RULES FOR
CLASSIFICATION OF

SHIPS

NEWBUILDING

SPECIAL SERVICE AND TYPE
ADDITIONAL CLASS

PART 5 CHAPTER 3

OIL CARRIERS

JANUARY 2009

CONTENTS PAGE

DET NORSKE VERITAS

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CHANGES IN THE RULES

General

The present edition of the rules includes additions and amendments decided by the Board in December 2008, and supersedes the July 2006 edition of the same chapter.

The rule changes come into force as indicated below.

This chapter is valid until superseded by a revised chapter. Supplements will not be issued except for an updated list of minor amendments and corrections presented in Pt.0 Ch.1 Sec.3. Pt.0 Ch.1 is normally revised in January and July each year.

Revised chapters will be forwarded to all subscribers to the rules. Buyers of reprints are advised to check the updated list of rule chapters printed in Pt.0 Ch.1 Sec.1 to ensure that the chapter is current.

Main changes coming into force 1 July 2009

- **Sec.15 Single Point Moorings**

— A documentation requirement has been introduced, stating that the manufacturer shall document the capacity of winches and strength of pedestal roller (A303).
— The safety factor against yield criteria has been increased from 1.5 to 2.0 (C103).
— Table C1 has been altered with modified requirements for DW >100 000 tonnes.
— The load angles have been increased (C204).
— The requirement for product certificate and material has been made applicable only to equipment loaded during single point mooring (**SPM**).
— The foundation for winches or capstans, and pedestal roller have been covered by updated (Pt.3 Ch.3 Sec.5).

Significant editorial changes coming into force with immediate effect

- **General**

— It has been clarified that ships arranged for bow loading, submerged turret loading or single point moorings will be assigned the corresponding class notation: **BOW LOADING**, **STL** or **SPM**. (ref. Sec.1, Sec.14 and Sec.15). I.e. the class notations are mandatory in such cases.

Corrections and Clarifications

In addition to the above stated rule requirements, a number of corrections and clarifications have been made in the existing rule text.

Comments to the rules may be sent by e-mail to *rules@dnv.com*
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SECTION 1
GENERAL REQUIREMENTS

A. Classification

A 100 Scope

101 The rules in this chapter govern safety hazards, marine pollution hazards and functional capability of systems. Incorporated in the rules are some requirements of SOLAS Ch. II-2, where these are specifically mentioned as applicable for tankers only, and the requirements in MARPOL 73/78 Annex I, insofar design and equipment are concerned.

A 200 Application

201 These rules apply to ships intended for carriage of liquid cargoes in bulk with a flash point not exceeding 60°C (closed cup test). Cargoes with a flash point exceeding 60°C, where the cargoes are heated to a temperature above their flash point shall be especially considered.

For ships intended for carriage of oil products regardless of flash point the requirements in Sec.2, Sec.3, Sec.4 and Sec.9 shall be complied with.

Liquid cargoes with vapour pressure above atmospheric pressure at 37.8°C shall not be carried unless the ship is especially designed and equipped.

Relevant requirements may be found in Ch.4; e.g. Sec.1 D, Sec.7 and Sec.15 B200.

The requirements shall be regarded as supplementary to those given for the assignment of main class.

202 Oil cargoes and cargoes other than oils covered by the classification in accordance with this chapter are listed in App.A.

203 Exemptions from the rules in this chapter may be granted for heated cargoes where found justifiable, for instance with respect to electrical equipment on open decks.

204 Oil carriers of 20 000 tonnes dwt and above and all ships fitted with equipment for crude oil washing shall fulfil the requirements for inert gas plants as given in Sec.11.

205 Ships for alternate carriage of oil cargo and dry cargo shall comply with the requirements for protected slop tanks given in Sec.12.

206 Ships intended to carry liquid cargoes with a flash point not exceeding 60°C or dry cargo alternatively, shall comply with the requirements in Sec.10.

207 Tanks for cargoes with specific gravity exceeding 1 025 kg/m^3, see Pt.3 Ch.1.

A 300 Class notations

301 The mandatory ship type and service notation **Tanker for Oil ESP** shall be assigned to sea-going ships having integral tanks and intended for the carriage of oil in bulk.

302 The mandatory ship type and service notation **Tanker for Oil Products ESP** shall be assigned to ships intended for the carriage of all types of oil products except crude oil.

303 The general term combination carrier is applied to ships intended for the carriage of oil and dry cargoes in bulk. It is assumed, however, that dry cargoes and oil cargoes will not be carried simultaneously, with the exception of oil retained in slop tanks.

The mandatory ship type and service notation **Bulk Carrier or Tanker for Oil ESP** (alternatively **Tanker for Oil Products ESP**) shall be assigned to single deck ships of double skin construction, with a double bottom, hopper side tanks and topside tanks fitted below the upper deck, and intended for the carriage of oil or dry cargoes in bulk.

The mandatory ship type and service notation **Ore Carrier or Tanker for Oil ESP** (alternatively **Tanker for Oil Products ESP**) shall be assigned to sea-going single deck ships having two longitudinal bulkheads and a double bottom and double skin throughout the cargo region, and intended for the carriage of ore cargoes in the centre holds or of oil cargoes in the centre holds and wing tanks.

The ships shall comply with Sec.1 to Sec.13 of this chapter, except Sec.13 when only oil products are carried.

304 Ships having a bow loading arrangement will be assigned the additional notation **BOW LOADING** and shall meet the relevant requirements in Sec.14.

305 Ships having a submerged turret loading arrangement (STL) will be assigned the additional notation **STL**. and shall meet the relevant requirements in Sec.14.

306 Ships having equipment enabling them to be moored to single point moorings will be assigned the additional notation **SPM** and shall meet the relevant requirements in Sec.15.

307 Arrangements for efficient cleaning of tanks when changing from dirty to clean oil cargoes.

Ships having cargo tanks, systems and cleaning arrangement satisfying the following conditions will be assigned the additional notation **ETC**:

— Tanks shall be designed with smooth surfaces. Under deck longitudinals of slab type are acceptable. Horizontal areas on stiffeners and brackets are generally not acceptable.

  Bulkheads may have horizontal or vertical corrugations. Horizontally corrugated bulkheads should normally not have an angle of the corrugations in excess of 45 degrees related to the vertical plane, see Fig.1. Bulkheads with larger angles - but not more than 65 degrees - might be accepted taking into consideration the location of washing machines in the tanks and the shadow diagrams.

  Vertical girders in horizontally corrugated bulkheads may also be accepted after special consideration.

— Tanks are of stainless steel or coated.
— Cargo piping is of stainless steel.
— Heating coils are of stainless steel or equivalent material.
— Capability of cargo tank washing with hot water of min 85°C with a capacity sufficient for washing at least the largest cargo tank.
— Cargo tanks served by individual in-tank cargo pumps.
— Cargo suction wells to be located for optimum drainage results.
— Permanently installed tank washing machines giving minimum coverage of 96% based on effective jet length at normal operating pressure according to DNV Type Approval Programme 785.70.

  For calculation of coverage, shadow areas shall include areas where the angle between jet and tank surface is less than 10 degrees, and shadow from cargo pump stacks.

  Heating coils and ladders shall not be included in the shadow areas.

  Areas where the angle between jet and tank surface is less than 10 degrees, shall be considered shadow areas.

  In addition to the permanent washing machines, portable washing equipment and necessary access openings enabling complete washing of shadow areas shall be provided. The additional washing to be carried out without need for tank entry.

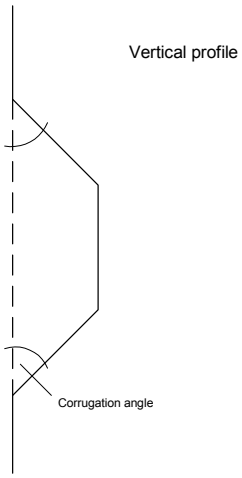

Fig. 1
Definition of corrugation angle, horizontally corrugated bulkhead

A 400 Special features notations

401 Oil carriers less than 20 000 tons deadweight fitted with inert gas system complying with the requirements in Sec.11 may be assigned the special features notation **INERT**.

402 *Noxious Liquid Substances* **NLS**

The notation implies that the ship is acceptable for an NLS certificate in accordance with MARPOL Annex II for carriage of IBC Code Ch.18, Category Z products, and:

a) complies with the requirements of Ch.4 Sec.1 A309 in respect of cargo stripping efficiency **str 0.075**,

b) is provided with an underwater discharge outlet in compliance with Ch.4 Sec.6 D200,

c) is provided with a procedures and arrangements manual in compliance with Ch.4 Sec.1 H100, and

d) is provided with a cargo record book in accordance with Ch.4 Sec.6 D300.

A 500 Register information

501 *Materials of construction* **(ssp)**

The notation **ssp** indicates that cargo piping and all equipment in contact with cargo and cargo vapours is made of stainless steel.

A 600 Structural and leak testing

601 Testing shall be in accordance with Pt.2 Ch.3 Sec.8 Table B1.

B. Definitions

B 100 Terms

101 *Accommodation spaces* are those used for public spaces, corridors, lavatories, cabins, offices, hospital, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces. Public spaces are those portions of the accommodation which are used as halls, dining rooms, lounges and similar permanently enclosed spaces.

102 An *air lock* is an enclosed space for entrance between an hazardous area on open deck and a non-hazardous space, arranged to prevent ingress of gas to the non-hazardous space.

103 *Cargo area* is that part of the ship which contains the cargo tanks, pump rooms and or cofferdams adjacent to cargo tanks, and includes deck areas over the full beam and length of above spaces.

104 *Cargo control room* is a space used in the control of cargo handling operations.

105 *Cargo handling spaces* are pump rooms and other enclosed spaces which contain fixed cargo handling equipment, and similar spaces in which work is performed on the cargo.

106 *Cargo tank* is the liquid-tight shell designed to be the primary container of the cargo.

107 *Cofferdam* is the isolating space between two adjacent steel bulkheads or decks. This space may be a dry space or a tank, see Sec.3 F100.

108 *Control stations* are those spaces in which the ship's radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment is centralised.

109 *Design vapour pressure* p_0 is the maximum gauge pressure at the top of the tank which has been used in the design of the tank.

110 *Flame arrester* is a device through which an external flame front cannot propagate and ignite an internal gas mixture.

111 A *flame screen* is a flame arrester, consisting of a fine-meshed wire gauze of corrosion-resistant material.

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.

Hazardous areas are divided into Zone 0, 1 and 2 as defined below and according to area classification specified in Sec.8 C.

— *Zone 0*
Area in which an explosive gas atmosphere is present continuously or is present for long periods.

— *Zone 1*
Area in which an explosive gas atmosphere is likely to occur in normal operation.

— *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.

113 A *high velocity vent* valve is a cargo tank vent valve which at all flow rates expels the cargo vapour upwards at a velocity of at least 30 m/s, measured at a distance equal to the nominal diameter of the standpipe above the valve outlet opening.

114 *Non-hazardous area.* An area not considered to be hazardous.

115 A *pressure-vacuum (P/V) valve* is a valve which keeps the tank overpressure or under-pressure within approved limits.

116 *Segregated ballast tanks* are tanks which are completely separated from the cargo oil and fuel oil systems and which are permanently allocated to the carriage of ballast or cargoes other than oil or noxious substances as defined in MARPOL 73/78.

117 *Service spaces* are spaces used for galleys, pantries containing cooking appliances, lockers and store rooms, workshops other than those forming part of the machinery spaces and similar spaces and trunks to such spaces.

118 *Slop tanks* are tanks particularly designated for the collection of tank draining, tank washing and other oily mixtures.

119 *Spaces not normally entered* are cofferdams, double bottoms, duct keels, pipe tunnels, stool tanks, spaces containing cargo tanks and other spaces where cargo may accumulate.

120 A *spark arrester* is a device which prevents sparks from the combustion in prime movers, boilers etc. from reaching the open air.

121 The following decks are designated *tank deck*:

- a deck or part of a deck which forms the top of a cargo tank
- the part of a deck upon which are located cargo tanks, cargo hatches, valves, pumps or other equipment intended for loading, discharging or transfer of the cargo
- that part of a deck within the cargo area, which is located lower than the top of a cargo tank
- deck or part of deck within the cargo area, which is located lower than 2.4 m above a deck as described above.

122 *Tank types*, definition see Ch.4 Sec.1 D.

123 *Void space* is an enclosed space not forming a cargo tank, ballast space, fuel oil tank, cargo pump room, or any space in normal use by personnel.

C. Documentation

C 100 General

101 In 200 are specified the plans and particulars which normally shall be submitted when the additional class notations as given in A are applied for.

The drawings shall show clearly that the requirements are fulfilled.

102 Other plans, specifications or information may be required depending on the arrangement and the equipment used in each separate case.

103 For general requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Pt.4 Ch.9 Sec.1.

C 200 Plans and particulars

201 A general arrangement shall be submitted for approval giving location of:

- cargo hatches, butterworth hatches and any other openings to cargo tanks
- doors, hatches and any other openings to pump rooms and other hazardous areas
- ventilating pipes and openings for cargo hatches, pump rooms and other hazardous areas
- doors, air locks, hatches, ventilating pipes and openings, hinged scuttles which can be opened, and other openings to non-hazardous spaces adjacent to the cargo area including spaces in and below the forecastle
- cargo oil pipes over the deck with shore connections including stern pipes for cargo discharge or pipes for bow loading arrangement
- hazardous areas of zone 0, 1 and 2, and their extent.

202 Plans of the following pumping and piping arrangements shall be submitted for approval:

- cargo piping system including drawings of details such as expansion elements and flange connections
- hydraulic system for cargo pumps
- bilge piping systems in pump rooms, cofferdams, pipe tunnels and other dry spaces within cargo area
- pumping and piping arrangement in the forward end of the ship and to permanent ballast tanks within cargo area.

203 Plans showing the following equipment and systems shall be submitted for approval:

- arrangement of cargo heating systems
- arrangement for gas-freeing of cargo tanks
- arrangement for cargo tank venting systems
- pressure-vacuum valves and high velocity vent valves (or reference to possible type approval)
- arrangement and capacity of air ducts, fans and their motors in the cargo area
- fan rotating parts and casing
- details of valve actuators (or reference to possible type approval)
- gastight bulkhead stuffing boxes.

204 Plans of electrical installations giving the following particulars shall be submitted for approval:

- area classification drawing(s)
- drawing(s) showing location of all electrical equipment in hazardous areas
- single line diagram for intrinsically safe circuits and data for verification of the compatibility between the barrier and the field component
- list of explosion protected equipment with reference to drawings. See also Pt.4 Ch.8 Sec.11, Table B1
- maintenance manual as specified in Sec.8 E101, for electrical installations in hazardous areas shall be submitted for approval.

205 For documentation regarding:

- combination carriers, see Sec.10
- inert gas plants, see Sec.11
- slop tanks in combination carriers, see Sec.12
- crude oil washing, see Sec.13
- offshore loading, see Sec.14.

206 For damage stability, the following documentation shall be submitted for approval:

- preliminary damage stability calculations
- final damage stability calculations.

This is not required in case of approved limit curves, or if approved lightweight data are not less favourable than estimated lightweight data.

The following documentation shall be submitted for information:

- internal watertight integrity plan.

Detailed description of stability documentation is given in Classification Note 20.1.

207 The following documentation is to be submitted for information:

- Calculations of hypothetical outflow of oil in case of side damage and bottom damage. Ref. Marpol 73/78 Annex I, Reg. 23.
- Calculations of limit values and arrangement of cargo tanks. Ref. Marpol 73/78 Annex I, Reg. 24.

208 The following control and monitoring systems shall be approved by the Society:

- cargo and vapour temperature control and monitoring system
- cargo tank level measurement system
- cargo tank overflow protection system
- cargo valves and pumps control and monitoring system
- flammable gas detection system (permanent system only)
- inert gas control and monitoring system
- offshore loading and unloading control and monitoring system
- oil discharge control and monitoring system
- cargo tank oil/water interface detection system.

For requirements to documentation, see Pt.4 Ch.9.

209 The following documentation is to be submitted for information:

- Calculations of hypothetical outflow of oil in case of side damage and bottom damage. Ref. Marpol 73/78 Annex I, Reg. 23.
- Calculations of limit values and arrangement of cargo tanks. Ref. Marpol 73/78 Annex I Reg. 24.

D. Surveys and Testing

D 100 General

101 All systems covered by this chapter are as far as possible, to be function tested under working conditions to the satisfaction of the surveyor.

E. Signboards

E 100 References

101 Signboards are required by the rules in:

- Sec.3 D101 regarding plates bolted to boundaries facing the cargo area and which can be opened for removal of machinery. These shall be supplied with signboards giving instruction that the plates shall be kept closed unless ship is gas-free.
- Sec.8 F101 regarding opening of a lighting fitting. Before opening its supply circuit shall be disconnected.
- Sec.8 F102 regarding spaces where the ventilation must be in operation before the lighting is turned on.
- Sec.8 F103 regarding portable electrical equipment supplied by flexible cables. This equipment shall not be used in areas where there is gas danger.
- Sec.8 F104 regarding welding apparatus. These shall not be used unless the working space and adjacent spaces are gas-free.
- Sec.10 B304 regarding access to stool tanks.
- Sec.12 C101 regarding hatches and other openings to cargo slop tanks. These shall be kept closed and locked during handling of dry cargo.
- Sec.12 C102 regarding instructions for handling of slop.

SECTION 2
MATERIALS AND HULL STRENGTH

A. General

A 100 Application

101 Requirements with respect to strength of the hull structure, including scantlings and testing of integral tanks and selection of hull materials are in general to follow the requirements and principles given in Pt.3 Ch.1 or Pt.3 Ch.2 supplemented by the requirements given in this section. For scantlings and testing of tanks other than integral tanks, see Ch.5 Sec.5.

102 The additional notation **CSR** is mandatory for tankers and combination carriers with class notations and length as described below:

— ships with class notation **Tanker for Oil** or **Tanker for Oil Products** and with L ≥ 150 m.

This includes combination carriers and chemical tankers with L ≥ 150 m, also intended for carriage of oil.

The **CSR** notation describes that the newbuilding is designed and built according to Common Structural Rules for Double Hull Oil Tankers as described in A200.

L = length as given in Pt.3 Ch.1 Sec.1 B101.

103 The additional notation **NAUTICUS(Newbuilding)** may be given to tankers except in combination with **CSR**.

NAUTICUS(Newbuilding) is described in Pt.3 Ch.1 Sec.15 and comprises extended fatigue calculations and extended direct strength calculations.

A 200 Common Structural Rules

201 **CSR** is described in Pt.8 Ch.1 "Common Structural Rules for Double Hull Oil Tankers", and comprises the scantling requirements for the classification of new tankers.

202 Requirements with respect to strength of the hull structure, including scantlings and testing of integral tanks and selection of hull materials given in Pt.3 Ch.1 and the requirements given in B, C, and D below are not applicable for vessels with **CSR** notation.

203 The following requirements are in addition covered by the common structural rules and are not applicable for vessels with **CSR** notation:

Pt.3 Ch.3 Sec.3 Anchoring and Mooring Equipment
Pt.3 Ch.3 Sec.6 Opening and Closing Appliances
Pt.3 Ch.3 Sec.7 Corrosion Prevention
Pt.3 Ch.3 Sec.8 Protection of the Crew.

204 For regions of the structure for which the common structural rules do not apply, the appropriate classification rules shall be applied. In cases where the common structural rules do not address certain aspects of the ship's design, the applicable classification rules shall be applied.

205 Optional design feature notations described in Pt.3 Ch.1 may be given to vessels with **CSR** notation.

206 Combination carriers with class notation **Bulk Carrier or Tanker for Oil ESP** or **Ore Carrier or Tanker for Oil ESP** shall fulfil design requirements for bulk carrier or ore carrier in addition to the common structural rules for double hull oil tankers.

A 300 Definitions

301 The following symbols are used:

T_A = minimum relevant seagoing draught (depending on the loading condition in question)
L_F = ship length as given in Pt.3 Ch.1 Sec.1 B101
D = moulded depth as given in Pt.3 Ch.1 Sec.1 B101.

B. Materials and Corrosion Prevention

B 100 Selection and testing

101 Materials are generally to be selected according requirements given in Pt.3 Ch.1 Sec.2 for hull materials. The selected materials shall be tested according to the requirements in Pt.2.

102 Other materials may be accepted after special consideration.

103 Specifications for corrosion prevention systems for water ballast tanks, comprising selection, application and maintenance, as defined in Pt.3 Ch.3 Sec.7 Table A1, shall be submitted for information for all vessels designed to carry products listed in Ch.3.

C. Hull Strength

C 100 General

101 Design of structures are in general to follow requirements and principles as given in Pt.3.

C 200 Design loads

201 Design loads are in general to be taken as described in Pt.3 Ch.1 or Pt.3 Ch.2.

C 300 Girders

301 Scantlings of girders shall be based on requirements given in Pt.3 Ch.1 or Pt.3 Ch.2 and the principles for direct calculations as given in this section.

C 400 Lower hopper knuckle

401 Particular attention should be paid to the fatigue strength of the knuckle between inner bottom and hopper plate. Calculations according to Pt.3 Ch.1 Sec.16 should be carried out for at least one transverse frame in the midship area. If the hot spot stress is not calculated by a fine mesh finite element model, a geometrical stress concentration factor may be used when the nominal stress is calculated according to D.

Guidance note:

For hopper knuckles with angles between inner bottom and hopper plate between 30° and 75° a geometrical stress concentration factor of 7.0 may be applied.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

402 The dynamic stresses shall be based on the simplified approach for calculation of dynamic loads as given in Classification Note 30.7 or wave loads derived from direct load calculations, using the wave scatter diagram representative for world-wide routes.

403 The fatigue calculation required in 501 and 502 may be omitted for knuckles with proper support.

Guidance note:

To have proper support of the knuckle, brackets should be fitted in ballast tanks in line with the inner bottom. Geometrical eccentricity in the knuckle should be avoided or kept to a minimum. In addition, one of the following structural solutions for knuckles with angles between inner bottom and hopper plate between 30° and 75°, should be adequate:

a) Bracket inside cargo tank. The bracket should extend approximately to the first longitudinals and the bracket toe should have a soft nose design.

b) Insert plate of 2.0 times the thickness normally required. Insert plates should be provided in inner bottom, hopper plate, and web frame. The insert plates should extend approximately 400 mm along inner bottom and hopper plate, approximately 800 mm in longitudinal direction, and 400 mm in the depth of the web.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

C 500 Emergency towing

501 Tankers of 20 000 tonnes deadweight and above, including oil tankers, chemical tankers and gas carriers shall be fitted with an emergency towing arrangement in accordance with IMO resolution MSC.35(63).

502 Drawings showing the towing arrangement, including the towing brackets, fairleads, towing pennant, pick-up gear and supporting structure shall be submitted for approval. Towing arrangements shall be arranged both forward and aft. Supports shall be adequate for towing angles up to 90° from the ship's centreline to both port and starboard and 30° vertically downwards.

503 Emergency towing arrangements shall have a working strength (SWL) of:

— 1 000 kN for vessels less than 50 000 tonnes deadweight
— 2 000 kN for vessels of 50 000 tonnes deadweight and above.

The minimum breaking load (MBL) of the major components of the towing arrangements, as defined in MSC.35(63), shall be 2 times the SWL.

504 The strong point and supporting structure for the towing arrangement shall be designed for a load of 1.3 times the SWL with allowable stresses as follows:

Bending stresses: $160\ f_1\ N/mm^2$
Shear stresses: $90\ f_1\ N/mm^2$

505 Material of welded parts used in the strong point shall be Charpy V-notch tested (minimum 27 J at 0 deg.), ref. Pt.2 Ch.1 Sec.2.

506 The pick-up gear shall be a floating line of minimum length 120 m and with a minimum breaking load (MBL) of 200 kN.

D. Direct Strength Calculations

D 100 General

101 For girders that are part of a complex 2 or 3 dimensional structural system, a complete structural analysis may have to be carried out to demonstrate that the stresses are acceptable when the structure is loaded as described in 200.

102 Calculations as mentioned in 101 shall be carried out for:

— transverse and vertical girders in cargo tanks
— transverse bulkhead structure
— double bottom structures
— other structures as deemed necessary by the Society.

D 200 Load conditions

201 The girder structure in the cargo region of oil carriers and chemical carriers is generally to be considered for load conditions given in 202 to 205.

202 Load conditions following the principles below shall be examined for upright seagoing conditions:

a) Any cargo tank to be empty on full draught (T) with adjacent cargo tanks full.

b) Any cargo tank to be filled on a minimum relevant seagoing draught (T_A) with the adjacent tanks empty.

c) All cargo tanks within a transverse section of the ship to be filled on minimum relevant seagoing draught (T_A) with adjoining cargo tanks forward and aft empty.

203 Load conditions following the principles below shall be examined for upright harbour conditions:

a) Any cargo tank may be filled on a draught of 0.25 D (0.35 T if this is less) with adjacent tanks empty.

b) All cargo tanks in a section of the ship to be filled at a draught of 0.35 D (0.5 T if this is less) with adjoining cargo tanks forward and aft empty.

204 The principles outlined in 202 and 203 are exemplified for different tankers as follows:

For ships with 2 longitudinal bulkheads:

— seagoing conditions as given in Fig. 1
— harbour conditions as given in Fig. 2.

For ships with 1 longitudinal bulkhead:

— seagoing conditions as given in Fig. 3
— harbour conditions as given in Fig. 4.

For ships without longitudinal bulkheads:

— seagoing conditions as given in Fig. 5
— harbour conditions as given in Fig. 6.

205 The girder structure of cargo- and ballast tanks with breadth, $b > 0.6$ B shall be checked for a seagoing load condition with filled tanks at a minimum draught (T_A), or 0.35 D if T_A is not known, and heeled to an angle of $\phi/2$ with adjacent tanks empty. See Fig. 7. ϕ is as given in Sec.4 B.

206 Girders on transverse bulkheads in ships with 1 or 2 longitudinal bulkheads are in addition to be considered for alternate loading of cargo tanks, see Fig. 8. In this condition a draught of T_A to be considered. The condition is a seagoing condition.

207 Ships with 2 longitudinal bulkheads and with cross ties in the centre tank shall be considered for an asymmetric load condition with one wing tank filled and other tanks empty, unless reservations are given against the practising of this condition or such condition will result in unrealistic heeling. The draught shall be taken as 0.25 D. The loading condition is a harbour condition and is illustrated in Fig. 9.

208 The sloshing pressure given in Pt.3 Ch.1 Sec.4 C303 to C306 need not be taken to act simultaneously over the total area of any exposed tank boundary. When found necessary, relevant parts of the girder system shall be checked.

D 300 Acceptance criteria

301 Acceptance criteria shall be taken as given in Pt.3 Ch.1 Sec.12.

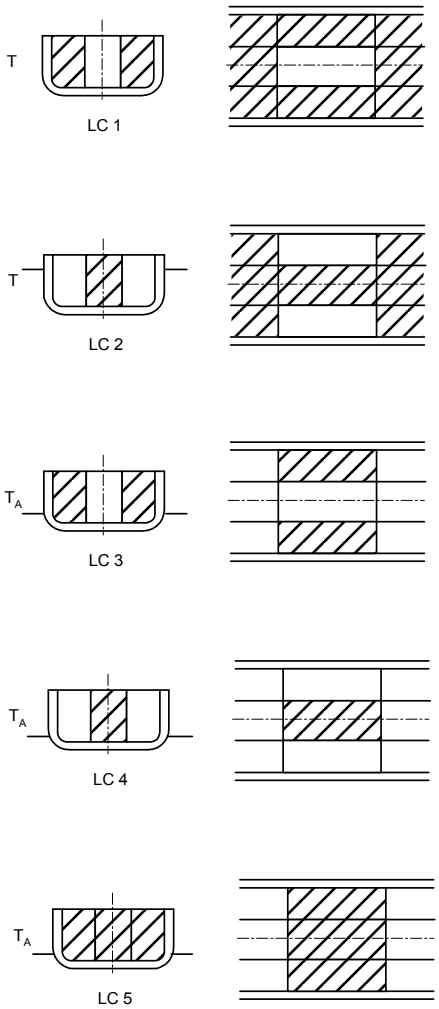

Fig. 1
Seagoing conditions for vessels with 2 longitudinal bulkheads

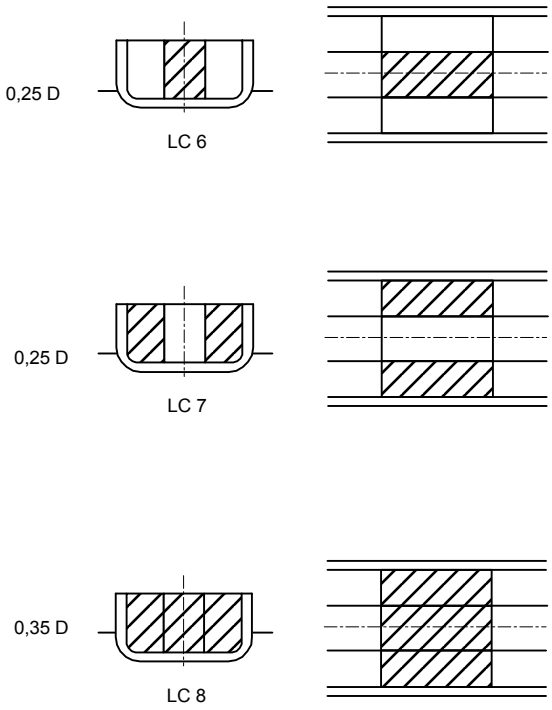

Fig. 2
Harbour conditions for vessels with 2 longitudinal bulkheads

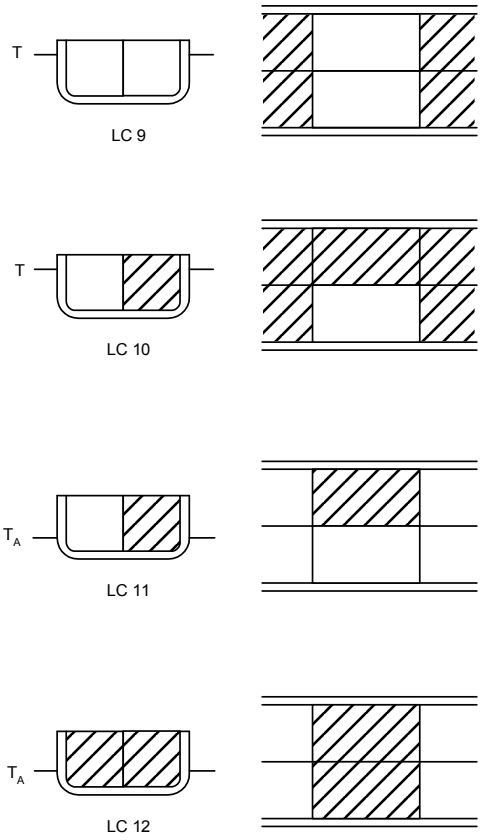

Fig. 3
Seagoing conditions for vessels with 1 longitudinal bulkhead

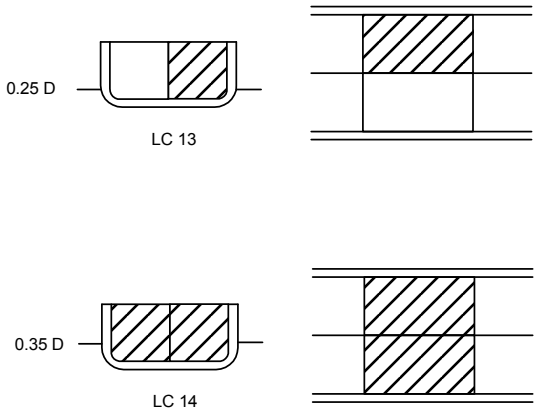

Fig. 4
Harbour conditions for vessels with 1 longitudinal bulkhead

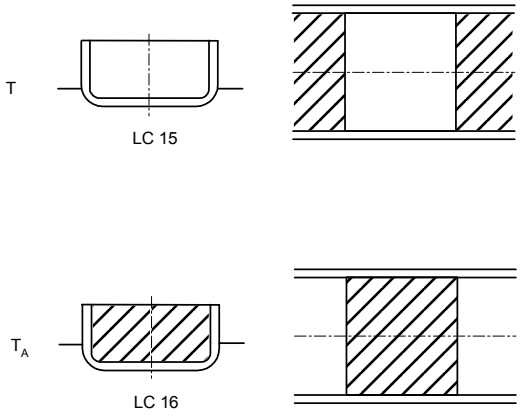

Fig. 5
Seagoing conditions for vessels without longitudinal bulkheads

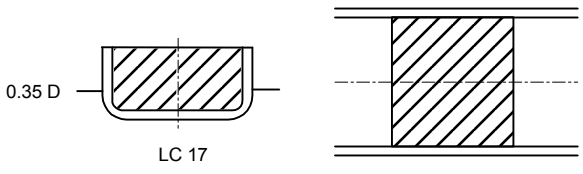

Fig. 6
Harbour conditions for vessels without longitudinal bulkheads

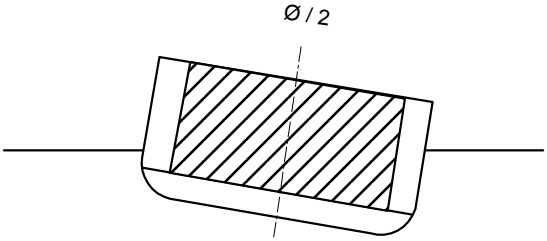

Fig. 7
Heeled loading conditions

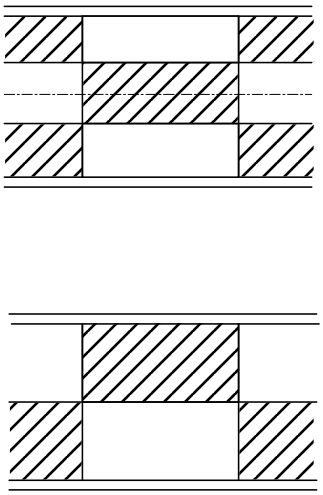

Fig. 8
Alternate loading conditions

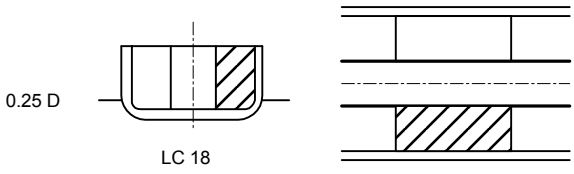

Fig. 9
Additional load condition for vessels with cross tie in centre tank

SECTION 3
SHIP ARRANGEMENT AND STABILITY

A. Intact and Damage Stability

A 100 Intact stability

101 Oil carriers of 5 000 tonnes deadweight and above shall comply with the intact stability criteria as specified in MARPOL Annex I, Reg. 27. The requirements shall be met by design only. For combination carriers simple operational procedures may be allowed.

a) For ships loading and or offloading in port only, the GM corrected for free surfaces measured at 0° heel shall be not less than 0.15 m, for any operating draught under the worst possible condition of cargo and ballast loading, consistent with good operational practice, including intermediate stages of liquid transfer operations.

Guidance note:

Ships meeting this requirement when homogeneously fully loaded at maximum draught and with the maximum free surface effect from all cargo, ballast and consumable tanks taken into account are normally considered to comply.

The unified interpretation 41 to MARPOL Annex I specifies that the vessel should be loaded with all cargo tanks filled to a level corresponding to the maximum total of vertical moment of volume plus free surface inertia moment at 0° heel for each individual tank. Cargo density should correspond to the available cargo deadweight at the displacement at which the transverse KM reaches a minimum value assuming full departure consumables and 1% of the total water ballast capacity. The maximum free surface moment should be assumed in all ballast tanks.

As an alternative to the unified interpretation 41, the Society can accept detailed calculations of all possible combinations of cargo and ballast tank's loading as proof of compliance with the condition mentioned in a).

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b) For ships loading and or offloading at sea, the criteria according to Pt.3 Ch.3 Sec.9 D101 shall be met for the same conditions as in a).

c) For combination carriers, simple written supplementary operational procedures made available to the master may be accepted which:

i) are approved

ii) indicate those cargo and ballast tanks that may, under any specific condition of liquid transfer and possible range of cargo densities, be slack and still allow the stability criteria to be met. The slack tanks may vary during the liquid transfer operations and be of any combination provided they satisfy the criteria

iii) will be readily understandable to the officer-in-charge of liquid transfer operations

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

v) require no mathematical calculations by the officer-in-charge

vi) provide for corrective actions to be taken by the officer-in charge in case of departure from recommended values and in case of emergency situations; and

vii) are prominently displayed in the approved trim and stability booklet and at the cargo and ballast transfer control station and in any computer software by which stability calculations are performed.

A 200 Damage stability

201 Oil carriers shall comply with the subdivision and damage stability requirements of MARPOL 73/78 Annex I, Reg. 19 and 28.

Ships of 20 000 tons deadweight and above, but less than 75 000 tons deadweight, shall survive bottom-raking damage extending 0.4 L measured from forward perpendicular.

Ships of 75 000 tons deadweight and above shall survive bottom-raking damage extending 0.6 L measured from forward perpendicular.

Transverse extent: B/3 anywhere in the bottom.

Vertical extent: Breach of the outer hull.

202 Maximum allowable VCG curve(s), for the purpose of checking damage stability compliance, shall be included in the stability manual, unless one of the following alternatives are preferred:

1) The loading manual includes, in approved form, all the conditions intended to be used.

2) The loading computer, intended for conditions at sea, includes approved software functions for damage stability.

See Pt.6 Ch.9 Sec.1 and Sec.2.

A 300 Watertight integrity

301 As far as practicable, tunnels, ducts or pipes which may cause progressive flooding in case of damage, shall be avoided in the damage penetration zone. If this is not possible, arrangements shall be made to prevent progressive flooding to volumes assumed intact. Alternatively, these volumes shall be assumed flooded in the damage stability calculations.

302 The scantlings of tunnels, ducts, pipes, doors, staircases, bulkheads and decks, forming watertight boundaries, shall be adequate to withstand pressure heights corresponding to the deepest equilibrium waterline in damaged condition.

B. Location and Separation of Spaces

B 100 General

101 Machinery space shall be isolated from cargo tanks and slop tanks by cofferdams, pump rooms, oil fuel bunker tanks or ballast tanks.

Spaces which may be approved as cofferdams, see F100.

102 Fuel oil bunker tanks shall not be situated within the cargo area. Such tanks may, however, be situated at forward and aft end of cargo area instead of cofferdams.

However, total boundary area against cargo tanks shall not exceed 1.5 B D.

Fuel oil bunker in double bottom tanks situated under cargo tanks is not permitted.

103 Machinery and boiler spaces and accommodation and service spaces shall be positioned aft of the cargo area, but not necessarily aft of fuel oil tanks.

104 The lower portion of the cargo pump room may be recessed into machinery and boiler spaces to accommodate pumps, provided the deck head of the recess is in the 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 tons deadweight, where it can be demonstrated that for reasons of

access and satisfactory piping arrangements this is impracticable, a recess in excess of such height may be permitted, though not exceeding one half of the moulded depth above the keel.

105 Spaces mentioned in 103 may be positioned forward of the cargo area after consideration in each case.

106 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.

107 Deck spills shall be kept away from accommodation and service areas and from discharge into the sea by a permanent continuous coaming of minimum 100 mm high surrounding the cargo deck. In the aft corners of the cargo deck the coaming must be at least 300 mm high and extend at least 4.5 m forward from each corner and inboard from side to side. Scupper plugs of mechanical type are required. Means of draining or removing oil or oily water within the coamings shall be provided.

108 Where a corner-to-corner situation occurs between a non-hazardous space and a cargo tank, a cofferdam created by a diagonal plate across the corner on the non-hazardous side, may be accepted as separation.

Such cofferdams shall be:

— ventilated if accessible,
— filled with a suitable compound if not accessible.

109 Paint lockers shall not be located within the cargo area, but may be located above oil fuel bunker tanks or ballast tanks aft of cargo tanks / slop tanks.

B 200 Arrangements of barges

201 The spaces forward of the collision bulkhead (forepeak) and aft of the aftermost bulkhead (afterpeak) shall not be arranged as cargo oil tanks.

C. Tank and Pump Room Arrangement

C 100 Segregated ballast tanks

101 Ships of 20 000 tons deadweight and above having the class notation **Tanker for Oil** and ships of 30 000 tons deadweight and above with class notation **Tanker for Oil Products** shall have segregated ballast tanks.

The capacity of segregated ballast tanks shall be at least such that, in any ballast condition at any part of the voyage, including the conditions consisting of lightweight plus segregated ballast only, the ship's draughts and trim can meet each of the following requirements:

a) The moulded draught amidships (dm) in metres (without taking into account any ship's deformation) shall not be less than:

$$dm = 2.0 + 0.02\ L_F$$

Where L_F is the length of the ship as defined by MARPOL.

b) the draughts at the forward and after perpendiculars shall correspond to those determined by the draught amidships (dm) as specified in subparagraph a) of this paragraph, in association with the trim by the stern of not greater than $0.015\ L_F$; and

c) in any case the draught at the after perpendicular shall not be less than that which is necessary to obtain full immersion of the propeller(s).

C 200 Protection of cargo tanks

201 Ships of 600 tons deadweight but less than 5 000 tons deadweight must have a double hull arrangement covering the entire cargo tank length with particulars as follows:

a) *Double side width (m):*

$$w = 0.4 + \frac{2.4DW}{20\ 000}$$ or w = 0.76 whichever is the greater.

DW = deadweight capacity of ship in metric tons.

b) Tankers where each cargo tank does not exceed 700 m^3 may be designed with single side.

Ships intended for carriage of heavy grade oil (as defined in MARPOL 73/78 Annex I, Reg. 21) as cargo, must comply with a).

c) *Double bottom height (m):*

$$h = \frac{B}{15}$$ or h = 0.76 whichever is the greater.

202 Ships of 5 000 tons deadweight and above must have double hull in the entire cargo tank length with arrangement as follows:

a) *Double side width (m):*

$$w = 0.5 + \frac{DW}{20\ 000}$$ or w = 2.0 whichever is the lesser,

but not less than 1.0 m.

b) *Double bottom height (m):*

$$h = \frac{B}{15}$$ or h = 2.0 whichever is the lesser, but not less than 1.0 m.

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

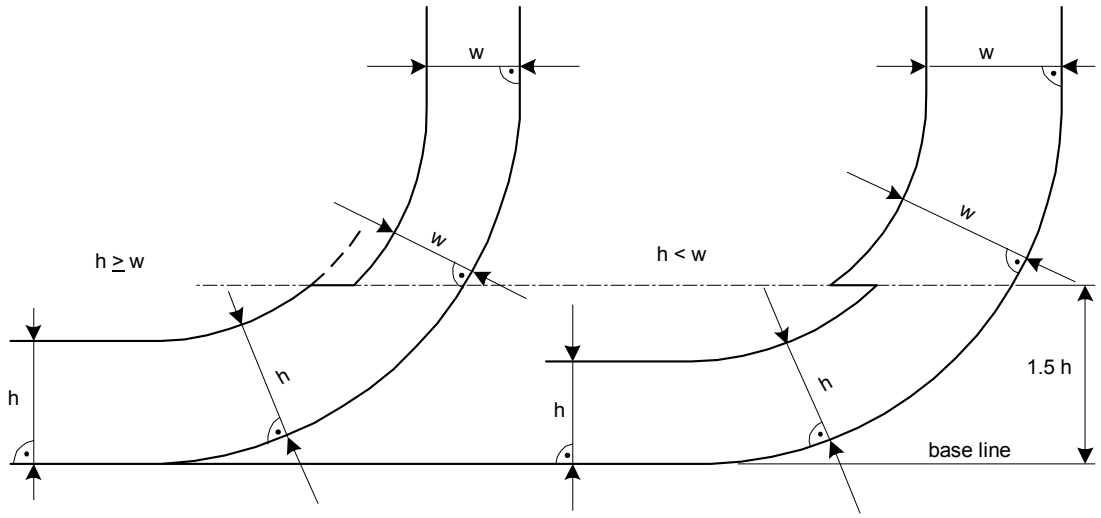

Fig. 1
Double hull distances

203 Double bottom tanks or spaces as required by 201 may be dispensed with, provided that 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:

$$f\, h_c\, \rho_c\, g + 100\, \delta p \le d_n\, \rho_s\, g$$

h_c = height of cargo in contact with the bottom shell plating in metres
ρ_c = maximum cargo density in t/m^3
d_n = minimum operating draught under any expected loading condition in metres
ρ_s = density of seawater in t/m^3
δp = 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 m/s^2).

Any horizontal partition necessary to fulfil the above requirements shall be located at a height of not less than B/6 or 6 m, whichever is the lesser, but not more than 0.6 D, above the baseline where D is the moulded depth amidships.

The location of wing tanks or spaces shall be as defined in 202 except that below a level 1.5 h above the baseline where h is as defined in 202 the cargo tank boundary line may be vertical down to the bottom plating.

204 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.

Guidance note:
For combined oil and chemical tankers, the requirements for the suction well in Pt.5 Ch.4 Sec.3 B104 are stricter.

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C 300 Cargo tanks and slop tanks

301 Hypothetical outflow of oil in the case of side damage and bottom damage shall be within the limits required in MARPOL 73/78 Annex I, Reg. 25.

302 Limitation of size and arrangement of cargo tanks shall comply with the provisions of MARPOL 73/78 Annex I, Reg. 26.

303 Oil carriers of 150 gross tonnage and above shall be provided with arrangements of slop tank or combination of slop tanks with a total capacity complying with MARPOL 73/78 Annex I, Reg. 29.

304 Oil carriers of 70 000 tons deadweight and above shall be provided with at least two slop tanks.

305 Slop tanks shall be designed particularly with respect to decantation purpose. Positions of inlets, outlets, baffles or weirs where fitted, shall be placed so as to avoid excessive turbulence and entrainment of oil or emulsion with the water.

C 400 Double bottom in pump rooms

401 Pump rooms in ships of 5 000 tons deadweight and above, must be provided with a double bottom with depth h as follows:

$$h = \frac{B}{15}\ \text{(m) or}$$

h = 2.0 m, whichever is lesser, but not less than 1.0 m.

D. Arrangement of Access and Openings to Spaces and Tanks

D 100 Accommodation and non-hazardous spaces

101 Entrances, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces shall not face the cargo area. They shall be located on the end bulkhead and or on the outboard side of the superstructure or deckhouse at a distance of at least L/25 but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance, however, need not exceed 5 m.

Within the limits specified above, the following apply:

a) Bolted plates for removal of machinery may be fitted. Such plates shall be insulated to A-60 class standard. Signboards giving instruction that the plates shall be kept closed unless the ship is gas-free, shall be posted on board.
b) Wheelhouse windows may be non-fixed and wheelhouse doors may be located within the above limits as long as they are so designed that a rapid and efficient gas and vapour tightening of the wheelhouse can be ensured.
c) Windows and side scuttles shall be of the fixed (non-open-

ing) type. Such windows and side scuttles except wheelhouse windows, shall be constructed to A-60 class standard.

102 Cargo control rooms, stores and other spaces not covered by 103 but located within accommodation, service and control stations spaces, may be permitted to have doors facing the cargo area. Where such doors are fitted, the spaces are not to have access to the spaces covered by 103 and the boundaries of the spaces are to be insulated to A-60 class.

103 For access and openings to non-hazardous spaces other than accommodation and service spaces, the following provisions apply:

— entrances shall not be arranged from hazardous spaces
— entrances from hazardous areas on open deck are normally not to be arranged. If air locks are arranged such entrances may, however, be approved, see 105 and 106
— entrances to non-hazardous forecastle spaces from hazardous areas shall be arranged with air locks, see 104.

104 Ventilation inlets for the spaces mentioned in 101 are to be located as far as practicable from gas-dangerous zones, and in no case are the ventilation inlets nor outlets to be located closer to the cargo area than specified for doors in 101.

105 Entrance through air locks to non-hazardous spaces shall be arranged at a horizontal distance of at least 3 m from any opening to a cargo tank or hazardous space containing gas sources, such as valves, hose connections or pumps used with the cargo.

106 Air locks shall comply with the following requirements:

a) Air locks shall be enclosed by gastight steel bulkheads with two substantially gas tight self-closing doors spaced at least 1.5 m and not more than 2.5 m apart. The door sill height shall comply with the requirement given in Pt.3 Ch.3 Sec.6 B, but shall not be less than 300 mm.

b) Air locks shall have a simple geometrical form. They shall provide free and easy passage, and shall have a deck area not less than about 1.5 m^2. Air locks shall not be used for other purposes, for instance as store rooms.

c) An alarm (acoustic and visual) shall be released on both sides of the air lock to indicate if more than one door have been moved from the fully closed position.

d) Air locks shall have effective ventilation. For requirements for ventilation, see Sec.6.

D 200 Access to and within hazardous spaces

201 Access to and within spaces in, and forward of, the cargo area shall comply with SOLAS Regulation II-1/3-6.

202 Doors to hazardous spaces, situated completely upon the open deck, shall have as low a sill height as possible. Such compartments shall not be connected with compartments at a lower level.

203 For deck openings for scaffolding wire connections, the number and position of holes in the deck are subject to approval.

The closing of the holes may be effected by screwed plugs of metal or an acceptable synthetic material, see Sec.4 A.

The material used in the manufacture of plugs and jointing, if any, shall be impervious to all cargoes intended to be carried.

Metal plugs shall have a fine screw thread to ensure an adequate number of engaging threads.

A number of spare plugs equal to at least 10% of the total number of holes shall be kept on board.

E. Guard Rails and Bulwarks

E 100 Arrangement

101 On tank deck open guard rails are normally to be fitted. Plate bulwarks, with a 230 mm high continuous opening at lower edge, may be accepted upon consideration of the deck arrangement and probable gas accumulation.

F. Cofferdams and Pipe Tunnels

F 100 Cofferdams

101 Cofferdams shall be of sufficient size for easy access to all parts, and they shall cover the entire adjacent tank bulkhead.

Minimum distance between bulkheads: 600 mm.

102 Pump rooms and ballast tanks will be accepted as cofferdams. Ballast tanks will, however, not be accepted as cofferdams for protected slop tanks. See Sec.12.

F 200 Pipe tunnels

201 Pipe tunnels shall have ample space for inspection of the pipes.

202 The pipes in pipe tunnels shall be situated as high as possible above the ship's bottom.

There shall be no connection between a pipe tunnel and the engine room neither by pipes nor manholes.

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

204 Where there is permanent access from a pipe tunnel to the main pump-room, a watertight door shall be fitted complying with the requirements of SOLAS Ch. II-1/25-9, and in addition with the following requirements:

a) In addition to bridge operation, the watertight door shall be capable of being manually closed from outside the main pump-room entrance.

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

G. Diesel Engines for Emergency Fire Pumps

G 100 General

101 Diesel engines for emergency fire pump, shall be installed in a non hazardous space.

102 The exhaust pipe of the diesel engine, if fitted forward of the cargo area, shall have an effective spark arrester, and shall be led out to the atmosphere outside hazardous areas.

H. Chain Locker and Anchor Windlass

H 100 General

101 The chain locker shall be arranged as a non hazardous space.

102 Windlass cable lifters and chain pipes shall be situated outside hazardous areas.

I. Equipment in Tanks and Cofferdams

I 100 General

101 Anodes, washing machines and other permanently attached equipment units in tanks and cofferdams shall be securely fastened to the structure. The units and their supports shall be able to withstand sloshing in the tanks and vibratory loads as well as other loads which may be imposed in service.

Guidance note:

When selecting construction materials in permanently attached equipment units in tanks and cofferdams, due consideration should to be paid to the contact spark-producing properties.

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J. Surface Metal Temperatures in Hazardous Areas

J 100 General

101 Surface metal temperatures of equipment and piping in hazardous areas shall not exceed 220°C.

SECTION 4
PIPING SYSTEMS IN CARGO AREA

A. Piping Materials

A 100 Selection and testing

101 Materials are generally to be selected according requirements given in Pt.4 Ch.6 for piping materials. The selected materials shall be tested according to regulations in Pt.2.

102 Other materials may be accepted after special consideration.

103 Synthetic materials for components and piping shall be approved in each separate case.

A 200 Special requirements for cargo piping system

201 Valves and distance pieces or reducers outboard of valves, which are connected directly to the cargo pipeline's shore connection on deck, shall be made of steel.

A 300 Plastic pipes in cargo area

301 Plastic pipes of approved type and tested according to an approved specification may be accepted. For the application of plastic pipes, see Pt.4 Ch.6.

302 When used in a hazardous area, the surface resistance per unit length of pipes shall not exceed 10^5 Ω/m and the resistance to earth from any point in the piping system shall not exceed 10^6 Ω.

A 400 Aluminium coatings

401 Aluminised pipes are generally accepted in non-hazardous areas and may be permitted in hazardous areas on open deck and in inerted cargo tanks and ballast tanks.

Restrictions on use of aluminium paints, see Pt.3 Ch.3 Sec.7.

B. Bilge, Ballast and Fuel Oil Systems

B 100 General

101 There shall be no connection between piping systems in the cargo area and piping systems in the remainder of the ship, unless explicitly specified in this section.

B 200 Drainage of pump rooms, cofferdams, pipe tunnels, ballast and fuel oil tanks

201 Cargo pump rooms shall have a drainage system connected to pumps or bilge ejectors.

202 Cargo pumps may be used for bilge service provided each bilge suction pipe is fitted with a screw-down non-return valve, and an additional stop valve is fitted to the pipe connection between pump and the non-return valve.

203 The bilge pipes in the cargo pump room shall not be led into the engine room.

204 Cofferdams and pipe tunnels shall be provided with bilge suctions.

205 The forward cofferdam may be drained with pumps situated forward of the cofferdam.

206 The after cofferdam not forming a part of the cargo pump room may be drained by a direct suction to the bilge system in the engine room.

207 Pipe tunnels shall be drained from the cargo pump room or an equivalent hazardous space.

208 Segregated ballast tanks within the cargo area shall be served by ballast pumps in the cargo pump room, in a similar hazardous space or inside ballast tanks. Ballast tanks shall be provided with at least two drain pumping units. At least one of the pumps shall be exclusively used for ballast. As another means an eductor or an emergency connection to a cargo pump may be accepted. Segregated ballast systems shall not have any connections to the cargo system, but an emergency discharge of ballast water may be arranged by connection to a cargo pump.

The connection pipe shall be provided with a removable spool piece and a closing valve and non-return valve in series in the suction side to the cargo oil pump.

209 Arrangements for discharge of water ballast and oil contaminated water from the cargo area shall be made above the waterline in the deepest ballast condition, in accordance with MARPOL 73/78 Annex I, Reg. 30.

210 A discharge manifold for connection to reception facilities for the discharge of dirty ballast water or oil contaminated water shall be located on the open deck on both sides of the ship.

211 For ships arranged with emergency connection between the cargo system and the segregated ballast system as specified in 208, the discharge manifold required by 210 may be omitted.

212 Ballast tanks forward of cargo area may be connected to the ballast pumps in the aft cargo pump room, see 213.

213 Ballast piping and other piping such as sounding and vent piping to ballast tanks shall not pass through cargo tanks.

214 Drainage of ballast tanks, see Pt.4 Ch.6 Sec.4 I.

215 Fuel oil bunker tanks adjacent to cargo tanks may be connected directly to pumps in the engine room. The pipes shall not pass through cargo tanks and shall have no connection with pipelines serving such tanks.

B 300 Fore peak ballast tank

301 The fore peak may be ballasted with the system serving ballast tanks within the cargo area, provided:

a) The fore peak tank is considered as hazardous.

b) The vent pipe openings are located on open deck 3 m away from sources of ignition.

c) Means are provided, on the open deck, to allow measurement of flammable gas concentrations within the tank by a suitable portable instrument.

d) The access to the fore peak and the sounding arrangements are directly from open deck. In case the fore peak tank is separated by cofferdams from the cargo tanks, an access through a gas tight bolted manhole located in an enclosed space may be accepted. In that case, a warning sign shall be provided at the manhole stating that the tank may only be opened after it has been proven to be gas free or the electrical equipment which is not certified safe in the enclosed space, is isolated.

B 400 Oil discharge monitoring and control systems

401 Oil carriers of 150 gross tonnage and above shall be equipped with an approved arrangement for oil content monitoring of oily ballast and tank washing water in accordance with MARPOL 73/78 Annex I, Reg. 31. The system shall record continuously the discharge of oil in litres per nautical mile and total quantity of oil discharged, or the oil content and rate of discharge.

402 An instruction and operation manual describing all es-

sential procedures for manual and automatic operations shall be worked out and submitted for approval.

Guidance note:

Reference is made to IMO MEPC.108(49) - Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers.

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403 Oil tankers of 150 gross tonnage and above, shall be provided with an effective oil and water interface detector of approved type in accordance with MARPOL 73/78 Annex I, Reg. 32, for determination of the oil water inter face in slop tanks and other tanks where separation of oil and water is effected and from which it is intended to discharge effluent direct to sea.

B 500 Oil Record Book and SOPEP

501 Oil carriers of 150 gross tonnage and above shall be provided with an Oil Record Book in accordance with MARPOL 73/78 Annex I, Reg. 36.

502 Oil carriers of 150 gross tonnage and above shall be provided with a Shipboard Oil Pollution Emergency Plan (SOPEP) approved by an Administration in accordance with MARPOL 73/78 Annex I, Reg. 37.

B 600 Air, sounding and filling pipes

601 Filling of tanks within cargo area shall be carried out from the cargo pump room or a similar hazardous space.

602 Filling lines to permanent ballast tanks and other discharge lines to cargo area may be connected to pumps outside the cargo area (e.g. engine room), provided the lines are not carried through cargo tanks and adjacent spaces and do not have a permanent connection to any cargo tank.

The arrangement is subject to approval in each separate case.

603 Filling lines to permanent ballast tanks shall be so arranged that the generation of static electricity is reduced, e.g. by reducing the free fall into the tank to a minimum.

604 Suction for seawater to permanent ballast tanks shall not be arranged in the same sea chest as used for discharge of ballast water from cargo tanks, see also C208.

Guidance note:

Seawater suction should be arranged at the opposite side from the discharge of ballast water from cargo tanks.

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605 Cofferdams shall be provided with sounding pipes and with air pipes led to the atmosphere. The air pipes shall be fitted with flame screens at their outlets.

C. Cargo Systems

C 100 General

101 A permanent system of piping and pumps shall be provided for the cargo tanks.

This system shall be entirely separate from all other piping systems on board.

Exemption, see Sec.5 A.

102 At least two independently driven cargo oil pumps shall be connected to the system.

103 In tankers where cargo tanks are equipped with independent pumps (e.g. deep well pumps), the installation of one pump per tank may be approved. Satisfactory facilities shall be provided for emptying the tanks in case of failure of the regular pump.

104 Hydraulically powered pumps, submerged in cargo tanks (e.g. deep well pumps), shall be arranged with double barriers, preventing the hydraulic system serving the pumps from being directly exposed to the cargo. The double barrier shall be arranged for detection and drainage of possible cargo leakages.

105 Materials, see A.

106 The wall thickness of cargo pipes will be specially considered on the basis of anticipated corrosion. The thickness of the pipes are, however, not to be less than given in Pt.4 Ch.6 Sec.6 A.

107 All cargo piping shall be electrically bonded to the ship's hull. The resistance to earth from any point in the piping system is not to exceed 10^6 Ω.

Fix points may be considered as an effective bonding.

Piping sections not permanently connected to the hull, shall be electrically bonded to the hull by bonding straps.

C 200 Piping systems

201 The complete cargo piping system shall be located within the cargo area.

202 Valves or branch pieces, which connect the cargo pipeline's shore connection on deck, and cargo piping shall be supported with due regard to load stresses.

203 Expansion elements shall be provided in the cargo piping as necessary.

204 Means for drainage of the cargo lines shall be provided. Tankers for oil (**Tanker for Oil**) of 20 000 tons deadweight and above, and tankers for oil products (**Tanker for Oil Products**) of 30 000 tons deadweight and above, shall be provided with a special small diameter line, not exceeding 10% of the cross-sectional area of main cargo line, for discharge ashore. This line shall be connected outboard of the ship's manifold valves.

Stripping systems for ships provided with deep well cargo pumps shall be specially considered.

205 The cargo piping system shall not have any connection to permanent ballast tanks.

206 Cargo piping and similar piping to cargo tanks shall not pass through ballast tanks. Exemptions to this requirement may be granted for short length of pipes with heavy wall thickness, provided that they are completely welded.

Guidance note:

Short length of pipes may be such as through stool tanks used for ballast etc.

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207 Filling lines to cargo tanks shall be so arranged that the generation of static electricity is reduced, e.g. by reducing the free fall into the tank to a minimum.

208 The discharge of ballast water from cargo tanks shall be arranged in such a way as to prevent the ballast water from being drawn into sea suctions for other pipe systems, i.e. cooling water systems for machinery.

209 Isolation of cargo piping connections to sea shall be made by means of at least two shut-off valves. Arrangement for tightness monitoring of sea valves shall be provided.

Guidance note:

- For tankers delivered on or after 2010-01-01, MARPOL 73/78 Annex I, Reg. 30.7 will apply for this arrangement.
- For arrangement of tightness testing of sea valves, see OCIMF's recommendations "Prevention of oil spillages through cargo pump room sea valves".

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210 Where pumps in cargo room or other hazardous spaces are driven by shafting passing into the pump room through bulkheads or deck plating, gastight glands of approved type shall be fitted. The glands shall be efficiently lubricated and constructed so as to reduce the risk of overheating. The glands shall be visible and easily accessible.

Parts which may accidentally come into contact if the seal is badly aligned or if a bearing is damaged, shall be of such materials that no spark may occur. If an expansion bellow is fitted, it shall be hydraulically pressure tested.

211 Displacement pumps shall have relief valves with discharge to the suction line.

212 For systems served by centrifugal pumps the design pressure for the piping shall be at least equal to the highest pressure the pump may generate. Alternatively a pressure relief valve or alternative means for automatically safeguarding against overpressure shall be provided.

213 Means shall be provided for stopping the cargo pumps at the cargo manifolds and at the lower pump room level.

214 Remote control and monitoring of the cargo handling, see Sec.9.

215 All ships having a Noxious Liquid Substances (NLS) Certificate for the carriage of liquid substances as listed in the IBC Code Chapter 18 Category Z, are to have on board a Cargo Record Book according to MARPOL 73/78 Annex II, Appendix 2.

C 300 Cargo piping systems for barges

301 The barge shall be equipped with a permanent piping system for the oil cargo.

Closing valves operable from outside the tank shall be fitted to each branch pipe within the tank it serves.

302 At least two independently driven cargo pumps shall be connected to the cargo piping system.

If each cargo tank is fitted with a separate cargo pump, one cargo pump per tank may be accepted.

303 For unmanned barges without auxiliary machinery, non-permanent cargo pumps with external power supply may be acceptable.

The pumps shall be connected to the piping system on open deck or in a cargo pump room.

304 Cargo pump room situated below deck shall have a power operated bilge system.

Cargo pump room may have bilge suctions to the cargo pumps.

C 400 Testing

401 Cargo piping shall be hydrostatically tested in the presence of the surveyor to a test pressure = 1.5 × the maximum working pressure.

If hydrostatic testing of separate lengths of piping valves, expansion elements etc. has been carried out prior to the installation on board, a tightness test to at least the design pressure is required after completion of the installation onboard.

D. Cargo Heating

D 100 General

101 The heating media shall be compatible with the cargo and the temperature of the heating medium is normally not to exceed 220°C.

D 200 Steam heating

201 Water systems and steam systems shall comply with Pt.4 Ch.6 unless otherwise stated.

202 Where steam and exhaust pipes for heating coils are fitted in the cargo tanks, it shall be possible to blank flange the steam and exhaust pipes outside the engine or boiler room.

203 Condensate from cargo heating systems shall be led into an observation tank placed in an easily accessible, well ventilated and well illuminated position where it can easily be observed whether the condensate is free from oil or not. The scum pipes shall be led to a waste oil tank. If the condensate shall be used as feed water for boilers, an effective oil filtering system shall be arranged.

D 300 Thermal oil heating

301 Requirements to thermal-oil installations are given in Pt.4 Ch.7 Sec.3 B.

302 Heating of liquid cargoes with flash point not exceeding 60°C shall be arranged by means of a separate secondary system located in the cargo area. However, a single circuit system may be accepted on the following conditions:

— system is so arranged that a positive pressure in the coil shall be at least 3 m water column above the static head of the cargo when circulating pump is not in operation
— the thermal oil system expansion tank shall be fitted with high and low level alarms
— means shall be provided in the thermal oil system expansion tank for detection of flammable cargo vapours
— valves for the individual heating coils shall be provided with locking arrangement to ensure that the coils are under static pressure at all times.

D 400 Heating of cargo with temperatures above 120°C

401 Heating plants for asphalt tanks shall be arranged with redundancy.

402 Heating coils in asphalt tanks shall be separated into at least two independent systems.

403 Heating system for cargo pumps and cargo lines to be arranged.

404 Temperature gauges shall be arranged in each cargo tanks enabling the recording of temperatures at bottom, midway between bottom and deck and at deck level in order to prevent overheating of cargo.

405 For requirements for NDT of heating coils, see Pt.4 Ch.6 Sec.7 A500.

E. Bow and Stern Loading and Unloading Arrangements

E 100 General

101 Subject to the approval of the society, cargo piping may be fitted to permit bow and stern loading and unloading.

E 200 Piping arrangement

201 In addition to Pt.4 Ch.6 Sec.6, the following provisions apply:

a) Bow and stern loading and unloading pipes shall be led outside accommodation spaces, service and machinery spaces within the accommodation or control stations.
b) Cargo lines forward or aft of the cargo area, except at the loading station shall have welded connections. Such piping shall be clearly identified and fitted with two valves or one valve and a spool piece or blanks at its connection to the cargo piping system within the cargo area.
c) The shore connection shall be fitted with a shut-off valve and a blank flange.
d) Spray shields shall be provided at the connections specified in c).

e) The piping shall be self-draining to the cargo area, preferably into a cargo tank.

f) Arrangements shall be made to allow for purging and gas-freeing of the piping to the cargo area.

g) Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall comply with SOLAS Reg. II-2/4.5.1.6 to 4.5.2.3.

h) A fixed foam fire-extinguishing system covering loading and unloading areas shall be provided.

i) Loading and unloading arrangements shall not interfere with safety equipment.

j) Continuous coamings shall be fitted to keep any spills away from accommodation and service areas.

Regarding additional class notations **BOW LOADING** or **STL** for offshore loading operations, see Sec.14.

SECTION 5
GAS-FREEING AND VENTING OF CARGO TANKS

A. Gas-freeing of Cargo Tanks

A 100 General

101 Means for gas-freeing of the cargo tanks shall be provided.

The gas-freeing system shall be used exclusively for ventilating and gas-freeing purposes. The system may, however, be combined with an inert gas system.

102 There shall be no connection between the gas-freeing system and the ventilation system for cargo pump room.

103 Permanently installed ventilating and gas-freeing systems with non-permanent connections to cargo tanks or cargo piping, shall comply with the following:

— where the fans are located in a non-hazardous space, the air supply piping from the fan shall have an automatically operated shut-off valve and a non-return valve in series
— the valves shall be located at the bulkhead where the air supply piping leaves the non-hazardous space, with at least the non-return valve on the outside
— the shut-off valve shall open after the fans are started, and close automatically when the fans stop.

104 If a connection is fitted between the inert gas supply mains and the cargo piping system, arrangements shall be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This isolation may consist of two shut-off valves with an arrangement to vent the space between the valves. The valve on the cargo side of the separation shall be of non-return type with a positive means of closure. Alternatively, two shut-off valves with a removable spool piece may be accepted. See Fig.1. (IACS UI SC62 (1985))

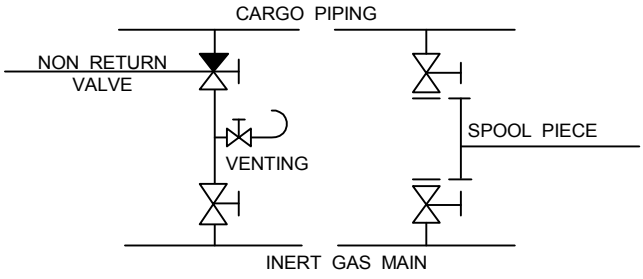

Fig. 1
Example of effective isolation

105 When the ship is provided with an inert gas system, gas outlets for tank purging and gasfreeing purposes shall comply with B, and be positioned as far as practicable from the inert gas and air inlets. Alternatively, gas outlets may be arranged specifically for this purpose. Such outlets shall have a minimum height of 2 m above tank deck and dimensioned to give a minimum vertical exit velocity of 20 m/s, when any three cargo tanks are simultaneously supplied with inert gas, until the concentration of hydrocarbon vapours in the cargo tanks has been reduced to less than 2% by volume. Thereafter, gasfreeing may take place at the cargo tank deck level.

106 When the ship is not provided with an inert gas system the operation shall be such that the flammable vapour is discharged initially through the vent outlets as specified in B, or through outlets at least 2 m above the tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gasfreeing operation, or through outlets at least 2 m above the tank deck level with a vertical efflux velocity of at least 20 m/s and which are protected by flame arresting elements as specified in B212. When the flammable vapour concentration at the outlet has been reduced to 30% of LEL, gasfreeing may be continued at tank deck level.

A 200 Gas-freeing of cargo tanks for barges

201 Gas-freeing equipment is not required to be installed nor stored onboard.

The tank hatches are, however, to be arranged so as to facilitate the use of portable gas-freeing equipment.

B. Cargo Tank Venting Systems

B 100 General

101 All cargo tanks shall have a breathing system for relief of pressure and vacuum. Such breathing shall be through P/V valves, (pressure or vacuum relief valves).

102 All cargo tanks shall have a venting system for avoiding excessive overpressure or vacuum during loading and unloading with closed tank hatch covers.

The system shall be designed with redundancy for the relief of full flow overpressure and vacuum. Pressure sensors fitted in each cargo tank, and connected to an alarm system, may be accepted in lieu of the redundancy requirement for pressure relief.

See Sec.9 regarding high level alarms, overflow systems etc.

B 200 System design

201 The breathing and venting systems may be independent or combined and may be connected to an inert gas system. Pipes for breathing and venting shall be led from each tank's highest point and shall be self-draining to the cargo tanks under all normal conditions of trim and list.

202 Separate system (e.g. stand pipe) for each tank or connection of tanks to a common main pipe may be approved. When connection to a common main pipe is arranged, each branch pipe shall be fitted with means of isolation. If the tank is not fitted with a separate P/V valve, the means of isolation shall be constructed in such a way that tank breathing is maintained when the branch pipe is isolated.

203 Shut-off valves shall not be fitted neither above nor below P/V valves, but by-pass valves may be provided.

204 The opening pressure of the pressure relief valves shall be less than the design vapour pressure for the cargo tanks. The opening pressure of the vacuum relief valves is normally not to be lower than 0.07 bar below atmospheric pressure.

205 P/V valves shall be located on open deck and shall be of a type which allows the functioning of the valve to be easily checked.

206 Venting systems to be used for cargoes (e.g. asphalt) that may cause clogging of the venting lines, will be specially considered.

207 Intake openings of vacuum relief valves shall be located at least 1.5 m above tank deck, and shall be protected against the sea. The arrangement shall comply with the requirements in Pt.3 Ch.3 Sec.6.

208 Gas outlets for thermal breathing only (small capacity P/

V valves) shall be located at a minimum height of 2 m above tank deck or gangway, if situated within 4 m of the gangway, and at a distance of not less than 5 m from air intakes and openings to enclosed spaces containing a source of ignition, and from equipment which may constitute an ignition hazard.

209 When the venting system during loading and unloading is by free flow of vapour mixtures, the outlets shall be not less than 6 m above the tank deck or gangway, if situated within 4 m of the gangway, and located not less than 10 m measured horizontally from air intakes and openings to enclosed spaces containing a source of ignition, and from equipment which may constitute an ignition hazard.

210 When the venting system during loading and unloading is by high velocity discharge the height of the gas outlets shall be located at a minimum height of 2 m above tank deck or gangway, if situated within 4 m of the gangway, and located not less than 10 m measured horizontally from air intakes and openings to enclosed spaces containing a source of ignition, and from equipment which may constitute an ignition hazard. High velocity devices shall be of an approved type.

211 Gas outlets used during loading shall be directed vertically upwards.

212 Gas outlets and air inlets for cargo tanks shall have flame arresting elements tested and approved according to IMO MSC/Circ.677 as amended by MSC/Circ.1009.

213 The flow area of the venting system used during loading shall be based upon not less than 125% of the gas volume flow corresponding to the maximum anticipated loading rate.

214 In pipe systems for escape gas, after P/V valves, means for draining shall be fitted where condensate may accumulate.

B 300 Venting of cargo tanks for barges

301 The cargo tanks shall be provided with a venting system to facilitate loading and unloading with closed tank hatches without imposing excessive overpressure or vacuum on the tanks.

302 Breathing system with P/V valves will normally not be required.

SECTION 6
VENTILATION SYSTEMS WITHIN THE CARGO AREA OUTSIDE THE CARGO TANKS

A. Ventilation Systems

A 100 General

101 Any ducting used for the ventilation of hazardous spaces shall be separate from that used for the ventilation of non-hazardous spaces.

Ventilation systems within the cargo area shall be independent of other ventilation systems.

102 Air inlets for hazardous enclosed spaces shall be taken from areas which, in the absence of the considered inlet, would be non-hazardous.

Air inlets for non-hazardous enclosed spaces shall be taken from non-hazardous areas at least 1.5 m from the boundaries of any hazardous area.

Where the inlet duct passes through a more hazardous space, the duct shall have over-pressure relative to this space, unless mechanical integrity and gas-tightness of the duct will ensure that gases will not leak into it.

103 Air outlets from non-hazardous spaces shall be located outside hazardous areas.

104 Air outlets from hazardous enclosed spaces shall be located in an open area which, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space.

105 Ventilation ducts for spaces within the cargo area are not to be led through non-hazardous spaces.

106 Non-hazardous enclosed spaces shall be arranged with ventilation of the overpressure type. Hazardous spaces shall have ventilation with under-pressure relative to the adjacent less hazardous spaces.

107 Starters for fans for ventilation of gas-safe spaces within the cargo area shall be located outside this area or on open deck.

If electric motors are installed in such spaces, the ventilation capacity shall be large enough to prevent the temperature limits specified in Pt.4 Ch.8 from being exceeded, taking into account the heat generated by the electric motors.

108 Wire mesh protection screens of not more than 13 mm square mesh shall be fitted in outside openings of ventilation ducts.

For ducts where fans are installed, protection screens are also to be fitted inside of the fan to prevent the entrance of objects into the fan housing

109 Spare parts for fans shall be carried onboard. Normally wear parts for one motor and one impeller is required for each type of fan serving spaces in the cargo area.

A 200 Fans serving hazardous spaces

201 Electric fan motors shall not be installed in ventilation ducts for hazardous spaces unless the motor is certified for the same hazard zone as the space served.

202 Fans shall be designed with the least possible risk for spark generation.

203 Minimum safety clearances between the casing and rotating parts shall be such as to prevent any friction with each other.

In no case is the radial air gap between the impeller and the casing to be less than 0.1 of the diameter of the impeller shaft in way of the bearing, but not less than 2 mm. It need not be more than 13 mm.

204 The parts of the rotating body and of the casing shall be made of materials which are recognised as being spark proof, and they shall have antistatic properties.

Furthermore, the installation on board of the ventilation units shall be such as to ensure the safe bonding to the hull of the units themselves. Resistance between any point on the surface of the unit and the hull, shall not be greater than 10^6 Ohm.

The following combinations of materials and clearances used in way of the impeller and duct are considered to be none-sparking:

- impellers and/or housing of non-metallic material, due regard being paid to the elimination of static electricity
- impellers and housings of non-ferrous metals
- 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 materials is fitted in way of the impeller, due regard being paid to static electricity and corrosion between ring and housing
- impellers and housing of austenitic stainless steel
- any combination of ferrous (including austenitic stainless steel) impellers and housing with not less than 13 mm tip design clearance.

205 Any combination of an aluminium or magnesium alloy fixed or rotating component, and a ferrous fixed or rotating component, regardless of tip clearance, is considered a spark hazard and shall not be used in these places.

B. Ventilation Arrangement and Capacity Requirements

B 100 General

101 The required capacity of the ventilation plant is normally based on the total volume of the room. An increase in required ventilation capacity may be necessary for rooms with a complicated shape.

B 200 Non-hazardous spaces

201 Spaces with opening to a hazardous area, shall be arranged with an air-lock, and be maintained at overpressure, relative to the external hazardous area.

The overpressure ventilation shall be arranged according to the following requirements:

1) During initial start-up or after loss of overpressure ventilation, it is required before energising any electrical installations not certified safe for the space in the absence of pressurisation, to:
   - proceed with purging (at least 5 air changes) or confirm by measurements that the space is non-hazardous, and
   - pressurise the space.
2) Operation of the overpressure ventilation shall be monitored.
3) In the event of failure of the overpressure ventilation:
   - an audible and visual alarm shall be given at a manned location

— if overpressure cannot be immediately restored, automatic or programmed disconnection of electrical installations is required according to IEC 60092-502, Table 5.

B 300 Cargo handling spaces

301 A permanent mechanical ventilation system of the extraction type shall be installed, capable of circulating sufficient air to give at least 20 air changes per hour.

In the cargo pump room, exhaust trunking shall be arranged as follows:

— in the cargo pump room bilges just above the transverse floor plates or bottom longitudinals, so that air can flow over the top from adjacent spaces.

302 The electrical lighting in the cargo pump room shall be fitted with an interlock so arranged that the ventilation must be in operation before the electrical supply to the lighting in the room can be connected. Emergency lighting shall not be interlocked. Failure of the ventilation system shall not cause the lighting to go out.

303 The exhaust outlets, which shall discharge upwards, shall be situated at least 3 m above tank deck.

304 When the space is dependent on ventilation for its area classification, the following requirements apply:

1) During initial start-up, and after loss of ventilation, the space shall be purged (at least 5 air changes), before connecting electrical installations which are not certified for the area classification in absence of ventilation.
2) Operation of the ventilation shall be monitored.
3) In the event of failure of ventilation, the following requirements apply;
   — an audible and visual alarm shall be given at a manned location
   — immediate action shall be taken to restore ventilation
   — electrical installations shall be disconnected if ventilation cannot be restored for an extended period. The disconnection shall be made outside the hazardous areas, and be protected against unauthorised re-connection, e.g. by lockable switches.

Guidance note:

Intrinsically safe equipment suitable for Zone 0, is not required to be switched off. Certified flameproof lighting, may have a separate switch-off circuit, satisfying B302.

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B 400 Other hazardous spaces normally entered

401 Pipe tunnel, ballast pump room and other similar spaces below deck, not covered by 300, where access may be necessary for normal operation and maintenance, shall be equipped with a fixed separate ventilation system, with a capacity of at least 8 air changes per hour.

402 Air lock spaces shall be mechanically ventilated at an overpressure relative to the adjacent open deck hazardous area.

403 Other spaces situated on or above cargo deck level (e.g. Cargo Handling Gear lockers) may be accepted with natural ventilation only.

B 500 Spaces not normally entered

501 All spaces mentioned in Sec.1 B119 shall be gas freeable. If necessary ducting shall be fitted in order to ensure efficient gasfreeing.

502 A mechanical ventilation system (permanent or portable) shall be provided, capable of circulating sufficient air to the compartments concerned. The capacity of the ventilation system is normally to give at least 8 air changes per hour for the spaces mentioned in Sec.1 C119, except ballast tanks.

503 Double hull and double bottom spaces shall be fitted with suitable connections for the supply of air for gas freeing.

B 600 Ventilation systems for barges

601 Engine room and cargo pump room situated below deck shall have separate mechanical ventilation systems of overpressure type and underpressure type, respectively.

602 Engine room, cargo pump room and service spaces situated on deck may have natural ventilation systems.

603 Accommodation spaces shall be provided with mechanical ventilation of the overpressure type.

SECTION 7
FIRE PROTECTION AND EXTINCTION

A. Fire Safety Measures for Tankers

A 100 Application

101 It is the responsibility of the government of the flag state to ensure that ships are provided with the fire safety measures required by the International Convention for the Safety of Life at Sea, 1974, as amended (hereafter referred as SOLAS).

102 Where the government of the flag state is authorising the Society to issue the SOLAS safety certificates (Safety construction and Safety Equipment certificates) on its behalf, the Society will apply the fire protection, detection and extinction requirements in Pt.4 Ch.10 for tankers.

103 If the government of the flag state is not authorising the Society to take care of the fire safety measures in SOLAS related to tankers, the Safety Equipment and the Safety Construction certificates from the flag state will be used as basis for this notation.

SECTION 8
AREA CLASSIFICATION AND ELECTRICAL INSTALLATIONS

A. General

A 100 Application

101 The requirements in this section are additional to those given in Pt.4 Ch.8 and apply to tankers intended for the carriage of oil cargoes in bulk having a flash point not exceeding 60°C (closed cup test).

102 For ships with class notation for alternative tanker and dry cargo service, the requirement for tankers generally apply. However, exemptions from the requirements for tankers may be accepted for equipment which is only used in dry cargo service, after consideration in each case. Instructions will be given that such equipment shall be disconnected and earthed when the ship is used as tanker and until it has been gas-freed after such service.

103 Tankers exclusively built to carry cargoes with flash point above 60°C, will be specially considered in each case. See C300.

A 200 Insulation monitoring

201 *Insulation fault*. Device(s) to continuously monitoring the insulation earth shall be installed for both insulated and earthed distribution systems. An audible and visual alarm shall be given at a manned position in the event of an abnormally low level of insulation resistance and or high level of leakage current.

B. Electrical Installations in Hazardous Areas

B 100 General

101 Electrical equipment and wiring are in general not to be installed in hazardous areas. Where essential for operational purposes, arrangement of electrical installations in hazardous areas shall comply with Pt.4 Ch.8 Sec.11, based on area classification as specified in C.

In addition, installations as specified in 102 are accepted.

102 *In Zone 1*. Impressed cathodic protection equipment is accepted provided the following is complied with:

- such equipment shall be of gas-tight construction or be housed in a gas tight enclosure
- cables are to be installed in steel pipes with gas-tight joints up to the upper deck
- corrosion resistant pipes, providing adequate mechanical protection, shall be used in compartments which may be filled with seawater (e.g. permanent ballast tanks)
- wall thickness of the pipes shall be as for overflow and sounding pipes through ballast or fuel tanks, in accordance with Pt.4 Ch.6 Sec.6.

C. Area Classification

C 100 General

101 Area classification is a method of analyzing and classifying the areas where explosive gas atmospheres may occur. The object of the classification is to allow the selection of electrical apparatus able to be operated safely in these areas.

102 In order to facilitate the selection of appropriate electrical apparatus an the design of suitable electrical installations, hazardous areas are divided into zones 0, 1 and 2 according to the principles of the standards IEC 60079-10 and IEC 60092-502.

Classification of areas and spaces typical for tankers, is given in 200 and 300, based on IEC 60092-502.

103 Areas and spaces other than those classified in 200 and 300, shall be subject to special consideration. The principles of the IEC standards shall be applied.

104 Area classification of a space may be dependent of ventilation as specified in IEC 60092-502, Table 1. Requirements to such ventilation are given in Sec.6 B304 to B306.

105 A space with opening to an adjacent hazardous area on open deck, may be made into a less hazardous or non-hazardous space, by means of overpressure. Requirements to such pressurisation are given in Sec.6 B202 to B205.

106 Ventilation ducts shall have the same area classification as the ventilated space.

C 200 Tankers for carriage of products with flashpoint not exceeding 60°C

201 *Hazardous areas zone 0*

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo or developing flammable gases or vapours.

202 *Hazardous area zone 1*

1) Void spaces adjacent to, above and below integral cargo tanks
2) Hold spaces containing independent cargo tanks
3) Cofferdams and permanent (for example, segregated) ballast tanks adjacent to cargo tanks
4) Cargo pump rooms arranged with ventilation according to Sec.6 B304.
5) Enclosed or semi-enclosed spaces, immediately above cargo tanks (for example, between decks) or having bulkheads above and in line with cargo tanks bulkheads, unless protected by a diagonal plate acceptable to the appropriate authority.
6) Spaces, other than cofferdam, adjacent to and below the top of a cargo tanks (for example, trunks, passageways and hold)
7) Areas on open deck, or semi- enclosed spaces on deck, within 3 m of any cargo tanks outlet, gas or vapour outlet (see note), cargo manifold valve, cargo valve, cargo pipe flange, cargo pump-room ventilation outlets and cargo tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation.

   Guidance note:

   Such areas are, for example, all areas within 3 m of cargo tank hatches, sight ports, tank cleaning openings, ullage openings, sounding pipes, cargo vapour outlets.

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8) Areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading and ballasting or during discharging, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet.

9) Areas on open deck, or semi-enclosed spaces on deck, within 1.5 m of cargo pump room entrances, cargo pump room ventilation inlet, openings into cofferdams or other zone 1 spaces.

10) Areas on the open deck within spillage coamings surrounding cargo manifold valves and 3 m beyond these, up to a height of 2.4 m above the deck.

11) Areas on open deck over all cargo tanks (including ballast tanks within the cargo tank area) where structures are restricting the natural ventilation and to the full breadth of the ship plus 3 m fore and aft of the forward-most and the aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck.

12) Compartments for cargo hoses.

13) Enclosed or semi-enclosed spaces in which pipes containing cargoes are located.

203 *Hazardous areas zone 2*

1) Areas within 1.5 m surrounding open or semi-enclosed spaces of zone 1 as specified in 202, if not otherwise specified in this standard.

2) Spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in 202 8).

3) The spaces forming an air-lock as defined in Sec.1 B102 and Sec.3 D105 and 106.

4) Areas on open deck extending to the coamings fitted to keep any spills on deck and away from the accommodation and service areas and 3 m beyond these up to a height of 2.4 m above deck.

5) Areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where unrestricted natural ventilation is guaranteed and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2.4 m above the deck surrounding open or semi-enclosed spaces of zone 1

6) Spaces forward of the open deck areas to which reference is made in 202 11) and 203 5), below the level of the main deck, and having an opening on to the main deck or at a level less than 0.5 m above the main deck, unless:

   a) the entrances to such spaces do not face the cargo tank area and, together with all other openings to the spaces, including ventilating system inlets and exhausts, are situated at least 10 m horizontally from any cargo tank outlet or gas or vapour outlet; and

   b) the spaces are mechanically ventilated.

7) Fore peak ballast tanks, if connected to a piping system serving ballast tanks within the cargo area. See Sec.4 B300.

C 300 Tankers for carriage of products with flashpoint exceeding 60°C

301 *Unheated cargoes and cargoes heated to a temperature below and not within 15°C of their flashpoint.*

Hazardous areas zone 2

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo.

302 *Cargoes heated above their flashpoint and cargoes heated to a temperature within 15°C of their flashpoint.*

The requirements of 202 are applicable.

D. Inspection and Testing

D 100 General

101 Before the electrical installations in hazardous areas are put into service or considered ready for use, they shall be inspected and tested. All equipment, cables, etc. shall be verified to have been installed in accordance with installations procedures and guidelines issued by the manufacturer of the equipment, cables, etc., and that the installations have been carried out in accordance to Pt.4 Ch.8 Sec.11.

102 For spaces protected by pressurisation it shall be examined and tested that the purging can be effected. Purge time at minimum flow rate shall be documented. Required shutdowns and or alarms upon ventilation overpressure falling below prescribed values shall be tested.

For other spaces where area classification depends on mechanical ventilation it shall be tested that ventilation flow rate is sufficient, and that and required ventilation failure alarm operates correctly.

103 For equipment for which safety in hazardous areas depends upon correct operation of protective devices (for example overload protection relays) and or operation of an alarm (for example loss of pressurisation for an Ex(p) control panel) it shall be verified that the devices have correct settings and / or correct operation of alarms.

104 Where interlocking and shutdown arrangements are required (such as for submerged cargo pumps), they shall be tested.

105 Intrinsically safe circuits shall be verified to ensure that the equipment and wiring are correctly installed.

106 Verification of the physical installation shall be documented by yard. The documentation shall be available for the Society's surveyor at the site.

E. Maintenance

E 100 General

101 The maintenance manual referred to in Sec.1 C205, shall be in accordance with the recommendations in IEC 60079-17 and 60092-502 and shall contain necessary information on:

— overview of classification of hazardous areas, with information about gas groups and temperature class
— records sufficient to enable the certified safe equipment to be maintained in accordance with its type of protection (list and location of equipment, technical information, manufacturer's instructions, spares etc.)
— inspection routines with information about detailing level and time intervals between the inspections, acceptance/rejection criteria
— register of inspections, with information about date of inspections and name(s) of person(s) who carried out the inspection and maintenance work.

102 Updated documentation and maintenance manual, shall be kept onboard, with records of date and names of companies and persons who have carried out inspections and maintenance.

Inspection and maintenance of installations shall be carried out only by experienced personnel whose training has included instruction on the various types of protection of apparatus and installation practices to be found on the vessel. Appropriate refresher training shall be given to such personnel on a regular basis.

F. Signboards

F 100 General

101 Where electric lighting is provided for spaces in hazardous areas, a signboard at least 300 mm shall be fitted at each entrance to such spaces with text:

BEFORE A LIGHTING FITTING IS OPENED ITS SUPPLY CIRCUIT SHALL BE DISCONNECTED

Alternatively a signboard with the same text can be fitted at each individual lighting fitting.

102 Where electric lighting is provided in spaces where the ventilation must be in operation before the electric power is connected, a signboard at least 200 × 300 mm shall be fitted at each entrance, and with a smaller signboard at the switch for each lighting circuit, with text:

BEFORE THE LIGHTING IS TURNED ON THE VENTILATION MUST BE IN OPERATION

103 Where socket-outlets are installed in cargo area or adjacent area, a signboard shall be fitted at each socket-outlet with text:

PORTABLE ELECTRICAL EQUIPMENT SUPPLIED BY FLEXIBLE CABLES SHALL NOT BE USED IN AREAS WHERE THERE IS GAS DANGER

Alternatively signboards of size approximately 600 × 400 mm, with letters of height approximately 30 mm, can be fitted at each end of the tank deck.

104 Where socket-outlets for welding apparatus are installed in areas adjacent cargo area, the socket outlet shall be provided with a signboard with text:

WELDING APPARATUS NOT TO BE USED UNLESS THE WORKING SPACE AND ADJACENT SPACES ARE GAS-FREE.

SECTION 9
INSTRUMENTATION AND AUTOMATION

A. General Requirements

A 100 General

101 For instrumentation and automation, including computer based control and monitoring, the requirements in this chapter are additional to those given in Pt.4 Ch.9.

102 The control and monitoring systems shall be certified according to Pt.4 Ch.9 for the following:

— cargo tank level measurement system
— cargo tank overflow protection system
— cargo valves and pumps control and monitoring system
— flammable gas detection system (permanent system only)
— inert gas control and monitoring system
— offshore loading and unloading control and monitoring system.

B. Cargo Valve and Pump Control

B 100 General

101 If valves and pumps for loading and unloading the ship are remotely controlled, all controls, indicators and alarms associated with a given cargo tank shall be centralised in one control station. Pump discharge pressure and vacuum meter to be fitted in the control station.

102 Cargo pumps, ballast pumps and stripping pumps, installed in cargo pump rooms and driven by shafts passing through pump room bulkheads shall be fitted with temperature sensing devices for bulkhead shaft glands, bearings and pump casings. An alarm shall be initiated in the cargo control room or the pump control station.

103 Cargo pump rooms shall be provided with bilge high level alarms.

The alarm signals (visual and audible) shall be provided in the cargo control room or station.

104 Local operation of valves may be carried out from separate deck stands provided satisfactory position indication is arranged locally and at the control station mentioned in 101.

105 Remote-controlled cargo tank valves shall be provided with an indication system, which at the manoeuvring stand indicates to the operator whether the valves are in open or closed position. A flow indicator in the hydraulic system for manoeuvring valves can be accepted. The flow indicator shall show whether the valves are in open or closed position.

106 Remote-controlled tank valves shall be arranged with means for manual (emergency) operation.

A handpump which can be connected to the control system as near the valve as possible, will normally be accepted.

B 200 Computer based systems for cargo handling

201 Local control of cargo handling systems independent of computer controlled systems will be required.

B 300 Centralised cargo control

301 Ships having their cargo and ballast systems built and equipped, surveyed and tested in accordance with the requirements in Pt.6 Ch.6 may be given the additional class notation **CCO**.

B 400 Design of integrated cargo and ballast systems

401 The operation of cargo and/or ballast systems may be necessary, under certain emergency circumstances or during the course of navigation, to enhance the safety of tankers. As such, measures are to be taken to prevent cargo and ballast pumps becoming inoperative simultaneously due to a single failure in the integrated cargo and ballast system, including its control and safety systems.

402 Integrated cargo and ballast systems meaning any integrated hydraulic and/or electric system used to drive both cargo and ballast pumps (including active control and safety systems and excluding passive components, e.g. piping), are to be designed and constructed as follows:

.1 the emergency stop circuits of the cargo and ballast systems are to be independent from the circuits for the control systems. A single failure in the control system circuits or the emergency stop circuits are not to render the integrated cargo and ballast system inoperative;
.2 manual emergency stops of the cargo pumps are to be arranged in a way that they are not to cause the stop of the power pack making ballast pumps inoperable;
.3 the control systems are to be provided with backup power supply, which may be satisfied by a duplicate power supply from the main switch board. The failure of any power supply is to provide audible and visible alarm activation at each location where the control panel is fitted.
.4 in the event of failure of the automatic or remote control systems, a secondary means of control is to be made available for the operation of the integrated cargo and ballast system. This is to be achieved by manual overriding and/or redundant arrangements within the control systems.

C. Cargo Tank Level Measurement

C 100 General

101 Types of level measuring devices:

Open type

A method which makes use of an opening in the tank and directly exposes the operator to the cargo or its vapours. Examples of this type are ullage openings and gauge hatches.

Restricted type

A device which penetrates the tank and which, when in use, permits a limited quantity of cargo vapour or liquid to be expelled to the atmosphere. When not in use, the device is completely closed. Examples of this type are rotary tube, fixed tube, slip tube and sounding pipe.

Closed type

A device which penetrates the tank, but which is part of a closed system which keeps the cargo completely sealed off from the atmosphere. Examples of this type are sight glasses, pressure cells, float-tape systems, electronic or magnetic probe.

102 Each cargo tank shall be fitted with at least one level gauging device. Where only one liquid level measuring device is fitted it shall be arranged so that any necessary maintenance can be carried out while the cargo tank is in service.

103 If a closed measuring device is not mounted directly on the tank, it shall be provided with shut-off valves situated as close as possible to the tank.

104 Level measuring in ships with inerted tanks, see Sec.11 C500. For crude oil and petroleum products having a flashpoint not exceeding 60°C, “closed type” only is acceptable.

For other cargo oils, "open type" or "restricted type" are acceptable.

D. Cargo Tank Overflow Protection

D 100 General

101 Provision shall be made to guard against liquid rising in the venting system to a height which will exceed the design head of cargo tanks. This shall be accomplished by high level alarms or overflow control systems or other equivalent means, together with gauging devices and cargo tank filling procedures.

High level alarms shall be independent of the closed level measuring system.

Combined level measuring system and high level alarm systems may be accepted as equivalent to independent systems provided extensive self-monitoring is incorporated in the system covering all credible faults.

E. Oil and Water Interface Detector

E 100 General

101 The ship shall be provided with instruments for measuring the interface level between oil and water. The instrument(s) may be fixed or portable.

F. Gas Detection in Cargo Pump Room

F 100 General

101 A system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted. Sampling points or detector heads shall be located in suitable positions in order that potentially dangerous leakage is readily detected. When the hydrocarbon gas concentration reaches a pre-set level, which shall not be higher than 10% of the lower flammable limit, a continuous audible and visual alarm signal shall be automatically initiated in the pump-room, engine control room, cargo control room and navigation bridge, to alert personnel to the potential hazard.

Sequential sampling is acceptable as long as it is dedicated for the pump room only, including exhaust ducts, and the sampling time is reasonably short.

Guidance note:

Suitable positions may be the exhaust ventilation duct and lower parts of the pump room above the floor plates.

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G. Explosimeters and Gas Detectors

G 100 General

101 The ship shall be provided with approved portable gas detectors.

Ships with inert gas systems shall be provided with two instruments for measuring O_2-content, two instruments for measuring hydrocarbon-content in the range of 0 to 20% hydrocarbon gas by volume and two instruments for measuring low hydrocarbon gas-content 0 to 100% LEL.

Ships without inert gas system shall be provided with two instruments for measuring low hydrocarbon gas-content 0 to 100% LEL.

Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. Alternatively a fixed gas detection system shall be fitted in these spaces. Alarms (visual and audible) to be provided on the bridge and in the cargo control room.

Ships for alternate carriage of oil and dry cargo, see Sec.10 C104.

Guidance note:

Oil and water interface detector, explosimeters and gas detectors shall be approved by an Administration.

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H. Installation Requirements for Analysing Units

H 100 General

101 Gas analysing units with non-explosion proof measuring equipment may be located in areas outside cargo areas, for example in the cargo control room, navigation bridge or engine room when mounted on the forward bulkhead provided the following requirements are observed:

a) Sampling lines shall not run through gas non-hazardous spaces, except where permitted under e).

b) The gas sampling pipes shall be equipped with flame arresters. Sample gas shall be led to the atmosphere with outlets arranged in a safe location.

c) Bulkhead penetrations of sample pipes between non-hazardous and hazardous areas shall be of an approved type and have the same fire integrity as the division penetrated. A manual isolating valve shall be fitted in each of the sampling lines at the bulkhead on the gas safe side.

d) The gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc. shall be located in a reasonably gas tight (e.g. fully enclosed steel cabinet with a door with gaskets) which shall be monitored by its own sampling point. At gas concentration above 30% LFL inside the steel cabinet the entire gas analysing unit shall be automatically shut down.

e) Where the cabinet cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing units, and shall be routed on their shortest ways.

SECTION 10
SHIPS FOR ALTERNATE CARRIAGE OF OIL CARGO AND DRY CARGO

A. General

A 100 Application

101 The requirements in this section apply to ships intended to carry in bulk liquid cargoes with a flashpoint not exceeding 60°C or dry cargo, alternately.

102 The requirements are supplementary to those for the class notation **Tanker for Oil** or **Tanker for Oil Products**.

A 200 Class notation

201 Ships satisfying the requirements in this section may be assigned one of the following class notations:

Bulk Carrier or Tanker for Oil

(alternatively **Tanker for Oil Products**)

Ore Carrier or Tanker for Oil

(alternatively **Tanker for Oil Products**)

A 300 Basic assumptions

301 The rules in this Section are based on the assumption that:

- dry cargo and liquid cargo with a flashpoint not exceeding 60°C are not carried simultaneously, except for cargo oil-contaminated water (slop) in the protected slop tank(s)
- before the ship enters dry cargo service, all cargo piping, tanks and compartments in the cargo area shall be cleaned and ventilated to the extent that the content of hydrocarbon gases is brought well below the lower explosion limit. Further, the cleaning shall ensure that the concentration of hydrocarbon gases remains below the lower explosion limit during the forthcoming dry cargo voyage
- measurements of hydrocarbon gas content are carried out regularly during dry cargo service.

Guidance note:

Measurement of hydrocarbon gas content once every day is considered appropriate during the first two weeks. Later on this may be reduced, depending on the results of the previous measurements. When sailing into higher air or sea-water temperatures, measurements should be taken daily.

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A 400 Documentation

401 In addition to the documentation required for the class notation **Tanker for Oil** the following documentation shall be submitted for approval:

- plans showing the cleaning and gas-freeing arrangement for cargo tanks and cargo piping
- description of operations with respect to:
  - procedures for conversion from tanker trade to dry cargo trade, and vice versa
  - procedures for cleaning and gas-freeing of cargo tanks and adjacent spaces
  - actions to be taken when the gas concentration exceeds the defined acceptable limits.
- instruction manual for the operation of the ship
- description and listing of cleaning equipment and its intended use
- for fixed gas detection and alarm systems: specification and location of detectors, alarm devices and call points, and cable routing layout drawing.

402 For requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Sec.1.

B. Cargo Area Arrangement and Systems

B 100 General

101 The ship shall comply with the requirements of Sec.12 for protected slop tank.

B 200 Design of cargo oil tanks

201 Cargo tanks shall be designed to facilitate efficient cleaning.

The bottom, side and end boundaries of the tanks may be of the following alternative designs:

- plane surfaces
- corrugated surfaces
- vertical stiffeners, but no internal primary structural members in the tanks.

202 In tanks where primary structural members are unavoidable, particular attention has to be paid to the arrangement and outfitting of cleaning facilities. The efficiency of such equipment shall be verified by a test after the discharge of the ship's first oil cargo. The established cleanliness and gas-free condition shall be verified by a measuring program approved by the Society.

B 300 Arrangement and access to compartments

301 Compartments in the cargo area such as pipe tunnels, stool tanks, cofferdams, etc. shall be arranged so as to avoid the spreading of hydrocarbons. For instance, stool tanks and cofferdams shall not have permanent openings to pipe tunnels.

302 The double bottom shall be arranged for segregated ballast with tanks of length not exceeding 0.2 L.

303 Pipe tunnels and other compartments of comparable extent in the cargo area shall be provided with access openings at forward and aft end.

For tunnels and compartments exceeding 100 m in length, an additional access opening shall be provided near the half length. The access entrances shall be arranged from open deck or a cargo pump room, and shall be suitable for use for cleaning and gas-freeing operations.

304 Stool tanks shall be provided with access from open deck. The access openings shall be suitable for use for cleaning and gas-freeing operations.

Access to stool tanks from pipe tunnel may be accepted if the following items are complied with:

- Bolted manhole cover or equivalent gastight closing with oil-resistant packings and signboards with instruction to normally keep it closed. The cover shall be lifted 300 mm above bottom of stool tank to prevent back-flow of oil when opened.
- Ventilation pipes of sufficient size on port and starboard side for cross ventilation and gas-freeing by portable fans.

305 Access entrances and passages shall have a clear opening of at least 600 by 600 mm.

306 Openings which may be used for cargo operations are not permitted in bulkheads and decks separating oil cargo

spaces from other spaces not designed and equipped for the carriage of oil cargoes unless alternative approved means are provided to ensure equivalent integrity.

B 400 Bilge, drainage and cargo piping

401 As far as compatible with the general arrangement of the ship, the cargo oil piping shall be located on open deck or within the cargo tanks.

402 If piping locations stated in 401 are not appropriate, the cargo oil piping may be located within special pipe tunnels of limited size.

403 The cargo oil piping system shall be designed and equipped so as to minimise the risk of oil leakage due to corrosion or to failures in the pipe connection fittings. Steel pipes inside water ballast tanks shall have a wall thickness not less than 12.5 mm.

404 A separate bilge system shall be provided for the compartments intended for carrying dry cargo. A separate cargo oil stripping system may be used for bilge pumping, provided the system has no connection to, or is easily isolated from, tanks not intended for dry cargo.

405 Bilge suctions in cargo holds, see Pt.4 Ch.6 Sec.4 C.

406 The bilge suctions of separate bilge system in cargo holds shall be arranged for blank flanging when the ship is carrying oil.

407 The cargo oil suctions in the holds intended for dry cargo shall be arranged for blank flanging when the ship is carrying dry cargo.

408 Arrangements required by 406 and 407 are not necessary if the ship is fitted with separate cargo pumps in each cargo hold.

409 Arrangements shall be made to avoid damage to oil wells and blank-flanging arrangements due to dry cargo, grab discharging, etc.

410 Top wing tanks may be arranged with gravity overboard discharge, see Pt.3 Ch.3 Sec.6.

411 Dry compartments adjacent to cargo tanks shall be provided with bilge or drainage arrangement. Pipe tunnels shall be provided with bilge suctions at forward and aft ends. Bulkhead stool tanks to be provided with bilge suctions.

B 500 Cleaning and gas-freeing

501 The cargo tanks shall be equipped with fixed or portable means for cleaning and gas-freeing.

502 The water cleaning system for cargo tanks with internal primary structural members shall comprise possibility for heating the cleaning water.

503 Compartments in the cargo area adjacent to the cargo tanks shall be arranged for cleaning and gas-freeing by equipment available onboard.

504 The cargo oil piping shall be arranged for easy cleaning, and an arrangement for gas-freeing shall be provided.

505 A branch line from the fire main shall be arranged in pipe tunnels housing cargo oil piping. A suitable number of hydrant valves shall be located along the length of the tunnel. The branch line shall be arranged for blank flanging outside the tunnel.

B 600 Ventilation

601 Pipe tunnel, ballast pump room and similar spaces within the cargo area, where access may be necessary for normal operation and maintenance, shall be equipped with a fixed separate ventilation system.

602 The capacity of the ventilation systems shall be at least 8 air changes per hour for ballast pump room and spaces normally entered.

If cargo piping and equipment is arranged in ballast pump room, the ventilation capacity shall be at least 20 air changes per hour.

603 Spaces not normally entered like cofferdams, double bottoms, pipe tunnels, stools and ballast tanks shall be gasfreeable with a mechanical ventilation system (permanent or portable). The ventilation capacity is normally to be at least 8 air changes per hour for the spaces mentioned except ballast tanks.

604 Pump room arranged adjacent to protected slop tank shall be fitted with interlock between electric lighting and ventilation, so arranged that the ventilation must be in operation before the electrical current supply to the room can be connected.

C. Gas Measuring Equipment

C 100 Measurement of hydrocarbon gases

101 Arrangements shall be made to facilitate measurement of gas concentration in all tanks and other compartments within the cargo area.

Measurements shall be made possible from open deck or other easily accessible locations.

102 The measuring equipment shall be of approved type, and may be fixed or portable except as stated in 103.

103 Pipe tunnel and cargo pump room shall be equipped with a fixed hydrocarbon gas detection system with alarm. The system shall cover at least 3 locations along the length of the tunnel, however, spaced not more than 30 m apart.

104 Apart from the gas detection arrangements required by 101 to 103 the ship shall have two sets of portable gas measuring equipment, each set consisting of one apparatus for measuring O_2 content, one apparatus for measuring hydrocarbon contents in the range 0 to 20% hydrocarbon gas by volume and one apparatus for measuring low hydrocarbon gas contents (0 to 100% LEL).

D. Instructions

D 100 Instruction manual

101 An instruction manual describing all essential procedures for conversion from oil to dry cargo service and vice versa, as well as procedure related to the measured gas content during dry cargo service, shall be worked out. The instruction manual shall describe the actions to be taken if gas concentration develops above the defined acceptable limits. The manual shall be kept onboard.

The manual is subject to approval.

Guidance note:

The actions may be repeated ventilation, cleaning and ventilation, inerting, water filling, depending on type of compartment, nature of problem and available equipment.

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D 200 Instructions onboard

201 Instructions for dry cargo and **Tanker for Oil** service shall be permanently posted in cargo control rooms and deck office.

SECTION 11
INERT GAS PLANTS

A. General

A 100 Application

101 The requirements in this section apply to inert gas systems for inerting of tanks and void spaces within the cargo area.

102 Oil carriers (**Tanker for Oil** or **Tanker for Oil Products**) of 20 000 tons deadweight and above intended for the carriage of oil cargoes having a flash point not exceeding 60°C (closed cup test) and all ships with crude oil washing arrangement regardless of size shall be fitted with a permanently installed inert gas system complying with the rules in this section.

Oil carriers (**Tanker for Oil** or **Tanker for Oil Products**) less than 20 000 tons deadweight fitted with inert gas system complying with the requirements in this section may be assigned the special features notation **INERT**.

Guidance note:

The requirements in this section are considered to meet the FSS Code Ch.15 and SOLAS Reg. II-2/ 4.5.6 and II-2/ 11.6.3.4.

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A 200 Documentation

201 The following plans shall be submitted for approval:

— schematic diagram of inert gas system, including water supply and discharge piping

and as applicable plans for:

— inert gas generating plant
— sectional view through gas cooling and cleaning device
— sectional view through non-return devices
— sectional view through pressure-vacuum breaking device
— piping arrangement for inert gas distribution and tank ventilation
— instruction manual.

202 For requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Sec.1.

A 300 Instruction manual

301 An instruction manual covering operational safety and health requirements shall be kept on board. The manual shall include guidelines on procedures to be followed in event of failure of the inert gas system.

B. Materials

B 100 General

101 Materials used in piping systems for inert gas plants shall comply with the requirements specified in Pt.4 Ch.6.

102 Materials used for other parts of the inert gas plant shall comply with the requirements in applicable chapters of the rules. Works' certificates will be accepted.

103 Materials shall be selected so as to reduce the probability for corrosion and erosion.

C. Arrangement and General Design

C 100 General

101 The inert gas system shall be capable of supplying a gas or mixture of gases with an oxygen content of not more than 5% at a capacity to satisfy the intended use under all normal operating conditions.

The system shall be able to maintain an atmosphere with an oxygen content not exceeding 8% by volume in any part of any cargo tank.

Inert gas plants based on flue gas from boilers which normally are not in operation during sea voyages (motor ships), and which are not equipped with separate inert gas generator for topping-up purposes, shall be arranged to enable production of flue gas of adequate quantity and quality (artificial load) whenever topping-up shall be carried out.

102 The inert gas system shall be designed and equipped in such a way as to prevent hydrocarbon gases from reaching non-hazardous spaces, and prevent interconnection between tanks and spaces within the cargo area, which normally do not have such connections, e.g. between segregated ballast tanks and cargo tanks.

103 The inert gas may be based on flue gas from boilers or from separate inert gas generators with automatic combustion control.

104 Systems using stored carbon dioxide will not be accepted unless the Society is satisfied that the risk of ignition from generation of static electricity by the system itself is minimised.

C 200 Piping arrangement

201 The piping arrangement shall be such that the cargo tanks during unloading can be filled with inert gas without having open connection to the atmosphere.

202 The piping arrangement shall be such that cargo tank washing can be carried out in an inert atmosphere.

203 The supply pipes for inert gas shall be so arranged that the velocity and direction of the jet will facilitate effective change of the tank atmosphere.

Guidance note:

With an arrangement utilising the dilution method and inlet at deck level, the diameter and flowrate of inlets shall be such that the jet will penetrate all the way down to the tank bottom.

Fig. 1 may be used for determining the relationship between jet penetration depth inlet diameter and flowrate

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The exhaust gas outlets shall comply with the requirements for cargo tank venting, see Sec.5 B.

Connection to cargo oil pipes, see Sec.5 A.

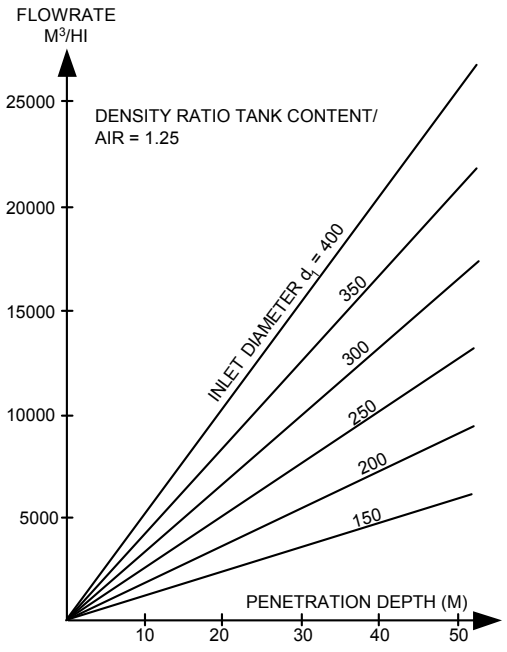

Fig. 1
Relation between flowrate and penetration depth for selected inlet diameters

204 The inert gas supply main(s) is (are) to be fitted with branch piping leading to each cargo tank. Branch piping for inert gas shall be fitted with either stop valves or equivalent means of control for isolating each tank. Any stop valves fitted shall be provided with locking arrangements. With regard to an arrangement of a common inert gas and vent pipe, see Sec.5 B.

205 To protect the tanks from a pressure exceeding design vapour pressure and a vacuum exceeding 0.07 bar, one or more pressure/vacuum breaking devices with sufficient capacity shall be provided in the system. Such device(s) is (are) to be installed on the inert gas main unless such devices are installed in the venting system required by Sec.5, or on individual cargo tanks.

If liquid filled pressure/vacuum breaking devices are fitted, means for easy control of the liquid level shall be provided. The liquid shall be operational in the temperature range -20°C to +40°C.

206 The piping system shall be designed so as to minimize the generation of static electricity.

207 Arrangements shall be made to allow bow or stern loading and discharge pipes to be purged after use and maintained gas safe when not in use. The vent pipes connected with the purge shall be located in the cargo area.

208 The piping arrangement shall be such that the main inert gas line can not be filled with cargo oil, for example by locating the main inert gas line at sufficient height above the cargo tanks or by installing liquid barriers in the branch lines.

209 Suitable arrangements shall be provided to enable the inert gas main to be connected to an external supply of inert gas. The arrangements shall be located forward of the non-return valve referred to in 603.

C 300 Inerting of double hull spaces

301 On oil tankers (**Tanker for Oil**) required to be fitted with inert gas system, double hull spaces shall be fitted with suitable connections for supply of inert gas. Portable means may be used. Where necessary, fixed purge pipes shall be arranged.

302 Where such spaces are connected to a permanently fitted inert gas system means shall be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system, e.g. by using blank flanges.

C 400 Fresh air intakes

401 Fresh air intakes to the inert gas system for gas-freeing of cargo tanks shall be arranged. The air intakes shall be provided with blanking arrangement.

C 500 Level measuring of inerted tanks

501 Means shall be provided to allow ullaging and sounding of inerted tanks without opening the tanks.

Separate ullage openings may be fitted as a reserve means.

C 600 Prevention of gas leakage into non-hazardous spaces

601 An automatically controlled valve shall be fitted near the bulkhead where the main line leaves non-hazardous spaces. The valve shall close automatically when there is no overpressure in the main line after the fans.

602 The inert gas main line shall have a water seal located in the cargo tank area on deck. The water seal shall prevent the return of hydrocarbon vapour to any non-hazardous spaces under all normal conditions of trim, list and motion of the ship.

As far as practicable, the water seal shall prevent entrained water in the gas. Provisions shall be made to secure operation of water seal below water freezing temperature.

Means for easy control of the level in the sealed condition shall be provided.

For oil carriers (**Tanker for Oil**) arranged also for carriage of chemicals an arrangement alternative to the water seal may be considered.

603 In addition to the water seal, the inert gas main line shall have a non-return valve installed on tank deck between the water seal and the nearest connection of any cargo tank. The non-return valve shall be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided forward of the non-return valve.

604 Means shall be provided to vent the inert gas main line in a safe manner between the automatically controlled valve and the second closing device on tank deck.

605 A water loop or other approved arrangement is also to be fitted to all associated water supply and drain piping and all venting or pressure sensing piping leading to non-hazardous spaces. Means shall be provided to prevent such loops from being emptied by vacuum.

606 The deck water seal and all loop arrangements shall be capable of preventing return of hydrocarbon vapours at a pressure equal to the test pressure of the cargo tanks.

D. Inert Gas Production and Treatment

D 100 General

101 The inert gas scrubber, fans and inert gas generators shall be located aft of all cargo tanks, cargo pump rooms and cofferdams separating these spaces from machinery spaces.

102 The system shall be capable of delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume. The fan capacity shall secure an acceptable positive pressure in the tanks and spaces at any normal operation condition.

103 At least two fans shall be provided which together will be capable of delivering to the cargo tanks at least the volume of gas required in 102. However, no fan shall have a capacity

less than one third of the combined fan capacity. In systems with gas generators a single fan may be accepted provided that sufficient spares for the fan and its prime mover are carried on board.

104 The fan pressure shall not exceed 0.3 bar.

D 200 Flue gas system

201 The flue gas connection from the boilers shall be located before a rotary air preheater, if fitted.

202 Flue gas isolating valve(s) is (are) to be fitted in the inert gas supply main(s) between the boiler uptake(s) and the gas scrubber. These valves shall be provided with indicators.

203 In addition to the valve nearest to the boiler uptake a sealing shall be arranged to prevent flue gas leakage when the inert gas system is not in operation.

204 A permanent arrangement for cleaning the valves nearest to the boiler uptake shall be arranged.

205 An interlocking device shall be arranged to prevent starting of sootblowing of the boiler when the valve nearest to the boiler uptake is open. For manual soot blowing, alarm and signboard is acceptable.

206 Isolating valves shall be fitted on both suction and delivery sides of each fan.

207 An adequate arrangement shall be provided for cleaning the impeller in place.

D 300 Inert gas generator

301 Two fuel oil pumps are generally to be fitted to the inert gas generator. A single pump may be accepted if sufficient spares for the pump and its prime mover are carried on board.

Guidance note:

A complete motor, impeller and bearings for the pump will normally be considered to be sufficient.

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D 400 Gas cleaning and cooling

401 A gas scrubber shall be fitted for the purpose of effective cooling and cleaning of the gas. The scrubber shall be protected against corrosion.

Devices shall be fitted to minimise carry-over of water and solids. For flue gas system the scrubber shall be fitted on the suction side of the fans.

D 500 Water supply

501 Both the gas scrubber and the water seal shall be supplied with cooling water from two pumps, each of sufficient capacity for supplying the system at maximum inert gas production, and without interfering with any essential service on the ship. One of the pumps shall serve the inert gas scrubber exclusively.

D 600 Water discharge

601 The water effluent piping from scrubber, valve(s) included, shall be protected against corrosion.

602 Distance piece between overboard valve and shell plating shall be of substantial thickness, at least shell plate thickness, but not less than 15 mm.

603 If water discharge is obtained by means of discharge pumps, a pumping arrangement equivalent to the supply shall be provided.

604 Discharge pipes from the water seal shall lead directly to sea.

E. Instrumentation

E 100 General

101 The instrumentation shall be in accordance with Pt.4 Ch.9.

E 200 Indication

201 Instrumentation shall be fitted for continuous indication of temperature and pressure of the inert gas at the discharge side of the gas fans, whenever the fans are operating.

202 Instrumentation shall be fitted for continuous indication and permanent recording, at all times when inert gas is being supplied, the pressure of the inert gas supply mains forward of the non-return devices on tank deck and oxygen content of the gas in the inert gas supply main on the discharge side of the fan. Such instrumentation is, where practicable, to be placed in the cargo control room, if fitted. In any case the instrumentation shall be easily accessible to the officer in charge of cargo operations.

203 In addition, meters shall be fitted on the navigation bridge to indicate the pressure of the inert gas supply main forward of the non-return devices on tank deck and in the machinery control room or machinery space to indicate the oxygen content of the inert gas in the inert gas supply main on the discharge side of the fans.

204 Portable instruments for measuring oxygen and flammable vapour concentration shall be provided, see Sec.9 G. In addition, suitable arrangement shall be made on each cargo tank and double hull space, such that the condition of the tank atmosphere can be determined using these portable instruments.

E 300 Monitoring

301 A common alarm connection shall be provided between the local inert gas control panel and the machinery control room or machinery space to indicate failure of the inert gas plant.

302 The extent of alarm and safety functions shall be in accordance with Table E1 and Table E2.

303 Monitoring of water supply to water seal and power supply for instrumentation is also to be maintained when the inert gas plant is not in use.

304 For burner control and monitoring, see Pt.4 Ch.7 Sec.7 B.

Table E1 Monitoring of inert gas plant based on flue gas

No	*Failure*	*Indication*			*Alarms* [1]		*Shutdown of gas regulating valve*	*Shutdown of gas regulating valve and blowers*
		CCR	*ER*	*Bridge*	*CCR*	*ER*		
1	High oxygen content > 8%		X		X	X		
2	Low pressure in IG main < 100 mm WG	X		X	X	X		
3	Low-low pressure < 50 mm WG	X		X	X [2]	X [2]		
4	High pressure in IG main	X		X	X			
5	High water level in scrubber				X			Automatic stop of water supply included
6	Low water pr/flow to scrubber				X			X
7	High temp. after blowers	X			65°C			75°C
8	Low level in water seal				X			
9	Failure of blowers				X		X	
10	Power fail.instrumentation				X	X		

[1] Audible and visual alarms

[2] Audible alarm or automatic stop of cargo pumps

Table E2 Monitoring of inert gas generators

No	*Failure*	*Indication*			*Alarms* [1]		*Shutdown of gas regulating valve*	*Shutdown of gas regulating valve and blowers*
		CCR	*ER*	*Bridge*	*CCR*	*ER*		
1	High oxygen content > 8%		X		X	X		
2	Low pressure in IG main < 100 mm WG	X		X	X	X		
3	Low-low pressure < 50 mm WG	X		X	X [2]	X [2]		
4	High pressure in IG main	X		X	X			
5	High water level in scrubber				X			Automatic stop of water supply included
6	Low water pr/flow to scrubber				X			X
7	High temp. after blowers	X			65°C			75°C
8	Low level in water seal				X			
9	Failure of blowers/ burner				X		X	
10	Power fail. instrumentation				X	X		
11	Insufficient fuel supply				X	X		
12	Power failure to generator				X	X		
13	Power fail. generator control system				X	X		

[1] Audible and visual alarms

[2] Audible alarm or automatic stop of cargo pumps

F. Survey and Testing

F 100 Survey

101 Main components of the inert gas plant shall be surveyed during construction by the surveyor. The gas scrubber and water seal shall be tested for tightness.

Component	*Certificate*	*Comment*
Inert gas blower/air blower	NV	
Inert gas generator	NV	
Scrubber	NV	
Deck water seal	NV	
Cooling water pump for scrubber	NV	
Sea water pump for deck seal	NV	
Liquid p/v breaker	W	
P/V valves	T	NV or MED
Control & monitoring system	NV	

NV = DNV product certificate
W = Maker's (Works) certificate
T = Type approval

102 After completion, the inert gas installation shall be surveyed by the surveyor.

F 200 Testing

201 All alarm, shutdown and safety devices shall be function tested.

202 A function test of the plant shall be carried out under normal operating conditions, including actual partial load conditions of boilers.

203 The capacity of the plant shall be confirmed by direct measurement of the gas flow or indirectly by running against maximum discharge capacity of the cargo oil pumps.

SECTION 12
PROTECTED SLOP TANK

A. General

A 100 Application

101 The requirements in this section apply to ships with class notation as given in Sec.10 A201.

A 200 Documentation

201 The following plans and specifications shall be submitted for approval:

- arrangement drawings of tanks, cofferdams and venting pipes
- schematic drawings of pump and piping systems included blank flanging arrangement and means for gas-freeing.
- schematic drawing of venting system
- schematic drawing and specifications of inert gas supply
- for fixed gas detection and alarm systems: specification and location of detectors, alarm devices and call points, and cable routing layout drawing.

202 For requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Sec.1.

B. Arrangement and Systems

B 100 Arrangement

101 Where not bounded by weather decks, pump rooms or fuel oil tanks, the slop tank(s) shall be surrounded by cofferdams. These cofferdams shall not be open to a double bottom, pipe tunnel, pump room or other enclosed space. However, openings provided with gastight bolted covers may be permitted.

102 Cofferdams shall be arranged for water filling and draining.

103 Hatches and other openings to slop tanks shall be arranged for locking in closed position.

B 200 Tank venting

201 Slop tanks shall have a separate, independent venting system with pressure/vacuum relief valves. Gas outlets shall have a minimum height of 6 m above tank deck and a minimum horizontal distance of 10 m from openings to non-hazardous spaces and exhaust outlet from machinery.

B 300 Pumping and piping system

301 Pipe connections to slop tanks shall have means for blank flanging on open deck or at another easily accessible location.

302 Pumping system installed for handling of slop while the ship is in service not covered by the class notation **Tanker for Oil** or **Tanker for Oil Products** shall be separated from all other piping systems. Separation from other systems by means of removal of spool pieces may be accepted.

B 400 Gas detection

401 Dry spaces surrounding slop tanks shall be equipped with an approved automatic gas detector system with alarm.

B 500 Protection inside slop tanks

501 An arrangement for protecting the tank atmosphere by inert gas or similar effective means, shall be provided.

502 Meter shall be fitted in the navigation bridge to indicate at all times the pressure in the slop tanks whenever those tanks are isolated from the inert gas supply main.

503 Inerting of slop tank(s) shall be possible irrespective of the blank flanging from the rest of the system.

C. Signboards and Instructions

C 100 General

101 Signboards with the following text shall be fitted at hatches and other openings to cargo slop tanks:

TO BE KEPT CLOSED AND LOCKED
DURING HANDLING OF DRY CARGO

102 Instructions for handling of slop shall be permanently posted in cargo pump room, cargo control room and deck office.

The following text shall be included in these instructions:

«When the ship is on dry cargo service and cargo slop is carried in protected slop tanks, the following items shall be complied with:

- All pipe connections to the slop tanks, except vent pipes (and connection to separate slop pumping system) shall be blanked off.
- Inert gas branch connections to the slop tanks shall be kept blanked off, except when filling or re-filling of inert gas is going on.
- Slop is only to be handled from open deck.
- During handling of dry cargo:
  - all hatches and openings to the slop tanks shall be kept closed and locked.
  - the slop tanks shall be kept filled with inert gas, and the O_2-content in the tanks shall not exceed 8% by volume.
- The gas detection system in cofferdams surrounding the slop tanks shall be function tested before loading of dry cargo commences».

SECTION 13
CRUDE OIL WASHING ARRANGEMENTS

A. General

A 100 Application

101 Crude oil carriers of 20 000 tons deadweight and above shall be fitted with a crude oil washing arrangement complying with MARPOL 73/78 Annex I, Reg. 33 and Reg. 35, which refers to "Revised Specifications for the Design, Operation and Control of Crude Oil Washing Systems" adopted by IMO with Res. A.446(XI) as amended by A.497(XII) and A.897(21).

102 Crude oil washing installations which are not mandatory according to MARPOL 73/78 Annex I need only comply with relevant requirements related to safety given in the specifications referred to in 101, such as installation of an inert gas system.

103 Crude oil carriers (**Tanker for Oil**) less than 20 000 tons deadweight, fitted with a crude oil washing arrangement complying with design requirements in the specifications referred to in 101, may be assigned the special feature notation **COW**.

Documentation requirement A201 8) need not be complied with.

A 200 Documentation

201 The following plans and particulars shall be submitted for approval:

1) schematic diagram of the crude oil washing system, including dimensions and materials
2) schematic diagram of the stripping and drainage arrangement
3) shadow diagrams showing the tank areas covered by direct impingement from the washing machines (not required for tanks or cargo-holds without internal structure)
4) documents showing number, location, make and type of washing machines with nozzle diameters
5) drawings showing installation and supporting arrangement for the washing machines
6) drawings showing the anchoring of piping for crude oil washing
7) drawings showing exact position and arrangement of dipping and gas sampling locations
8) operation and equipment manual.

202 For requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Sec.1.

SECTION 14
OFFSHORE LOADING ARRANGEMENTS

A. General

A 100 Application

101 The requirements in this section apply to oil carriers having a mooring and loading system for transfer of crude oil from offshore loading terminals to the ship.

102 The requirements are supplementary to those for the class notation **Tanker for Oil**.

A 200 Class notation

201 Ships having a bow loading arrangement satisfying the requirements of this section, will be assigned the additional class notation **BOW LOADING**.

202 Ships having a submerged turret loading arrangement (STL) satisfying the requirements of this section, will be assigned the additional class notation **STL**.

A 300 Documentation

301 In addition to the documentation required for the class notation **Tanker for Oil** the following documentation shall be submitted for approval:

Bow loading

- plans showing the bow loading and mooring arrangement with position of bow loading manifold, fairlead and chain stopper, traction winch, storage reel and bow control station
- plans showing:
  - fire protection of the bow area
  - ventilation of spaces in the bow area.
- operation manual, see G.

Submerged turret loading (STL)

- plans showing the arrangement of the STL room with the mating recess, loading manifold and the hydraulic operated mating recess hatch
- plans showing:
  - fire protection of the STL room
  - ventilation arrangement
  - hydraulic system
  - location of all electrical equipment
  - position of traction winch and storage reel.
- operation manual, see G.

302 For requirements related to documentation of instrumentation and automation, including computer based control and monitoring, see Sec.1.

B. Materials

B 100 General

101 Materials used in offshore loading piping systems shall comply with the requirements specified in Sec.4.

102 Materials used for the winches and the chain stopper shall comply with the requirements specified in Pt.3 Ch.3 Sec.3.

C. Arrangement and General Design

C 100 Positioning of ship

101 The ship shall be fitted with controllable pitch propeller and side thrusters of sufficient power for adequate manoeuvrability and positioning of the ship during offshore loading operations.

102 When a dynamic positioning system is installed, this shall include monitoring and self-check facilities equivalent to class notation **DYNPOS-AUT**. Manual override of automatic thruster or propulsion control shall be arranged.

C 200 Piping system for bow loading

201 Cargo pipes and related piping equipment forward of the cargo area shall have only welded connections, except at loading station, and shall be led externally past service and control station and machinery spaces. Such pipes shall be clearly identified and segregated by at least two valves situated in the cargo area or by one valve and other means together providing an equivalent standard of segregation. The piping shall be self-draining to the cargo area and into a cargo tank.

202 Means shall be provided to allow the bow loading pipe to be purged by inert gas after use and maintained gas free when not in use.

203 The connector shall be fitted with a shut-off valve and a blank flange. The blank flange may be omitted when a patent hose coupling is fitted.

204 Installation of spray shield at the connector, which will prevent oil leakage from reaching potential danger areas, may be required as found necessary. Collecting tray of sufficient capacity, with means for disposal of drainage, is also to be provided.

C 300 Hazardous areas

301 Entrances, air inlets and openings to service and machinery spaces and control stations shall not face the cargo hose connection location, and shall be located at least 10 m from the bow loading hose coupling.

302 Spaces housing the loading pipe and loading manifold shall be considered as hazardous area zone 1, with corresponding requirements to electrical equipment and wiring.

303 Spaces considered as non-hazardous shall not have any connections with hazardous spaces or areas, and shall be ventilated in accordance with Sec.6.

304 Air vent pipes to the forepeak tank shall be located as far as practicable from hazardous areas.

D. Control and Monitoring

D 100 General

101 For instrumentation and automation, including computer based control and monitoring, the requirements in this chapter are additional to those given in Pt.4 Ch.9.

D 200 Control station

201 A control station for offshore loading may be arranged within the bow area or on the navigation bridge. From this station all operations concerning positioning of the ship and monitoring of mooring and loading parameters shall be performed.

202 The bridge used in normal sailing mode is the main command location.

D 300 Instrumentation and automation

301 Ship manoeuvring instrumentation shall cover:

— variable pitch control
— side thruster(s) control
— main engine(s) emergency stop, or disengagement of clutch, if fitted
— steering gear control
— radar
— log.

302 Bow mooring instrumentation shall cover:

— mooring line traction control
— chain stopper control
— data logger system for recording of mooring and load parameters.

The mooring system shall be provided with a tension meter continuously indicating the tension during the bow loading operation. This requirement may be waived if the vessel has in operation an approved dynamic positioning system.

303 STL and bow loading instrumentation shall cover:

— indicator for loading connector coupling position
— cargo valve position indicators
— cargo tank level indicators and high level alarm
— a system for automatic transfer of signals from the control and safety system, to enable automatic and remote control of crude oil transfer pump(s) and closing of valve(s) on offshore terminal.

304 For bow loading arrangement an emergency disconnection system shall be provided. The system shall be divided into two modes.

The first mode shall perform the following functions:

— tripping the main crude oil transfer pumps
— closing the connector and loading hose end coupler valves.

Guidance note:
Minimum valve closing time should normally not be less than 25 s.

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The second mode shall perform the following functions:

— tripping the main crude oil transfer pumps
— closing of the connector and loading hose end coupler valves
— opening of the coupler
— opening of the chain stopper.

All functions shall be performed in sequence.

In addition to the above automatic disconnection systems, a manually-operated backup emergency disconnection system shall be provided. By this system, individual operation of the chain stopper and coupling bypass locks located in the bow control station, shall be possible.

D 400 Communication

401 Means of communication between the control station and the offshore loading terminal shall be provided and certified safe for hazardous areas, if necessary.

402 Means of emergency communication between control station and the offshore terminal shall be arranged.

403 Both primary and secondary methods shall be provided to ensure that continuous communication can be maintained between control station and the offshore terminal in the event of any equipment failure or other problems arising during the operations.

404 A detailed communication sequence shall be established concerning premooring, mooring, preloading, loading and tanker departure phases.

E. Bow Loading Area Safety Installations

E 100 General

101 The entire bow loading area shall be designed with due consideration to means and methods for ensuring a safe and reliable offshore loading operation. The system layout and equipment design shall be optimised with regard to safety aspects.

102 Special attention shall be given for minimising the risk for and consequences of fire and explosion caused by system and or equipment failure and/or malfunction.

103 The safety installations shall include the following arrangements, equipment and subsystems:

— water jet and foam monitors covering the bow loading and mooring area. Number, location and type of monitors shall be optimised with regard to fire-fighting efficiency. The foam system shall be independent from the vessel's main foam system
— water-based sprinkler system covering the mooring chain, fairlead and the exterior of the bow control station, if fitted
— foam-based sprinkler system for the bow loading connector room
— protection for the mooring chain, thimble, shackles, loading hose termination coupling, etc. against contact with steel structure elements, via use of hardwood or equivalent material
— overpressure ventilation for the bow control station, if fitted, as a precaution against ingress of hydrocarbon gas
— natural ventilation of the bow loading connector room
— emergency escape route from the bow control station
— fire protection standard equal to A-60 class for the floor, door(s), bulkheads and windows of the bow control station
— interlock functions to avoid malfunction of the offshore mooring and loading system
— emergency disconnection system, to be used if a hazardous situation should arise, see D304.

F. STL Room Safety Installations

F 100 General

101 The safety installations shall include the following arrangements and equipment:

a) A permanent mechanical ventilation system of extraction type shall be installed, capable of circulating sufficient air to give at least 20 air changes per hour with the following arrangement of exhaust trunking:
   — intake just above lower floor plate in the STL room
   — an intake located 2 m above the lower floor plate and one intake located above deepest water line. These intakes shall have dampers fitted which can be remotely opened from main deck. The exhaust outlet shall be situated at least 3 m above tank deck and 5 m from any opening to non-hazardous spaces.

b) The STL room shall be fitted with interlock between electric lighting and ventilation, so arranged that the ventilation must be in operation before the electrical current supply to the room can be connected.

c) Fixed fire-extinguishing system according to SOLAS Ch. II-2/10.9.

d) Intrinsically safe electrical circuits.

e) Connection for supply of inert gas. If connected permanently to the inert gas system the connection shall be fitted with a blank flange.

f) Certified safe type luminaires of pressurised or flameproof type.

g) A fixed gas-detection system. Sampling points or detector heads shall be located at the lower parts of the room. At least one point shall be located above deepest water line.

h) Electrical equipment, instrumentation and automation installed in STL room shall be of certified safe type and for submerged use (IP 68). Certified safe equipment with degree of protection IP 66 may be accepted for installation higher up than 2 m above the deepest water line after consideration in each case.

G. Operation Manual

G 100 General

101 The ship shall have an approved operation manual on board. The manual shall give information regarding the safe use of the ship during bow loading or submerged turret loading operations and shall have references to enclosed drawings.

102 The operation manual is in general to give information regarding the following:

1) Arrangement and equipment

— tank arrangement
— cargo transfer system
— mooring arrangement
— communication system
— instrumentation
— ventilation equipment.

2) Safety installations

— fire protection and extinction
— emergency escape routes
— emergency disconnection system
— blanking-off of pipes.

3) Operation

— mooring procedure
— connection and disconnection of cargo hose coupling
— transfer of oil cargo
— cargo distribution and loading conditions
— precautions against overfilling of tanks.

4) Cleaning and gas-freeing.

H. Tests after Installation

H 100 General

101 All arrangement and equipment covered by this section shall be function tested.

102 Control of the calibration of the load cell for bow loading shall be carried out by the surveyor.

SECTION 15
SINGLE POINT MOORINGS

A. General

A 100 Application

101 The requirements in this section apply to ships fitted with equipment enabling them to be moored to single point moorings.

102 The requirements cover the parts of OCIMF's (Oil Companies' International Marine Forum) "Recommendations for Equipment Employed in the Mooring of Ships at Single Point Moorings" applicable for the vessel.

103 The requirements are supplementary to those for the type notation **Tanker for Oil**.

A 200 Class notation

201 Ships with equipment that satisfies the requirements of this section will be assigned the additional notation **SPM**.

A 300 Documentation

301 In addition to the documentation required for the type notation **Tanker for Oil**, the following documentation shall be submitted for approval:

- plan showing the mooring arrangement with position of bow fairleads, bow chain stoppers, winches and capstans and possible pedestal rollers and winch storage drum
- details of bow fairleads and their attachment to the bulwark
- details of attachment to deck and supporting structure of the bow chain stoppers, winch or capstans as well as possible pedestal rollers and winch storage drums.

302 A DNV product certificate shall be provided for the following components:

- for bow chain stopper, confirming compliance with C102 and C103 and bow fairlead confirming compliance with C103 and C200.

303 The following components shall be provided with documentation of max. SWL from manufacturer (works certificate):

- for winch or capstan, confirming compliance with C401
- for pedestal roller, (if fitted) confirming necessary structural strength to withstand the forces to which it will be exposed when the winch or capstan is lifting with its maximum capacity.

B. Materials

B 100 General

101 The materials used in bow fairleads shall comply with the requirements specified in Pt.2 Ch.2.

102 The materials used for bow chain stopper shall comply with the requirements specified in Pt.3 Ch.3 Sec.3.

C. Arrangement and General Design

C 100 Bow chain stoppers

101 The arrangement and capacity shall be in accordance with Table C1.

102 A standard 76 mm stud-link chain shall be secured when the chain engaging pawl or bar is in closed position. When in open position, the chain and associated fittings shall be allowed to pass freely.

103 The structural strength of the stopper, bow fairlead and supporting structure shall be based on a safety factor of 2.0 against the yield criterion when applying a load equal to SWL.

104 Stoppers shall be located between 2.7 and 3.7 m inboard from the bow fairlead.

105 When positioning, due consideration shall be given to the correct alignment of stoppers relative to the direct lead between bow fairlead and pedestal roller or the drum end of the winch or capstan.

106 Stoppers shall be fitted as close as possible to the deck structure, however, taking due consideration to possible obstacles in order to obtain a free lead through the fairleads.

107 Upon installation bow stoppers shall be load tested to the equivalent SWL and a test certificate shall be issued. The test certificate shall be available for inspection on board the ship.

Guidance note:

The installation test required by 107 may be omitted if the actual bow stopper has been type approved, and proof load testing to the equivalent SWL was carried out for type approval. Applicable strength of the supporting structure should be documented by adequate analyses. DNV will issue a declaration confirming that evaluation of the support strength has been carried out with acceptable results. A document issued by the Society should in such cases be available onboard.

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Table C1 Arrangement and capacity for single point mooring

Ship size (tonnes DW)	*Chafe chain size (mm)*	*Grade (for info)*	*Number of bow fairleads (recommended)*	*Number of bow stoppers*	*SWL (tonnes) (for information)*	*Minimum breaking load (tonnes) (for information)*
100 000 or less	76	K3	1	1	200	438
Over 100 000 but not greater than 150 000	76	R3	1	1	250	498
Over 150 000	76	R4	2	2	350	612
Note: "tonnes DW" refers to the deadweight at maximum summer draught						

C 200 Bow fairleads

201 Bow fairleads shall measure at least 600 × 450 mm.

202 For ships fitted with two fairleads: When practicable the fairleads shall be spaced 2.0 m apart, from centre to centre. In any event, the fairleads shall not be spaced more than 3.0 m apart.

203 For ships fitted with one fairlead: The fairlead shall be positioned on the centre line.

204 Leads shall be oval or round in shape and adequately faired when fitted in order to prevent chafe chains from fouling on the lower lip when heaving inboard. Square leads are not suitable.

Guidance note:

- "Adequately faired" will be achieved if 3 links of chain have contact with the fairlead simultaneously at the design conditions.
- The design force should be established at an angle of 90° to the sides and 30° up or downwards. The same allowable design stress as for the stoppers applies.

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C 300 Position of pedestal rollers

301 Winches or capstans shall be positioned to enable a direct pull to be achieved on the continuation of the direct lead line between the bow fairleads and bow stoppers. Alternatively, if found required, a pedestal roller shall be positioned between the stopper and the winch or the capstan, in order to achieve direct pull.

302 The distance between the bow stoppers and pedestal roller shall be considered so that an unrestricted line pull is achieved from the bow fairlead and through the bow stopper.

C 400 Winches or capstans

401 Winches or capstans shall be capable of lifting at least 15 tonnes.

C 500 Winch storage drum

501 If a winch storage drum is used to stow the pick-up rope, it shall be of sufficient size to accommodate 150 m rope with 80 mm in diameter.

APPENDIX A
LIST OF CARGOES

A. List of Oil Cargoes

A 100 General

101 This list specifies oil cargoes [1] which may be carried on ships with class notation **Tanker for Oil** and **Tanker for Oil Products** [2]

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
— Lubricating Oils and Blending Stocks
— Mineral Oil
— Motor Oil
— Penetrating Oil
— Spindle Oil
— Turbine Oil.

Distillates

— Straight Run
— Flashed Feed Stocks.

Gas Oil

— Cracked.

Gasoline Blending Stocks

— Alkylates — fuel
— Reformates
— Polymer — fuel.

Gasolines

— Casing head (natural)
— Automotive
— Aviation
— Straight Run
— Fuel Oil No. 1 (Kerosene)
— Fuel Oil No. 1-D
— Fuel Oil No. 2
— Fuel Oil No. 2-D.

Jet Fuels

— JP-1 (Kerosene)
— JP-3
— JP-4
— JP-5 (Kerosene, Heavy)
— Turbo Fuel
— Kerosene
— Mineral Spirit.

Naphtha

— Solvent
— Petroleum
— Heartcut Distillate Oil.

1) The list of oils shall not necessarily be considered as comprehensive.

2) May carry all the listed oil cargoes except crude oil.

B. Cargoes other than Oils

B 100 Cargoes and conditions for carriage

101 Cargoes other than oils may be carried by ships with class notation **Tanker for Oil Products** as follows:

a) OS (Other substances), as per IBC Code Chapter 18 may be carried. No MARPOL requirements apply.

b) Pollution category Z, as per IBC code Chapter 18 may be carried by ships which comply with relevant requirements for the **NLS** class notation (Sec.1 A402). In addition, relevant safety criteria such as possible increased foam fire extinguishing requirement must be complied with. Density of the product will need to be considered additionally.