, at right angles to the centre line at level of summer load line):	B/5 or 11,5 metres, whichever is less.
3 Vertical extension:	From the moulded line of the bottom plates, at the enter line, upwards, without limit.

TABLE T.H5.402.2 – BOTTOM DAMAGE:

	Region between the perpendicular Fwd and 0,3 L	**Other regions of the ship**
1 Longitudinal extension:	1/3 ($L^{2/3}$), or 14,5 m whichever is less	1/3 ($L^{2/3}$), or 5 m whichever is less
2 Transverse extension:	B/5 or 11,5 metros, whichever is less	5 metres
3 Vertical extension:	B/15 ou 6 metres, whichever is less	

402. For the bottom damage, it shall also be considered that two transverse compartments were flooded

403. The lower edge of the non-watertight openings (e.g. doors, windows, access scuttles) shall not be less than 0.10 m above of the load line after the damage.

405. The transverse extension of the damage shall be measured in the direction from the ship's sides to the centre line, perpendicular to the centre line, at the level of the summer load line.

406. To determine the extent of the damage, the suction small wells may be disregarded provided that such small wells extend under the tank at a distance no longer than the half of the double bottom height.

407. The table T.H5.407.1 shows the locations of the standards of application of damage, depending on the length of the ship.

Table T.H5.407.1 – DAMAGE STANDARDS

Ship's length (m)	Damage in whichever point of the length	Damage between transverse bulkheads	Flooded Engine Room
$L_{LL} \leq 100$	No	Yes (1) (2)	No
$100 < L_{LL} \leq 150$	No	Yes (1)	No
$150 < L_{LL} \leq 225$	Yes	No	Yes, only
$L_{LL} > 225$	Yes	No	Yes
(1) Non-flooded Engine Room (2) Exemptions from survival Topic H5.600. below can be accepted by RBNA under case by case analysis			

408. The metacentric heights (GM), righting arms (GZ) and positions of the centre of gravity (KG) to assess the final conditions of survival shall be calculated by the constant displacement method (lost buoyancy).

409. Oil tankers shall be regarded as complying with the damage stability criteria if the following requirements are met:

a. The final waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding may take place. Such openings shall include air-pipes and those which are closed by means of weathertight doors or hatch covers and may exclude 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.

b. In the final stage of flooding, the angle of heel due to unsymmetrical flooding shall not exceed 25°, provided that this angle may be increased up to 30° if no deck edge immersion occurs.

c. The stability in the final stage of flooding shall be investigated and may be regarded as sufficient if the righting lever curve has at least a range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 metre within the 20° range; the area under the curve within this range shall not be less than 0.0175 metre radians. Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. Within this range, the immersion of any of the openings listed in subparagraph 3.1 of this paragraph and other openings capable of being closed watertight may be permitted.

d. Administration shall be satisfied that the stability is sufficient during intermediate stages of flooding.

e. Equalization arrangements requiring mechanical aids such as valves or cross-levelling pipes, if fitted, shall 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 H5.409.a, H5.409.b and H5.409.c above and sufficient residual stability shall be maintained during all stages where equalization is used. Spaces which are linked by ducts of a large cross-sectional area may be considered to be common.

410. Where the damage involving transverse bulkheads is envisaged as specified in subparagraphs 1.1 and 1.2 of this regulation (see guidance below), transverse watertight bulkheads shall be spaced at least at a distance equal to the longitudinal extent of assumed damage specified in TABLE T.H5.402.1 (Side shell damage) above in order to be considered effective. Where transverse bulkhead are spaced at a lesser distance, one or more of these bulkheads within such extent of damage shall be assumed as non-existent for the purpose of determining flooded compartments.

Guidance

Subparagraphs 1.1 and 1.2 of Regulation 28, MARPOL 74/78, Annex I:

Every oil tanker delivered after 31 December 1979, as defined in regulation 1.28.2, of 150 gross tonnage and above, shall comply with the subdivision and damage stability criteria as specified in paragraph 3 of this regulation, after the assumed side or bottom damage as specified in paragraph 2 of this regulation, for any operating draught reflecting actual partial or full load conditions consistent with trim and strength of the ship as well as relative densities of the cargo. Such damage shall be applied to all conceivable locations along the length of the ship as follows:

.1 in tankers of more than 225 metres in length, anywhere in the ship's length;

.2 in tankers 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 shall be treated as a single floodable compartment; and

.3 in tankers not exceeding 150 metres in length, anywhere in the ship's length between adjacent transverse bulkheads with the exception of the machinery space. For tankers of 100 metres or less in length where all requirements of paragraph 3 of this regulation cannot be fulfilled without materially impairing the operational qualities of the ship, Administrations may allow relaxations from these requirements.

End of guidance

411. Where the damage between transverse watertight bulkheads is considered in the table H5.T.407.1, no main transverse bulkhead or a transverse bulkhead bounding side tanks or double bottom tanks shall be assumed damaged, unless:

a. the spacing between adjacent bulkheads is less than the longitudinal extension specified in Paragraph H 5.401.; or

b. there is a step or recess in a transverse bulkhead of more than 3.05 metres in length, located within the extent of penetration of assumed damage. The step formed by the after peak bulkhead and after peak top shall not be regarded as a step for the purpose of this regulation.

412. In the case of pipes, ducts or tunnels are located within the extent of penetration of the damage as specified in item H 5.401, the arrangement shall be made so that the progressive flooding cannot extend to compartments other than those considered non-flooded in the calculation for each case of damage.

500. Permeability

501. The value of permeability, in general, will be 95% (ninety five percent), unless there is a statement specifying different value. In all cases, the minimum values are:

store rooms	60%
machinery spaces:	85%;
accommodations:	95%;
double bottoms, fuel tanks, ballast etc., depending on their functions, are considered full or empty in the condition of the ship in draft maximum allowed	0% ou 95%

502. Whenever a damage below standard imply in more severe conditions of heel, trim and reserve buoyancy reserve, the criteria for damage stability shall be taken into consideration

503. The Engine Room will be considered as a single compartment, i.e. the end bulkheads of Engine Room will be deemed intact, so considering as a floodable compartment. For vessels of more than 150 m in length, but not more than 225 m.

600. Survival requirements

601. In the damage stability study it will be demonstrated, in the final stage of balance in flooding, that:

a. the final waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding may take place. Such openings shall include air-pipes and those which are closed by means of weathertight doors or hatch covers and may exclude 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.

b. in the final stage of flooding, the angle of heel due to unsymmetrical flooding shall not exceed 25°, provided that this angle may be increased up to 30° if no deck edge immersion occurs.;

c. the stability in the final stage of flooding shall be investigated and may be regarded as sufficient if the righting lever curve has at least a range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 metre within the 20° range; the area under the curve within this range shall not be less than 0.0175 metre radians. Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. Within this range, the immersion of any

of the openings listed in H5.601.a and other openings capable of being closed watertight may be permitted.;

d. the minimum values of stability shall extend for a minimum range of 20 (twenty) degrees beyond the point of balance.

602. The requirements of H5.601 above shall be confirmed by calculations which take into consideration the design characteristics of the ship, the arrangements, configuration and contents of the damaged compartments; and the distribution, relative densities and the free surface effect of liquids. The calculations shall be based on the following:

Account shall be taken of any empty or partially filled tank, the relative density of cargoes carried, as well as any outflow of liquids from damaged compartments.

The permeabilities assumed for spaces flooded as a result of damage shall be according to H5.501 above

603. For oil tankers with TDW > 20.000, the hypotheses of damage assumed, concerning bottom damage in H5.401., shall be supplemented by the damages due to bottom touching of the table T. H5.603.1. below.

Table T.H5.603.1 – BOTTOM DAMAGE EXTENSION FOR TDW > 20.000

Deadweight	Longitudinal extension	Transverse extension	vertical extension
< 75000 t	0,4 L_{LL} (1)	B/3	(2)
≥75000 t	0,6 L_{LL} (1)	B/3	(2)
(1) Measured from the forward perpendicular (2) External hull rupture			

604. The requirements of H 5.601 shall considered for this type of damage.

605. Equalization provisions - provisions for equalization employing mechanical aid such as valves or transverse piping for leveling, if installed, shall not be taken into consideration for the purpose of reducing the heel angle or achieving the minimum residual stability extension intended to fulfill the requirements of H5.601. Sufficient residual stability shall be maintained at all stages, whenever equalizing process are used.

606. Compartments that are connected by ducts of large cross section area complete one single compartment only.

607. The following information shall be available to an oil tanker's captain, in the approved form:

-information relating to loading and load distribution necessary to ensure compliance with the stability requirements; and

-information about the capacity of the ship to comply with the stability criteria as determined in H5.601, including the effects of the application standards of damages, shown in table T.H5.407.1.

H6. INTACT STABILITY OF TANKERS DURING LIQUID TRANSFER OPERATIONS [IACS Rec 60]

100. Approach

101. This sub chapter H6 for tankers (i.e. vessels designed to carry liquid in bulk) is developed from MSC/Circ.706 (MEPC/Circ.304) containing recommendations for existing oil tankers. The phenomenon of lolling is considered by IACS to be a safety issue for double hull tankers, as well as for other tankers having exceptionally wide cargo tanks (i.e.having cargo tank breadths greater than 60% of the vessel s maximum beam), which shall be solved for every vulnerable tanker. The solutions shall not be limited only to tankers subject to MARPOL.

102. This r sub chapter H6 applies to a tanker which is not subject to MARPOL, Annex I, Reg. 25A. Alternatively MARPOL, Annex I, Reg. 25A could be applied as a matter of equivalence.

103. Liquid transfer operations include cargo loading and unloading, lightering, ballasting and deballasting, ballast water exchange, and tank cleaning operations.

104. Every tanker is to comply with the intact stability criteria specified in subparagraphs 2.1 and 2.2 for any operating draught reflecting actual, partial or full load conditions, including the intermediate stages of liquid transfer operations:

200. Stability criteria

201. In port, the initial metacentric height GMo is not to be less than 0.15m. Positive intact stability is to extend from the initial equilibrium position at which GMo is calculated over a range of at least 20 degrees to port and to starboard.

202. At sea, the intact stability criteria contained in paragraphs 3.1.2.1 to 3.1.2.4 of IMO Intact Stability Code, are applicable, or the criteria contained in the national requirements of the flag RBNA if the national stability requirements provide at least an equivalent degree of safety.

300. Loading conditions

301. For all loading conditions in port and at sea, including intermediate stages of liquid transfer operations, the initial metacentric height and the righting lever curve are to be corrected for the effect of free surfaces of liquids in tanks.

706. The intact stability criteria preferably is to be met by design of the ship, i.e. the design shall allow for maximum

free surface effects in all cargo, ballast and consumables tanks during liquid transfer operations.

707. If the intact stability criteria are not met through design of the ship alone, the Master is to be provided with clear instructions covering the operational restrictions and methods necessary to ensure compliance with these criteria during liquid transfer operations. These instructions shall be simple and concise, and

a. in a language understood by the officer-in-charge of transfer operations;

b. require no more than minimal mathematical calculations by the officer-in-charge;

c. indicate the maximum number of cargo and ballast tanks which may be slack under any possible condition of liquid transfer, and

d. provide pre-planned sequences of cargo/ballast transfer operations; which indicate the cargo and ballast tanks which may be slack to satisfy the stability criteria under any specific condition of liquid transfer, including possible range of cargo densities. The slack tanks may vary during stages of the transfer operations and be any combination which satisfied the stability criteria.

e. provide instructions for pre-planning other sequences of cargo/ballast transfer operations, including use of stability performance criteria in graphical or tabular form which enable comparisons of required and attained stability. These instructions for pre-planning other sequences, in relation to individual vessels, shall take account of:

e.1. the degree of criticality with respect to the number of tanks which can simultaneously have maximum free surface effects at any stage of liquid transfer operations;

e.2. the means provided to the officer-in-charge to monitor and assess the effects on stability and hull strength throughout the transfer operations;

e.3. the need to give sufficient warning of an impending critical condition by reference to suitable margins (and the rate and direction of change) of the appropriate stability and hull strength parametres. If appropriate, the instructions shall include safe procedures for suspending transfer operations until a suitable plan of remedial action has been evaluated.

e.4. the use of on-line shipboard computer systems during all liquid transfer operations, processing cargo and ballast tank ullage data and cargo densities to continuously monitor the vessel s stability and hull strength and, when necessary, to provide effective warning of an impending critical situation, possibly automatic shut-down, and evaluation of possible remedial actions. The use of such systems is to be encouraged.

f. provide for corrective actions to be taken by the officer-in-charge in case of unexpected technical difficulties with recommended pre-planned transfer operations and in case of emergency situations. A general reference to the vessel s shipboard oil pollution emergency plan may be included.

g. be prominently displayed:

g.1. in the approval trim and stability booklet;

g.2. at the cargo/ballast transfer control station;

g.3. in any computer software by which intact stability is monitored or calculations performed;

g.4. in any computer software by which hull strength is monitored or calculations performed.

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