



RULES FOR CLASSIFICATION OF **SHIPS**

NEWBUILDINGS

SPECIAL SERVICE AND TYPE ADDITIONAL CLASS

PART 5 CHAPTER 4

CHEMICAL CARRIERS

JULY 2006

*This booklet includes the relevant amendments and corrections
shown in the July 2009 version of Pt.0 Ch.1 Sec.3.*

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CHANGES IN THE RULES

General

The present edition of the rules includes additions and amendments decided by the Board in June 2006 and June 2008, and supersedes the January 2003 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This chapter is valid until superseded by a revised chapter.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 adopted July 2008

Coming into force 1 January 2009

- **Sec.11 Fire Protection and Extinction**

- Item B206 has been modified and two new items, B207 and B208 have been inserted. The subsequent items have been renumbered.

Significant editorial changes adopted July 2008

Taking effect immediately

- **Sec.3 Ship Arrangement and Damage Stability**

- A new item B104 has been added.

Main changes adopted January 2007

Coming into force 1 January 2007

- **Sec.11 Fire Protection and Extinction**

- Under item B206, the last paragraph has been replaced.

Main changes adopted July 2006

Coming into force 1 January 2007

- **General**

- The concept of "Gas Safe/Dangerous Zones and Spaces" has been replaced by "Non-hazardous/Hazardous Areas of Zone 0, 1 and 2". This mainly affects Sec.1, Sec.10 and Sec.12, which have been revised accordingly.
- Most of the fire safety items have been deleted and replaced by reference to Pt.4 Ch.10.

- **Sec.11 Fire Protection and Extinction**

- Requirements for structural fire protection has been removed.

- **Sec.12 Electrical Installations**

- The specification of permitted types of electrical equipment in the different Gas Dangerous Zones and spaces, has been replaced by an area classification of typical spaces (based on IEC 60092-502) - and reference to Pt.4 Ch.8 Sec.11 for selection of equipment. Pt.4 Ch.8 Sec.11 "Hazardous Areas Installations" has previously been revised with regard to the concept of Hazardous Area Zones.

- **Appendix A List of Cargoes - Tanker for Chemicals**

- Appendix A has been deleted and replaced by references to the IBC Code.

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 Application

101 The rules in this chapter apply to ships intended for carriage of liquid chemicals in bulk. The requirements shall be regarded as supplementary to those given for assignment of main class.

102 The requirements of this chapter are considered to meet the requirements of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and MARPOL 73/78 Annex II.

103 Cargoes covered by the classification in accordance with this chapter are considered to be those listed in IBC Code chapter 17 and 18 and the agreed additions given in the latest IMO MEPC.2/Circ.xx List 1. Non-hazardous cargoes except oil, are covered by the general requirements for main class unless otherwise stated.

104 Chemical tankers also intended for carriage of oil shall comply with the requirements in Ch.3.

A 200 Class notations

201 Ships built according to Sec.1 to Sec.14 of this chapter may be assigned the class notation:

Tanker for Chemicals ESP or

Tanker for Chemicals.

Ships built for carriage of cargoes not requiring full compliance with Sec.1 to Sec.14 may be assigned the class notation:

Tanker for C ESP or

Tanker for C

where **C** indicates the type of cargo for which the ship is classified.

The mandatory ship type and service notation

Tanker for Chemicals ESP or

Tanker for C ESP

shall be assigned to self propelled ships having integral tanks intended for carriage of liquid chemicals in bulk in accordance with the IBC Code.

202 The requirements for ships with the class notation

Tanker for C ESP or

Tanker for C

will be considered in each case depending on the nature of the cargo to be carried.

A 300 Register information

301 In the "Register of vessels classed with DNV", a ship with the class notation

Tanker for Chemicals ESP or

Tanker for Chemicals

may be given a series of letters and numbers describing technical features of the ship as described in 302 to 310.

302 Ship type

The damage stability standard in accordance with IMO's IBC Code is identified by one of the following notations:

- **Ship type 1**
- **Ship type 2**
- **Ship type 3**

See Sec.3.

303 Tank type (a)

The tank types are identified as follows:

- **a1**: Integral tank, type **a1**
- **a2**: Integral tank, type **a2**
- **a3**: Independent tank, type **a3**
- **a4**: Independent tank, type **a4**

See D.

304 Materials of construction (ssp) and (ss)

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

The notation **ss** indicates that the ship has one or more cargo tanks made of stainless steel, solid or clad, and that the pertaining cargo piping and all equipment in contact with cargo and cargo vapours is made of stainless steel.

305 Liquid level gauging devices for cargo tanks (b)

The liquid level gauging devices are identified as follows:

- **b1**: open device
- **b2**: restricted device
- **b3**: closed device
- **b4**: indirect device

See Sec.13.

306 Tank vent system (c)

The tank vent systems are identified as follows:

- **c1**: open type vent system
- **c2**: tank vent system, outlet 6 m above deck
- **c3**: tank vent system, outlet B/3, minimum 6 m above deck, alternatively 3 m above deck and high velocity valves.

See Sec.9.

307 Ventilation system (v)

Guidance note:

Register notation (v) to indicate ventilation capacity in cargo handling spaces (v_2/v_3 for 30/45 air changes per hour respectively), has been taken out of use.

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

308 Overflow control (f)

The overflow control systems for cargo tanks are identified as follows:

- **f1**: high level alarm
- **f2**: high-high level alarm.

See Sec.13.

309 Cargo stripping efficiency (str)

The efficiency of the cargo stripping arrangements of a cargo tank and associated cargo piping is identified as follows:

- **str 0.075**: residue quantity not in excess of 0.075 m³

Guidance note:

Register notations for stripping efficiency according to previous MARPOL 73/78 Annex II requirements, were **str 0.3** and **str 0.1** for residue quantity not in excess of 0.3 m³ and 0.1 m³ respectively.

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

See Sec.6.

310 Cofferdam (k)

The meaning of the letter **k** is:

- **k**: bunker tanks are separated from cargo tanks by cofferdams.

See Sec.3.

311 Ship type and tank groups may be indicated in the "Register of vessels classed with DNV". This will, for a ship with cargo tanks of different technical standard, be limited to the groups with the lowest and highest technical standard, respectively.

EXAMPLE:

A ship has lowest and highest technical standard in tank groups as follows: **Ship type 3, a1, b2, c2, f1, str 0.075** and **Ship type 2, a2, b3, c3, f2 str 0.075**. In the Register of ships the following will be given: **Ship type 2, a1.2, b2.3, c2.3, f1.2, str 0.075**. Where more than one number is given in connection with a letter, all first and second numbers shall be combined, respectively.

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 a hazardous area on open deck and a non-hazardous space, arranged to prevent ingress of gas to the non-hazardous space.

103 *Boiling point* is the temperature at which a liquid exhibits a vapour pressure equal to the atmospheric barometric pressure.

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

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

106 *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.

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

108 *Cofferdam* is the isolating space between two adjacent steel bulkheads or decks. The space may be a void space or ballast space.

109 *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.

110 *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.

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 the area classification specified in Sec.12 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 *Hold space* is the space in which an independent cargo tank is situated.

115 *Independent* means that a piping or venting system, for example, is in no way connected to another system and that there are no provisions available for the potential connection to other systems.

116 *Liquid cargo* is cargo with a vapour pressure below 2.75 bar absolute at 37.8°C.

117 *Non-hazardous area* is an area not considered to be hazardous.

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

119 For the purpose of cargoes with high vapour pressure (see IBC Code Chapter 15.14), *reference temperature* means the temperature corresponding to the vapour pressure of the cargo at the set pressure of the cargo tank pressure relief valve.

120 *Separate* means that a cargo piping system or cargo vent system, for example, is not connected to another cargo piping or cargo vent system. This separation may be achieved by the use of design or operational methods. Operational methods shall not be used within a cargo tank and shall consist of one of the following types:

- removing spool pieces or valves and blanking the pipe ends
- arrangement of two spectacle flanges in series with provisions for detecting leakage into the pipe between the two spectacle flanges.

121 *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.

122 *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.

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

124 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 tank 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.

125 *Tank types.* See D.

126 *Void space* is an enclosed space in the cargo area external to a cargo containment system, not being a hold space, ballast space, fuel oil tank, cargo pump or compressor 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. 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 tank hatches, tank cleaning hatches and any other openings to the cargo tanks
- doors, hatches and any other openings to pump rooms and other hazardous areas
- ventilating pipes and openings for cargo tanks, 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 pipes and gas return pipes over the deck with shore connections including stern pipes for cargo discharge or gas-freeing of cargo tanks
- hazardous areas of zone 0, 1 and 2, and their extent.

202 Plans with the following particulars for the tanks shall be submitted for approval:

- drawings of cargo tanks including information on non-destructive testing of welds and strength and tightness testing of tanks
- drawings of support and staying of independent cargo tanks
- a complete stress analysis shall be submitted for independent tanks type **a4**.

203 Plans of the following pumping and piping arrangements with accessories shall be submitted for approval:

- diagrams of the cargo piping system including details such as expansion elements and flange connections
- bilge piping systems in pump rooms, cofferdams, pipe tunnels and hold spaces
- arrangement for drainage of cargo pumps and piping in the pump room
- drawing of cargo pump
- arrangements for cargo tank stripping and drainage/ stripping of cargo lines
- diagram of tank washing
- arrangement and location of underwater discharge outlet(s)
- emergency showers and eye wash with water supply and arrangements to prevent freezing.

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

- arrangement and capacity of air ducts, fans and their motors in the cargo area, drawing and material specification of rotating parts and casing of the fans
- drawings of portable ventilators and drawings showing where and how these shall be fitted
- arrangement for gas-freeing of cargo tanks and cargo lines
- arrangement of cargo tank venting systems
- pressure-vacuum valves (or reference to possible type approval)
- drawings of gastight bulkhead stuffing boxes
- arrangement of cargo heating systems
- arrangement of cargo cooling systems
- arrangement of possible thermal insulation and specification of insulation materials
- drawings showing details of design, attachment and location of anodes and other fittings in tanks and cofferdams
- Procedures and Arrangements Manual for the discharge of noxious liquid substances.

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

- area classification drawings
- drawings 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.12 E101, for electrical installations in hazardous areas shall be submitted for approval.

206 Fire protection and extinction

The following plans and particulars shall be submitted for approval:

- arrangement and specification of fire water main equipment, location of hydrants and stop valves
- specification of water nozzles, pipes, valves and other fittings in the fire water main line
- arrangement and specifications of fixed fire extinguishing systems on deck
- arrangement and specifications of fixed fire smothering installations in enclosed hazardous spaces.

207 For documentation regarding inert gas plants, see Sec.16.

208 Damage stability

The following documentation shall be submitted for approval:

- preliminary damage stability calculations
 - final damage stability calculations
- 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 No. 20.1.

209 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.

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

D. Tank Types

D 100 Integral tanks, general

101 Integral tanks form a part of the ship's hull and are influenced in the same manner and by the same loads which stress the adjacent hull structure.

102 The design vapour pressure p_0 is normally not to exceed 0.25 bar. If, however, the hull scantlings are increased accordingly, p_0 may be increased to a higher value but less than 0.7 bar.

D 200 Integral tanks, type a1

201 Integral tanks type **a1** are built in such a way that the cargo is separated from the sea by a single skin.

D 300 Integral tanks, type a2

301 Integral tanks type **a2** are built in such a way that the cargo, except in way of a sea chest, is separated from the sea by a double skin.

302 The distance between the ship's shell plating (bottom and side) shall comply with the distances given in Sec.3 B102 for Ship type 2 and B103 for Ship type 3.

303 Drainage sumps will be considered in each separate case.

D 400 Independent tanks, general

401 Independent tanks do not form a part of the ship's hull. An independent tank is built and installed in such a way that the influence on the tank by the hull's deformation and stresses is minimised. An independent tank does not contribute to the hull strength. An independent tank is normally to have longitudinally rigid fixture to the ship in only one transverse plane. Distance between tanks and hull: See Sec.4 A100.

D 500 Independent tanks, type a3

501 Independent tanks type **a3** are self-supporting tanks with a design vapour pressure p_0 not exceeding 0.7 bar.

D 600 Independent tanks, type a4

601 Independent tanks type **a4** tanks are self-supporting pressure vessels with a design vapour pressure higher than 0.7 bar and where the internal pressure is carried mainly as tensile membrane stresses in the tank skin (cylinders, spheres, etc.).

E. Filling Limits for Cargo Tanks

E 100 General

101 Tanks for liquid cargo shall be so loaded as to avoid the tank becoming liquid full during the voyage taking into consideration the highest temperature which the cargo may reach.

F. Signboards

F 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 fitted with signboard giving instructions that the plates shall be kept closed unless ship is gas-free.
- Sec.8 regarding marking plates for independent tanks.
- Sec.10 B302 regarding pumps and compressors which shall not be started before the ventilation system in the electric motor room has been in operation for 15 minutes.
- Sec.12 F101 regarding opening of a lighting fitting. Before opening, its supply circuit shall be disconnected.
- Sec.12 F102 regarding ventilation to be in operation before lighting is turned on.
- Sec.12 F103 regarding portable electrical equipment supplied by flexible cables. This equipment shall not be used in areas where there is gas danger.
- Sec.12 F104 regarding welding apparatus. These shall not be used unless the working space and adjacent spaces are gas-free.

G. Cargo Information

G 100 General

101 A copy of International Code for Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk, provisions of this Code, shall be on board every ship covered by this Code.

102 Information shall be on board, and available to all concerned, giving the necessary data for the safe carriage of the cargo. Such information should include a cargo stowage plan to be kept in an accessible place, indicating all cargo on board, including each dangerous chemical carried:

- 1) A full description of the physical and chemical properties, including reactivity necessary for the safe containment of the cargo.
- 2) Action to be taken in the event of spills or leaks.
- 3) Countermeasures against accidental personal contact.
- 4) Fire-fighting procedures and fire-fighting media.
- 5) Procedures for cargo transfer, tank cleaning, gas-freeing and ballasting.
- 6) For those cargoes required to be stabilised or inhibited, the cargo should be refused if the certificate required by these paragraphs, is not supplied.

H. Procedures and Arrangements Manual

H 100 General

101 Each ship shall be provided with a *Procedures and Arrangements manual* (P & A Manual) developed for the ship in accordance with MARPOL Annex II, Appendix 4 - Standard Format for the Procedures and Arrangements Manual, and approved by the Society.

102 Each ship shall be fitted with equipment and arrangements identified in its *P & A Manual*.

SECTION 2 MATERIALS AND HULL STRENGTH

A. General

A 100 Selection and testing

101 Detailed requirement for materials are given in Pt.2.

102 For materials other than mild steel, the Society will stipulate requirements as to quality and properties in each case.

103 Where stainless steel in cargo tanks is required for the carriage of particular cargoes, the content of molybdenum in the material shall not be less than 2.5% if type NV 316 L or NV 316 LN is specified.

104 Clad steel will be accepted if the requirements of Pt.2 Ch.2 Sec.3 and Pt.2 Ch.3 Sec.4 are fulfilled. Acceptance of other linings necessary to protect the structural material will be specially considered.

105 Requirements for welding procedure tests and production weld tests are given in Sec.5 and Sec.6.

106 For certain cargoes as specified in Sec.15 and the IBC Code Chapter 15, special requirements for materials apply.

B. Hull

B 100 General

101 Hull materials may generally be selected in accordance with ordinary practice as given in Pt.3 Ch.1 Sec.2.

C. Cargo Tanks

C 100 General

101 Materials for integral tanks and independent tanks type

a3 may generally be selected in accordance with ordinary practice as given in Pt.3 Ch.1 Sec.2 for hull materials. Materials for independent tanks type **a4** (pressure tanks) shall be pressure vessel steel in accordance with Pt.2 Ch.2 Sec.2.

D. Cargo Piping

D 100 General

101 Steel is the normal material of construction for cargo pipes. Other materials may be accepted for non-flammable chemicals. Grey cast-iron is not accepted as material of construction in cargo piping on ships with class notation **Tanker for Chemicals**.

102 Bodies of valves and fittings, and pump housings shall be of cast steel, nodular cast iron Grade NV1 or NV2 or other approved material (see Pt.2 Ch.2).

103 Cargo steel pipes shall be tested according to relevant parts of Pt.2 Ch.2 Sec.4.

104 Tank vent piping for tanks made of or protected by corrosion-resistant material shall be made of or protected by similar material.

D 200 Documentation of material quality and testing

201 The materials used in cargo piping systems shall be furnished with one of the following types of documentation according to Table D1.

NV certificate, Works' certificate, and Test report are defined in Pt.1 Ch.1 Sec.4.

Table D1 Documentation of material quality and testing						
Type	Material	Piping system	Nominal diameter mm	Type of documentation		
				NV certificate	Works certificate	Test report
Cargo pipes and heating coils		Pressure		x		
		Open ended			x	
Flanges and bolts						x
Bodies of valves and fittings, pump housings, source materials of steel expansion bellows, other pressure containing components not considered as pressure vessels	Steel, nodular cast-iron grade 1 and 2	Pressure	> 100		x	
		Pressure	≤ 100			x
		Open ended				x
	Copper alloys	Pressure	> 50		x	
		Pressure	≤ 50			x
		Open ended				x

E. Hull Strength

E 100 Emergency towing

101 Emergency towing arrangements for chemical carriers of 20 000 tonnes deadweight and above shall comply with requirements in Pt.5 Ch.3 Sec.2 C500.

SECTION 3

SHIP ARRANGEMENT AND DAMAGE STABILITY

A. Damage Stability

A 100 General

101 The ship shall meet the damage stability requirements of chapter 2.8 of the IBC Code either for:

- **Ship type 1,**
- **Ship type 2** or
- **Ship type 3.**

102 The ship shall be supplied with a loading and stability information booklet. This booklet shall contain details of typical service and ballast conditions, provisions for evaluating other conditions of loading and a summary of the ship's survival capabilities. In addition, the booklet shall contain sufficient information to enable the master to load and operate the ship in a safe and seaworthy manner.

103 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:

- a) The loading manual includes, in approved form, all the conditions intended to be used.
- b) The loading computer, intended for conditions at sea, includes approved software functions for damage stability.

Reference is made to Pt.6 Ch.9 Sec.1 and Pt.6 Ch.9 Sec.2.

A 200 Requirements for watertight integrity

201 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 stability calculations.

202 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. Cargo Tank Location

B 100 General

101 Tanks intended for carriage of cargoes for which **Ship type 1** is required shall be located at a minimum distance from the ship's side shell plating of $B/5$ or 11.5 m, whichever is less, measured inboard from the ship's side at right angle to the centre line at the level of the summer load line, and at a vertical distance from the moulded line of the bottom shell plating at centre line not less than $B/15$ or 6 m, whichever is less but not less than 760 mm from the shell plating.

102 Tanks intended for carriage of cargoes for which **Ship type 2** is required shall be located at a vertical distance from the moulded line of the bottom shell plating at centreline of $B/15$ or 6 m, whichever is less, but not less than 760 mm from the shell plating.

103 For **Ship type 3**, there are no restrictions in respect of cargo tank location.

104 Except for **Ship type 1**, suction wells in cargo tanks may protrude into the double bottom below the boundary line

defined by the distance given in 102 provided that such wells are as small as practicable and the protrusion below the inner bottom plating does not exceed 25% of the depth of the double bottom or 350 mm, whichever is less.

Where there is no double bottom, the protrusion of the suction well of independent tanks below the upper limit of bottom damage shall not exceed 350 mm.

C. Location and Separation of Spaces

C 100 General

101 A cofferdam shall be provided at aft end of cargo area. 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.

The fuel oil tanks shall not extend beneath cargo tanks.

Ships which do not have bunker tanks arranged adjacent to cargo tanks, will get the letter **k** added to the series of letters and numbers given in the "Register of vessels classed with DNV".

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

Where deemed necessary, machinery spaces other than those of category A may be permitted forward of the cargo area.

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 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 Accommodation spaces and service spaces shall be positioned outside the cargo area, but not necessarily aft of fuel oil tanks.

Accommodation spaces shall not be situated directly onto fuel oil bunker tanks adjacent to cargo tanks.

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 through suitable precautionary means, such as a permanent, continuous coaming of a suitable height extending from side to side.

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.

D. Arrangement of Entrances and Other Openings

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 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 sidescuttles shall be of the fixed (non-opening) type. Such windows and sidescuttles except wheelhouse windows, shall be constructed to A-60 class standard.
- d) Sidescuttles according to c), in the first tier on the main deck shall be fitted with inside covers of steel or equivalent material.

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 shall not have access to the spaces covered by 103 and the boundaries of the spaces shall 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:

- a) entrances shall not be arranged from hazardous spaces
- b) entrances from hazardous areas on the open deck shall normally not be arranged. If air locks are arranged such entrances may, however, be approved. See 105 and 106.

104 Ventilation inlets for the spaces mentioned in 101 shall 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 openings 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 hazardous space containing gas sources, such as valves, hose connection or pump used with the cargo.

106 Air locks shall comply with the following requirements:

- 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 requirements given in Pt.3 Ch.3 Sec.6, but shall not be less than 300 mm.
- air locks shall have a simple geometrical form. They shall provide free and easy passage, and shall have a deck area not less than 1.5 m^2 . Air locks shall not be used for other purposes, for instance as store rooms.
- 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 closed position.
- air locks shall have effective ventilation. Ventilation requirements, see Sec.10.

D 200 Hazardous spaces and cargo tanks

201 Pump room entrances shall be from open deck.

202 Doors to hazardous spaces, situated completely upon the open deck, shall have as low a sill height as possible.

203 For cargo tanks, no hatches, openings for ventilation, ullage plugs or inspection openings shall be arranged in enclosed compartments.

D 300 Access to and within cargo tanks, void spaces and other spaces in the cargo area

301 Arrangements for void spaces, cargo tanks and other spaces in the cargo area shall be such as to ensure adequate access for complete inspection.

302 Access to cofferdams, ballast tanks, cargo tanks and other spaces in the cargo area shall be directed from the open deck. Access to double bottom spaces may be through a cargo pump room, pump room, deep cofferdam, pipe tunnel or similar compartments, subject to consideration of ventilation aspects.

303 For access through horizontal openings, hatches or manholes, the dimensions shall be sufficient to allow a person wearing a breathing apparatus to ascend or descend without obstruction and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall be not less than 600 mm x 600 mm.

304 For access through vertical openings, or manholes providing passage through the length and breadth of the space, the minimum clear opening shall be not less than 600 mm x 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

305 Smaller dimensions than specified in 303 and 304 may be approved in special circumstances.

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. Cargo Pump Rooms, Cofferdams and Pipe Tunnels

F 100 General

101 Arrangements shall be installed to deal with possible leakage from cargo pumps and valves in the pump room.

102 Cofferdams shall be of sufficient size for easy access to all parts, and they shall cover the entire adjacent tank bulkheads. Minimum distance between bulkheads 600 mm.

103 Pump rooms and ballast tanks are accepted as cofferdams. See also C102.

104 Spaces surrounding independent tanks, are normally accepted as cofferdams.

105 Pipe tunnels shall have ample space for inspection of the pipes, and the pipes shall be situated as high as possible above the ship's bottom.

106 On ships with integral tanks, no connection between a pipe tunnel and the engine room, either by pipes or manholes, will be accepted.

G. Diesel Engines Driving Emergency Fire Pumps, etc

G 100 General

101 Diesel engines driving emergency fire pumps, etc., shall be installed in a non-hazardous area.

102 The exhaust pipe of the diesel engine shall have an effective spark arrester and shall be led out to the atmosphere at a safe distance from hazardous areas.

H. Chain Locker and Windlass

H 100 General

101 The chain locker shall be arranged as a non-hazardous space. Windlass and chain pipes shall be situated in a non-hazardous area.

I. Anodes, Washing Machines and Other Fittings 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 ought to be given to the contact spark-producing properties.

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

J. Slop Tanks

J 100 Arrangement

101 One or more slop tanks for storage of contaminated bilge water from cargo area and tank washings shall be provided. Means shall be provided to transfer contaminated water to on-shore slop tanks. Cargo tanks may be accepted as slop tanks.

K. Stowage of Cargo Samples

K 100 General

101 Samples, which have to be kept on board, should be stowed in a designated space situated in the cargo area or, exceptionally, elsewhere subject to special approval.

K 200 Arrangement

201 The stowage space shall be:

- a) Cell-divided in order to avoid shifting of the bottles at sea.
- b) Made of material fully resistant to the different liquids intended to be stowed.

Guidance note:

This may be achieved by placing the bottles in leak tight boxes of resistant material, or arranging a spill containment tray of resistant material in the bottom of the locker.

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

- c) Equipped with adequate ventilation arrangements.

202 Samples, which react with each other dangerously, shall not be stowed close to each other.

203 Samples shall not be retained on board longer than necessary.

SECTION 4 ARRANGEMENT IN HOLD SPACES

A. General

A 100 Distance between tanks and hull

101 The distance between independent tanks and the distance between such tanks and parts of the hull shall be sufficient to give reasonable space for inspection and maintenance.

Guidance note:

The free distance between independent tanks and the inner edge of ordinary frames should not be less than 500 mm. The free space between tanks and web frames should be not less than 50 mm.

The free distance between independent tanks and the inner bottom should generally be not less than 400 mm.

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

102 The distance between the ship's shell and an independent tank shall not be less than 760 mm.

103 The vertical distance between independent tanks and the outer bottom shall not be less than B/15.

Drainage sumps will be considered in each case.

B. Gas Pressure Relief Devices

B 100 Pressure/vacuum relief valves

101 If spaces for independent tanks can be completely

closed, these spaces shall be equipped with pressure and vacuum relief valves. The number and size of these valves shall be decided depending on size and shape of the spaces.

102 The valves are normally to open at a pressure of 0.15 bar above and below atmospheric pressure.

C. Sealing around Tanks

C 100 General

101 Efficient sealing shall be provided where independent tanks extend above the upper deck. The sealing material shall be such that it will not deteriorate, even at considerable movements between the tanks and the deck.

The sealing shall be able to withstand all temperatures and environmental hazards which may be expected.

D. Earth Connections

D 100 General

101 At least two effective earth connections between each tank and the hull shall be arranged.

SECTION 5 SCANTLINGS AND TESTING OF CARGO TANKS

A. Scantlings of Cargo Tanks

A 100 Integral tanks

101 Scantlings for integral tanks shall be in accordance with Pt.3.

The principles for direct strength calculations given in Ch.3 Sec.2 shall be followed.

For materials other than mild steel, the minimum thickness requirements will be considered in each case.

A 200 Independent tanks

201 Scantlings of independent tanks, constructed mainly of plane surfaces, shall be in accordance with relevant requirements given in Pt.3 Ch.1.

Tanks of pressure vessel configuration type (cylinders, spheres etc.) shall be in accordance with the requirements given in Ch.5 Sec.5.

B. Requirements for Testing of Welds and Non-Destructive Testing

B 100 General

101 Non-destructive testing of tank shell welds for chemical tankers with **Ship type 1** and **Ship type 2** notations shall be

carried out as given in Table B1. For chemical tankers with **Ship type 3** notation, non-destructive testing shall be as for oil carriers.

102 Most of the testing is to be placed at weld crossings and highly stressed connections.

The Society may approve ultrasonic testing in lieu of or in addition to radiographic testing. Where such ultrasonic testing is carried out, the Society may require supplementary radiographic testing. Further, the Society may require ultrasonic testing in addition to radiographic testing. For surface crack detection magnetic particle testing is to be used for ferromagnetic materials and penetrant testing is to be used for non-ferromagnetic materials. The quality of welds in steel is to comply with ISO 5817 quality level B.

B 200 Welding procedure tests

201 Welding procedure tests are required for independent tanks.

B 300 Weld production tests

301 Weld production tests are required for independent tanks type **a4** (pressure tanks) and independent tanks **a3** (atmospheric), if of pressure vessel configuration i.e. cylindrical, spherical.

302 The requirements for weld production testing are as given for independent cargo tanks type C in Ch.5 Sec.5.

Table B1 Non-destructive testing of tank welds

Tank type		Non-destructive testing	
		Butt welds ^{1) 4)} Minimum extent of radiographic testing, % of total weld length	Welds other than butt welds. Surface crack detection, % of total weld length
Integral tanks ²⁾	a1	1%	³⁾
	a2	2%	³⁾
Independent tank	a3	20%	10%, nozzles: 100%
	a4	Longitudinal welds: 100% Transverse welds: 10%	10%, nozzles: 100%

1) Butt welds of face plates and web plates of girders, stiffening rings etc. shall be radiographically tested as considered necessary.
2) Guidance: Where double continuous fillet weld is used, full penetration weld at some points is recommended in order to reduce the possibility of leakage along the root of the fillet weld.
3) The extent of surface crack detection will be decided on the basis of the visual inspection of the boundary welds. Normally this will be 2% to 5% of the total weld length.
4) Ultrasonic testing may supplement or substitute radiographic testing in accordance with 102.

SECTION 6

PIPING SYSTEMS IN THE CARGO AREA

A. Pumping and Piping Systems for Bilge, Ballast and Fuel Oil

A 100 General

101 There shall be no connection between the piping systems serving the cargo area and the systems in the remainder of the ship except as specially permitted by this section.

102 The steam temperature in steam pipes in the cargo area shall not exceed 220°C.

A 200 Cargo pump rooms

201 Two possibilities for drainage shall be provided, one of which shall be operable from open deck. One ejector with two sources of supply will be accepted.

202 Bilge pump or ejector independent of the cargo pumps shall be fitted for drainage of the cargo pump rooms.

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

A 300 Cofferdams and pipe tunnels

301 Cofferdams and pipe tunnels shall be provided with sounding pipes and with air pipes led to the atmosphere.

302 Cofferdams and pipe tunnels shall be provided with bilge suction.

A 400 Spaces for independent tanks

401 Spaces for independent tanks shall be connected to a bilge system.

402 The capacity is normally to be such that the requirements given in Pt.4 Ch.6 Sec.4 are complied with. However, these requirements may be reduced by 50%, when the volume of the tanks is more than 75% of the total volume of the space.

403 Cargo pumps may be accepted for bilge system purposes to spaces for independent tanks when the pumps are so arranged that they effectively can be used for this purpose. The necessary pipe connection between cargo pumps and the space around the tanks shall not penetrate any part of tank walls situated in closed spaces or lower than the liquid level to maximum filling of the tank. Pipe connections shall be so arranged that cargo cannot be pumped into the spaces due to incorrect operation of valves etc.

A 500 Ballast tanks

501 Filling or discharge of tanks within cargo area with ballast shall be carried out from the cargo pump room, a similar hazardous space or from inside ballast tanks, except as permitted by 502.

502 Pumps, ballast lines, vent lines and other similar equipment serving permanent ballast tanks should be independent of similar equipment serving cargo tanks and from cargo tanks themselves. Discharge arrangements for permanent ballast tanks sited immediately adjacent to cargo tanks should be outside engine room and accommodation spaces. Filling arrangements may be in the engine room provided that such arrangements ensure filling from tank deck level and non-return valves are fitted.

503 Filling of ballast in cargo tanks may be arranged from deck level by pumps serving permanent ballast tanks, provided that the filling line has no permanent connection to cargo tanks or piping and that non-return valves are fitted.

504 Filling lines to permanent ballast tanks shall be so arranged that the formation of static electricity is reduced, e.g. by

reducing the free fall into the tank to a minimum.

505 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 B305.

Guidance note:

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

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

506 Lines from engine room to ballast tanks forward of cargo area shall be carried outside cargo tanks.

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

A 600 Forepeak ballast tank

601 The forepeak may be ballasted with the system serving ballast tanks within the cargo area, provided:

- The forepeak tank is considered as hazardous.
- The vent pipe openings are located on open deck 3 m away from sources of ignition.
- Means are provided, on the open deck, to allow measurement of flammable gas concentrations within the tank by a suitable portable instrument.
- The access to the forepeak and the sounding arrangements are directly from open deck. In case the forepeak 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.

A 700 Fuel oil tanks

701 Fuel oil bunker tanks situated at forward or aft end of the cargo area may be connected directly to pumps in the engine room. The pipes shall not pass through cargo tanks.

B. Cargo Piping System

B 100 General

101 A complete 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.

Steam and water systems shall be connected to the cargo piping only by non-permanent means, and be fitted with a non-return valve in the cargo area upstream of the first outlet branch.

See Sec.9 regarding pipes for ventilation or inerting purposes.

102 The cargo piping system shall be dimensioned according to Pt.4 Ch.6 Sec.6. The design pressure p is the maximum working pressure to which the system may be subjected. Due consideration shall be given to possible liquid hammer in connection with the closing of valves.

The design pressure for cargo piping is as a minimum to be taken as 10 bar.

For chemical tankers certified for a range of cargoes also including products with density (ρ) above 1.5 t/m³, the permissible stress according to Pt.4 Ch.6 Sec.6 A307 may be increased by a factor $\rho/1.5$.

Guidance note:

Maximum pressure will occur with cargo pumps running at full speed against closed manifold valves.

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

103 The cargo piping shall be joined by butt welding with a minimum of flange connections.

- Flange types A and B will be accepted in piping systems with design pressure $p > 16$ bar. See Pt.4 Ch.6 Sec.6 Fig.4.
- Flange types A, B and C will be accepted in piping systems with design pressure $p \leq 16$ bar.
- Flange connections in piping systems constructed of materials other than mild steel, will be especially considered.

104 All cargo piping shall be electrically bonded to the ship's hull. The resistance to earth from any point in the piping system shall not exceed $10^6 \Omega$.

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.

B 200 Cargo pumps

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

202 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.

203 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 leakage.

204 Where machinery in cargo pump room or other hazardous spaces are driven by shafting passing into the pump room through bulkheads or deck plating, gastight glands shall be fitted. The glands shall be efficiently lubricated and shall be 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 material that no spark will occur. If an expansion below is fitted, it shall be hydraulically pressure tested.

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

206 Means shall be provided for stopping the pumps from an easily accessible position outside the pump room.

B 300 Arrangement and general design

301 The complete cargo piping system shall be located within the cargo area. Bow or stern loading and discharge arrangements may be accepted by the Society after special consideration.

302 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.

303 Expansion elements shall be provided in the cargo piping as necessary. The elements shall not be of the sliding type.

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

305 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, e.g. cooling water systems for machinery.

306 Cargo piping systems shall not be installed under deck between the outboard side of the cargo containment spaces and the skin of the ship, unless clearances required in Sec.1 D are maintained. This requirement does not apply when damage to the pipe would not cause release of cargo.

307 Means for drainage of the cargo lines shall be provided.

308 Runs of cargo piping, located below the weather deck, may run from the tank they serve and penetrate tank bulkheads or boundaries common to adjacent (longitudinally or transversely) cargo tanks, ballast tanks or empty tanks or pump rooms, provided that inside the tank they serve, the runs are fitted with a stop valve operable from the weather deck.

As an exception, where a cargo tank is adjacent to a pump room the stop valve operable from the weather deck may be situated on the tank bulkhead on the pump room side, provided an additional valve is fitted between the bulkhead valve and the cargo pump.

309 Runs of cargo piping installed in pipe tunnels are also to comply with the requirements in 308 and 311. The tunnel shall not have any other openings except to the weather deck and the pump room.

310 Runs of cargo piping through bulkheads shall not utilise flanges bolted through the bulkhead.

311 In any pump room where a pump serves more than one tank, a stop valve shall be fitted in the line to each tank.

312 A stop valve shall be fitted at each cargo hose shore connection.

313 A stop valve capable of being manually operated, shall be fitted on each tank filling and discharge line, located near the tank penetration. If individual deep-well pumps are installed, a stop valve at the tank is not required on the discharge line.

314 Means for gas-freeing of the cargo lines shall be provided.

315 The controls necessary during transfer and or transport of cargoes other than in pump rooms which have been specially dealt with shall not be located below the weather deck.

316 In case of pressure type independent cargo tanks, all pipe connections shall be above the liquid level.

B 400 Pressure indication

401 Pump discharge pressure gauges shall be provided outside the pump room.

B 500 Welding procedure tests

501 Welding procedure tests are required for cargo piping of austenitic stainless steel.

502 The requirements are as given in Pt.2 Ch.3 Sec.5 except that Charpy tests are not required for austenitic stainless steel.

503 Special welding procedure tests will not be required if previous welding procedure tests for similar material, thicknesses and welding positions are satisfactorily documented.

Guidance note:

In order to comply with requirements for passing radiographic testing of welding of butt joints on stainless steel pipes, it is strongly recommended that welding is carried out with argon-backing inside piping.

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B 600 Testing

601 Cargo piping butt welds shall be subjected to radiographic testing covering at least 10% of the welded connections, when steel pipes are used. This percentage may be increased as found necessary by the Surveyor. The quality of the welds in steel shall comply with ISO 5817 quality level B.

602 Cargo piping shall be hydrostatically tested in the presence of the Surveyor to a test pressure = 1.5 x the design 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 only is required after completion of the installation onboard.

C. Stripping of Cargo Tank and Cargo Lines

C 100 General

101 The pumping and piping arrangement shall ensure that the amount of residues in each cargo tank and its associated piping, is not in excess of 75 litres (Cargo stripping performance **str 0.075**).

102 The verification of the above residue quantity shall be through actual testing with water and in accordance with an approved test procedure.

See MARPOL 73/78 Annex II, Appendix 5.

D. Discharge of Contaminated Water

D 100 Location of discharge outlet

101 For discharge of cargo contaminated water an outlet located below the waterline in vicinity of the turn of the bilge shall be arranged within the cargo area.

102 The outlet(s) shall be located such that the cargo contaminated discharges will not enter the ship's seawater intakes.

D 200 Sizing of the discharge outlet

201 The internal diameter of the outlet shall not be less than:

$$D = \frac{Q_D}{5L}$$

Q_D = discharge rate (m³/h)

L = distance of outlet from forward perpendicular (m).

In the case of angled outlets only the velocity component of the discharge perpendicular to the ship's shell plating need to be considered when determining Q_D .

The discharge rate assumed as the basis for outlet(s) sizing shall not be taken less than the aggregate throughput of the washing machines in anyone tank.

D 300 Cargo Record Book and SMPEP

301 All ships having a Certificate of Fitness (COF) for the carriage of liquid substances as listed in the IBC Code Chapter 17 and 18, shall have on board a Cargo Record Book according to MARPOL 73/78, Annex II Appendix 2.

302 All ships having a Certificate of Fitness (COF) for the carriage of liquid substances as listed in the IBC Code Chapter 17 and 18, shall carry on board a Shipboard Marine Pollution Emergency Plan (SMPEP) according to MARPOL 73/78 Annex II, Reg. 17.

E. Stern loading and unloading arrangements

E 100 General

101 Subject to the approval of the Society, cargo piping may be fitted to permit stern loading and unloading. Portable arrangements will not be permitted.

102 Stern loading and unloading lines shall not be used for

the transfer of products required to be carried in **Ship type 1** ships. Stern loading and unloading lines shall not be used for the transfer of cargoes emitting toxic vapours required to comply with Sec.9 B400, unless specifically approved by the Society.

E 200 Piping arrangement

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

- The piping outside the cargo area shall be fitted at least 760 mm inboard on the open deck. Such piping shall be clearly identified and fitted with a shut-off valve at its connection to the cargo piping system within the cargo area. At this location, it shall also be capable of being separated by means of a removable spool piece and blank flanges when not in use.
- The shore connection shall be fitted with a shut-off valve and a blank flange.
- The piping shall be full penetration butt welded, and fully radiographed. Flange connections in the piping shall only be permitted within the cargo area and at the shore connection.
- Spray shields shall be provided at the connections specified in a) as well as collecting trays of sufficient capacity with means for the disposal of drainage.
- The piping shall be self-draining to the cargo area and preferably into a cargo tank. Alternative arrangements for draining the piping may be accepted by the Society.
- Arrangements shall be made to allow such piping 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. The relevant connections to the piping shall be provided with a shut-off valve and blank flange.

E 300 Accommodation entrances

301 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall not face the cargo shore connection location of stern loading and unloading arrangements. They shall be located on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship but not less than 3 m from the end of the house facing the cargo shore connection location of the stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore connection location and on the sides of the superstructure or deckhouse within the distance mentioned above shall be of the fixed (non-opening) type. In addition, during the use of the stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deckhouse side shall be kept closed. Where, in the case of small ships, compliance with Sec.3 D103 and this paragraph is not possible, the Society may approve relaxations from the above requirements.

302 Air pipes and other openings to enclosed spaces not listed in 301 shall be shielded from any spray which may come from a burst hose or connection.

303 Escape routes shall not terminate within the coamings required by 304 or within a distance of 3 m beyond the coamings.

304 Continuous coamings of suitable height shall be fitted to keep any spills on deck and away from the accommodation and service areas.

E 400 Electrical equipment — Fire fighting

401 Electrical equipment within the coamings required by 304 or within a distance of 3 m beyond the coamings shall be in accordance with the requirements of Sec.12.

402 Means of communication between the cargo control station and the cargo shore connection location shall be provided and certified safe, if necessary. Provision shall be made for the remote shutdown or cargo pumps from the cargo shore connection location.

403 Ships fitted with stern loading and unloading arrangements shall be provided with one additional foam monitor meeting the requirements of Sec.11 B208 and one additional applicator meeting the requirements of Sec.11 B211. The additional monitor shall be located to protect stern loading and unloading arrangements. The area of the cargo line aft of the cargo area shall be protected by the above mentioned applicator.

F. Cargo Hoses

F 100 General

101 Liquid and vapour hoses used for cargo transfer shall be compatible with the cargo and suitable for the cargo temperature.

102 Hoses subject to tank pressure or the discharge pressure of pumps shall be designed for a bursting pressure not less than 5 times the maximum pressure the hose will be subjected to during cargo transfer.

103 Each type of cargo hose, complete with end-fittings, shall be prototype-tested at a normal ambient temperature with 200 pressure cycles from zero to at least twice the specified maximum working pressure. After this cycle pressure test has been carried out, the prototype test shall demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the extreme service temperature. Hoses used for prototype testing shall not be used for cargo service. Thereafter, before being placed into service, each new length of cargo hose produced shall be hydrostatically tested at ambient temperature to a pressure not less than 1.5 times its specified maximum working pressure but not more than two-fifths of its bursting pressure. The hose shall be stencilled or otherwise marked with the date of testing, its specified maximum working pressure and, if used in services other than the ambient temperature services, its maximum and minimum service temperature as applicable. The specified maximum working pressure shall not be less than 10 bar gauge.

SECTION 7 CARGO HEATING AND COOLING ARRANGEMENTS

A. Cargo Heating and Cooling Arrangements

A 100 General

101 Requirements for water systems and steam systems are identical to those of Pt.4 Ch.6 unless otherwise stated.

102 The heating and cooling media shall be compatible with the cargo.

103 Heating or cooling systems shall be provided with valves to isolate the system for each tank and to allow manual regulation of flow.

104 For any heating or cooling system, means shall be provided to ensure that, when in any other but the empty condition, a higher pressure is maintained within the system than the maximum pressure head exerted by the cargo tank content on the system.

105 Cargo heating and cooling pipes shall not penetrate the cargo tank boundaries other than on the top of the tank.

106 Means shall be provided for measuring the cargo temperature. When overheating or overcooling could result in a dangerous condition, temperature alarm shall be provided. The means for measuring the cargo temperature shall be of restricted or closed type, respectively, when a restricted or closed gauging device is required for individual substances as shown in the IBC Code Ch.17 column j.

Guidance note:

- A restricted temperature measuring device is subject to the definition for a restricted gauging device in Sec.13 B100, e.g. a portable thermometer lowered inside a gauge tube of the restricted type.
- a closed temperature measuring device is subject to the definition for a closed gauging device in Sec.13 B100, e.g. a remote thermometer of which the sensor is installed in the tank.

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107 Where products with a significant toxic hazard (IBC Code Ch.17 column o refers to Ch. 15.12, 15.12.1 or 15.12.3) are being heated or cooled, the heating or cooling media shall operate:

- in a circuit independent of other ship's services, except for another cargo heating or cooling system, and not enter the engine room; or

- in a circuit dependent of other services, if the condensate is not returned to the engine room, or
- in a system external to the tanks; or
- in a circuit where the medium is sampled to check for the presence of cargo before it is recirculated to other ship's services or into the engine room. The sampling equipment shall be located within the cargo area and be capable of detecting the presence of any toxic cargo being heated or cooled.

Guidance note:

The suitability of the sampling method must be documented for each product.

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108 A cooling system shall be arranged in accordance with the requirements in Ch.5 Sec.7 A201. In addition the cooling system shall comply with the requirements given in Ch.10 to the extent these are applicable.

109 Steam and exhaust pipes for heating coils fitted in cargo tanks, shall be arranged for blank flanging outside the engine or boiler room.

110 Heating coils fitted in tanks intended for carriage of heat sensitive products (IBC Code Ch.17 column o refers to Ch. 16.6.2), shall be arranged for blank flanging at each tank.

111 Heating medium temperature is normally not to exceed 220°C. If cargoes with an auto-ignition temperature lower than 220°C are carried, the heating medium temperature shall be adjusted accordingly, during transfer of cargo.

112 Condensate from cargo heating systems shall not be used for feed water for main boilers.

A 200 Heating of cargoes with temperatures above 80°C

201 Heating plants for cargoes with temperatures above 80°C shall be arranged with redundancy.

202 Pumps and valve systems shall be suitable for the type of cargo to be transported.

203 Heating system for cargo pumps and cargo lines to be arranged as found necessary.

204 Temperature gauges shall be arranged in each cargo tank enabling the monitoring of temperature at bottom, middle and top of tanks.

SECTION 8

MARKING OF TANKS, PIPES AND VALVES

A. General

A 100 Marking plates

101 Marking plates shall be made of corrosion resistant material, and shall be permanently fixed to valve handles, flanges or similar parts. Markings, bolt holes, etc. in the tanks themselves shall be avoided.

The lettering shall be impressed on the marking plate in letters of at least 5 mm height. The marking plates shall be placed in easily visible positions and shall not be painted.

A 200 Pipelines

201 Pumps, valves and pipelines shall be distinctively marked to identify the service and tanks which they serve. General remarks regarding marking of valves are given in Pt.4 Ch.6 Sec.3.

A 300 Marking of independent tanks

301 Every independent tank shall have a marking plate giving the following information as relevant:

Tank No.

Design vapour pressure: bar

Maximum cargo density: kg/m³

Capacity of the tank: m³ (98% filled)

Test pressure: bar

Name of builder:

Year of construction:

The marking plate may also be used for the necessary marking of identification.

For definitions of:

Design vapour pressure p_o , see Sec.1 B.

Test pressure.

SECTION 9

GAS FREEING AND VENTING OF CARGO TANKS

A. Gas Freeing of Cargo Tanks

A 100 General

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

The arrangement for gas freeing cargo tanks shall be such as to minimize the hazards due to the dispersal of flammable or toxic vapours in the atmosphere and to flammable or toxic vapour mixtures in a cargo tank.

The ventilating system for cargo tanks shall be used exclusively for ventilating purposes. Connection between cargo tank and pump room ventilation will not be accepted.

102 Gas freeing operations shall be carried out such that vapour is initially discharged in one of the following ways:

- 1) through the vent outlets specified in B300 or B400; or
- 2) through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation; or
- 3) through outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame.

Guidance note:

When the flammable vapour concentration at the outlets has been reduced to 30% of the lower flammable limit and in the case of a toxic product the vapour concentration does not present a significant health hazard, gas freeing may thereafter be continued at cargo tank deck level.

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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 Permanent pipe connections between a ventilating plant or inert gas plant and cargo piping systems will normally not be accepted.

B. Tank Venting Systems

B 100 General

101 In the following the term «pressure relief valve» denotes a safety valve which opens at a given internal pressure above atmospheric pressure, and the term «vacuum relief valve» denotes a safety valve which opens at a given internal pressure below atmospheric pressure. By P/V valves are meant combined pressure/ vacuum relief valves.

102 The master shall be provided with the maximum permissible loading and unloading rates for each tank or group of tanks consistent with design of the venting systems.

103 Tank venting systems as described in 200-400 below, shall be provided according to IBC Code Ch.17 column g.

104 For carriage of IBC Code Ch.18 products with flash point not exceeding 60°C, tank venting shall at least comply with 300.

B 200 Tank venting system, type c1 (Open)

201 For some particular products an open tank venting system is applicable.

B 300 Tank venting system, type c2 (Controlled)

301 The tanks shall have arrangement for pressure/ vacuum relief during voyage and venting during loading and unloading with closed tank hatch covers.

302 Pressure vacuum relief valves shall be fitted to each tank to limit the pressure or vacuum in the tank.

The venting system may consist of individual vents from each tank or the vents from each individual tank may be connected on the pressure side of the P/V-valve to a common header. Due regard is in that case to be paid to cargo segregation.

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

304 The venting 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.

The opening pressure of the vacuum relief valves is normally not to be lower than 0.07 bar below atmospheric pressure.

305 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.

306 Venting systems to be used for cargoes that may cause clogging of the venting lines, will be specially considered.

307 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.

308 Cargo tank vent outlets shall be situated not less than 6 m above the weather deck or above the fore and aft gangway, if fitted within 4 m of the gangway.

The vent height may be reduced to 3 m above the deck or fore and aft gangway as applicable, provided high velocity vent valves of an approved type with an exit velocity of at least 30 m/s, are fitted.

The vent exits are also to be arranged at a distance of at least 10 m from the nearest air intake or opening to accommodation and service spaces and ignition sources. The vapour discharge shall be directed upwards in the form of unimpeded jets.

309 Vapour outlets for tanks to be used for cargoes with flashpoint not exceeding 60°C shall be provided with devices tested and approved according to IMO MSC/Circ.677 as amended by MSC/Circ.1009, to prevent the passage of flame into the cargo tanks. Due attention shall be paid in the design of P/V valves, flame screens and vent heads to the possibility of the blockage of these devices by the freezing of cargo vapour or by icing up in adverse weather conditions. Provisions shall be made that the system and fittings may be inspected, operationally checked, cleaned or renewed as applicable.

310 The vent system shall be sized, allowing for flame screens, if fitted, to permit loading at a design rate without overpressuring the tank. Specifically, under conditions in

which a saturated cargo vapour is discharged through the venting system at the maximum anticipated loading rate, the pressure differential between the cargo tank vapour space and the atmosphere shall not exceed the design vapour pressure of the tank, or, for independent tanks, the maximum working pressure of the tank.

311 The venting system shall be connected to the highest point of each cargo tank and vent lines shall be self-draining under all normal operating conditions of list and trim. Where it is necessary to drain venting systems above the level of any P/V valve, capped or plugged drain cocks should be provided.

312 Provision shall be made to ensure that the liquid head in any tank does not exceed the test head of that tank; overflow control systems or spill valves, together with gauging devices and tank filling procedures may be accepted for this purpose.

Guidance note:

Where the means of limiting cargo tank overpressure includes an automatic closing valve, the valve shall comply with Sec.13 B200.

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B 400 Tank venting system, type c3 (Controlled venting for toxic products)

401 Type **c3** venting is required for products for which IBC Code Ch.17 column o refers to Ch. 15.12 or parts thereof. The

requirements of 300 apply with the additions given in 402, 403 and 404.

402 The opening pressure of the pressure relief valves is normally to be 0.20 bar above atmospheric pressure. The opening pressure of the vacuum relief valves is normally not to be lower than 0.07 bar below atmospheric pressure.

403 Gas outlets are normally to be at a minimum height of $B/3$ or 6 m, whichever is greater above the weather deck, or in the case of a deck tank the access gangway, where B = ship's moulded breadth. Further, the outlets shall not be less than 6 m above the fore and aft gangway if fitted within a horizontal distance of 6 m from the gangway.

The vent height may be reduced to 3 m above the deck or fore and aft gangway as applicable provided high velocity vent valves of an approved type, directing the vapour and air mixture upwards in an unimpeded jet with an exit velocity of at least 30 m/s, are fitted.

The outlets shall be situated at a horizontal distance of at least 15 m from air intakes, port holes or doors to accommodation and service spaces.

For ships with length less than 90 m, smaller distances may be accepted.

404 Valved pipe connections for returning the expelled gases ashore during loading, shall be provided.

SECTION 10

MECHANICAL VENTILATION IN THE CARGO AREA OUTSIDE THE CARGO TANKS

A. System Requirements

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 shall not 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 underpressure 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 great 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 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 $10^6 \Omega$.

The following combinations of materials and clearances used in way of the impeller and duct are considered to be non-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 materials;
- impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non-ferrous 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 sparking 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 having a complicated form.

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, auto-

matic 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 shall be installed capable of circulating sufficient air to give at least 30 air changes per hour. Extraction from above and below floor plates shall be possible, with the following arrangement of exhaust trunking:

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

For carriage of certain products, increased ventilation rates are required. See Sec.15 A1100.

302 Ventilation systems for pump rooms, compressor rooms and other cargo handling spaces shall be in operation when pumps or compressors are working. Warning notices to this effect shall be placed in an easily visible position near the control stand.

303 The exhaust outlets shall discharge upwards and shall be situated at least 4 m above tank deck and at least 10 m in the horizontal direction from ventilation inlets to the accommodation and other gas safe spaces.

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.

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B 400 Other hazardous spaces normally entered

401 Pump rooms and other enclosed spaces below deck not covered by 300, where access may be necessary for normal operation and maintenance, shall be provided with a mechanical ventilation system giving at least 20 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 B122 shall be gasfreeable. 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 shall give at least 8 air changes per hour for spaces referred to in Sec.1 C122 (water ballast tanks not included).

SECTION 11

FIRE PROTECTION AND EXTINCTION

A. General

A 100 Application

101 The fire safety measures in SOLAS related to tankers in general, will apply depending on flag state authorisation, as specified in Ch.3 Sec.7 A100.

102 Fire safety measures applicable to chemical tankers, are specified in B below and in Sec.6 E.

B. Fire Extinguishing

B 100 Fire extinguishing in cargo area

101 Suitable fire extinguishing equipment for all products carried shall be provided. Fire extinguishing media considered to be suitable for certain products, are indicated in the IBC Code Ch.17 column 1.

B 200 Deck fire extinguishing system in cargo area

201 All ships with the class notation **Tanker for Chemicals** or **Tanker for C** for dedicated chemical cargoes, except those engaged solely in the transport of non-flammable products, shall be fitted with a fixed deck foam fire-extinguishing system in accordance with the following requirements. Ships which are dedicated to the carriage of specific cargoes may, however, be protected by alternative provisions to the satisfaction of the Society when they are equally effective for the products concerned as the deck foam system required for the generality of flammable cargoes.

Guidance note:

The term «ships which are dedicated to the carriage of specific cargoes» means ships which are dedicated to the carriage of a restricted number of cargoes.

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202 For ships intended to carry flammable products with flash point exceeding 60°C the requirements as specified for oil tankers in Ch.3 Sec.7 A100 shall be applied in lieu the regulations of this section.

203 Only one type of foam concentrate shall be supplied, and it shall be effective for the maximum possible number of cargoes intended to be carried. For other cargoes for which foam is not effective or is incompatible, additional arrangements to the satisfaction of the Society shall be provided. Basic protein foams shall not be used.

204 The arrangements for providing foam shall be capable of delivering foam to the entire cargo tank area as well as into any cargo tank, the deck of which is assumed to be ruptured.

205 The deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside of the cargo tank area, adjacent to the accommodation spaces and readily accessible and operable in the event of fires in the areas protected.

206 The rate of supply of foam solution shall be not less than the greater of the following:

- 2 l/m² minute of the cargo deck area, where cargo deck area means the maximum breadth of the ship times the total longitudinal extent of the cargo tank spaces,
- 20 l/m² minute of the horizontal sectional area of the single tank having the largest such area,
- 10 l/m² minute of the area protected by the largest monitor,

such area being entirely forward of the monitor, but not less than 1 250 l/minute. For ships of less than 4 000 tons deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Society.

207 The foam concentrate shall be type approved, and delivered with a declaration of conformity and a declaration of the main characteristics (sedimentation, pH-value, expansion ratio, drainage time and volumetric mass and date of production).

208 Alcohol resistant fluorine protein based foam concentrates is subjected to a chemical stability test with acetone before pouring into foam tank and a new chemical stability test after installation onboard (preferably as long as possible but not less than after 14 days after installation onboard).

A DNV surveyor will collect the sample and witness the test.

Guidance note:

For test programme and requirements see Appendix A of Type Approval Program 474.65.

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209 Sufficient foam concentrate shall be supplied to ensure at least 30 minutes of foam generation when using solution rates stipulated in 206 (a), (b) and (c), whichever is the greater.

210 Foam from the fixed foam system shall be supplied by means of monitors and foam applicators. At least 50% of the foam rate required in 206 (a) or (b) shall be delivered from each monitor. The capacity of any monitor shall be at least 10 l/minute of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of the monitor. Such capacity shall be not less than 1 250 l/minute. For ships of less than 4 000 tons deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Society.

211 The distance from the monitor to the farthest extremity of the protected area forward of that monitor shall be not more than 75% of the monitor throw in still air conditions.

212 A monitor and hose connection for a foam applicator shall be situated both port and starboard at the poop front or accommodation spaces facing the cargo tanks.

213 Applicators shall be provided for flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator shall be not less than 400 l/minute and the applicator throw in still air conditions shall be not less than 15 m.

The number of foam applicators provided shall be not less than four. The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed to any part of the cargo tank deck area.

214 Valves shall be provided in the foam main, and in the fire main where this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains.

215 Operation of a deck foam system at its required output shall permit the simultaneous use of the minimum required number of jets of water at the required pressure from the fire main.

216 Suitable portable fire extinguishing equipment for the products to be carried shall be provided and kept in good operating order.

217 All sources of ignition shall be excluded from spaces where flammable vapours may be present, except as permitted in Sec.12.

218 When the alternative deck fire extinguishing system permitted under 201 is a fixed dry chemical powder fire extinguishing system, the system shall comply with Ch.5 Sec.11 B300.

B 300 Fire extinguishing in cargo pump rooms

301 Ships with the class notation **Tanker for Chemicals**, shall be equipped with a fixed carbon dioxide fire-extinguishing system in the cargo pump room, as specified in 302 to 304 below.

For ships with class notation **Tanker for C** for dedicated chemical cargoes, see 307.

302 A cargo pump room carbon dioxide fire extinguishing system shall comply with the requirements in Pt.4 Ch.10.

303 The amount of gas carried shall be sufficient to provide a quantity of free gas equal to 45% of the gross volume of the cargo pump room in all cases.

304 A notice shall be exhibited at the controls stating that the system is only to be used for fire extinguishing and not inerting purposes due to the electrostatic ignition hazard.

305 Cargo pump rooms of ships which are dedicated to the

carriage of specific cargoes shall be protected to the satisfaction of the Society.

Guidance note:

The term “ships which are dedicated to the carriage of specific cargoes”, means ships which are dedicated to the carriage of a restricted number of cargoes.

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

306 A fire-extinguishing system consisting of either a fixed pressure water spray system or a high expansion foam system could be provided for the cargo pump room if it can be adequately demonstrated to the Society that cargoes will be carried which are not suited to extinguishment by carbon dioxide. The Appendix to Classification Certificate will reflect this conditional requirement.

307 Steam smothering systems are not accepted for cargo pump rooms.

SECTION 12

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 with the class notations **Tanker for Chemicals**. The requirements may be made wholly or partly valid also for tankers for dedicated chemical cargoes (**Tanker for C**) in some cases.

102 Tankers exclusively built to carry cargoes with flash point above 60°C will be 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, the 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.

103 Additional requirements may apply for certain cargoes according to IBC Code Ch.15 and Ch.17.

104 The materials used for electrical equipment shall not react dangerously with the cargo liquids or gases to which they may be exposed, and shall be corrosion resistant against such liquids or gases.

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 electri-

cal 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.10 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.10 B201 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.10 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 tank 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.
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.
- 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 centered 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) Forepeak ballast tanks, if connected to a piping system serving ballast tanks within the cargo area. See Sec.6 A600.

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.

C 400 Tankers for carriage of products (e.g. acids) reacting with other products/materials to evolve flammable gases

401 Hazardous areas zone 1

Areas as specified in 201, 202 4) and 202 12).

402 Hazardous areas zone 2

- 1) Areas of 1.5 m surrounding openings of zone 1 spaces as specified in 401, if not otherwise specified in the rules.
- 2) Areas specified in 202 1), 202 2), 202 3), 202 5), 202 6), 202 13).
- 3) Areas as specified in 202 7) and 202 10) but with the distances of 2.4 m and 3 m reduced to 1.5 m, and areas as specified in 202 8) but with the distance of 6 m reduced to 3 m.

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 200 x 300 mm shall be fitted at each entrance to such spaces with text:

**BEFORE A LIGHTING FITTING IS OPENED
ITS SUPPLY CIRCUIT IS
TO 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 x 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
IS NOT TO BE USED IN AREAS WHERE THERE IS
GAS DANGER**

Alternatively signboards of size approximately 600 x 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 13 INSTRUMENTATION AND AUTOMATION

A. General Requirements

A 100 General

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

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.

102 Remote reading systems for cargo temperature and pressure shall not allow the cargo or vapour to reach gas safe spaces. Direct pipe connections will not be accepted

103 If the loading and unloading of the ship is performed by means of remotely controlled valves and pumps, all controls and indicators associated with a given cargo tank shall be concentrated in one control position.

104 Ships arranged with cargo pump room, carrying chemicals with flashpoint not exceeding 60°C, shall comply with the requirements for pump room safety as given in Ch.3 Sec.6 A303 and Ch.3 Sec.9 B102, B103 and F101.

B. Alarm, Indicating and Recording Systems

B 100 Cargo tank level gauging

101 By «gauging device» is meant an arrangement for determining the liquid level of cargo in tanks. Consideration of the hazard and physical properties of each cargo will give the base for selecting one of the following types:

- open, type **b1**
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 **b2**
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 **b3**
A permanently installed device which penetrates the tank, but which is part of a closed system which keeps the cargo containment system completely sealed off from the atmosphere. Examples of this type are sight glasses, pressure cells, float-tape systems, electronic or magnetic probe.
- indirect, type **b4**
A device which does not penetrate the tank shell or is independent of the tank and which makes use of an indirect measurement for determining the amount of cargo. Examples are weighing of cargo, pipe flow meter.

102 Each cargo tank shall be provided with at least one liquid level gauging device. Type of gauging devices required for the individual cargoes are shown in the *IBC Code Ch.17 column j*.

103 If a closed gauging device is not mounted directly on the

tank, it shall be provided with shut-off valves situated as close as possible to the tank.

B 200 Overflow control

201 Arrangements as described below shall be provided according to the IBC Code Ch.17 column **o** (references to 15.19.6 corresponds to **f1**, references to 15.19 corresponds to **f2**).

202 Type **f1**. The cargo tank shall be fitted with a visual and audible high level alarm.

This shall be able to be function tested from the outside of the tank and is also to be independent of the level gauging device required in 102 and the high-high level alarm required in 203.

203 Type **f2**. In addition to the high level alarm as described in 202, a high-high level alarm shall be fitted. The high-high level alarm shall be independent of the high level alarm and the level gauging device.

B 300 Vapour detection

301 Ships carrying toxic and/or flammable cargoes (ref. IBC Code Ch.17 column **k**) shall be equipped with at least two instruments designed and calibrated for testing for the specific vapours in question. If such instruments are not capable of testing for both toxic concentrations and flammable concentrations, then two separate sets of instruments shall be provided.

302 Vapour detection instruments may be portable or fixed. If a fixed system is installed, at least one portable instrument shall be provided.

303 In the case of portable instruments being used, provisions shall be made to facilitate easy measurements, and where necessary fitting of guide tubes to enable gas sampling hose to be easily lead to the space to be tested.

B 400 Cargo temperature measurement

401 Means for measuring the cargo temperature shall be provided. Tanks intended for carriage of cargoes requiring cargo level gauging systems type **b2, b3** or **b4**, shall be provided with a temperature measuring system providing a gas segregation equivalent to the gauging systems required.

B 500 Hold leakage alarm

501 Hold spaces containing independent cargo tanks shall be provided with alarm for leakage of liquids into the holds.

B 600 Computer (PLC) based systems for cargo handling

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

B 700 Centralised cargo control

701 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 800 Integrated cargo and ballast systems

801 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.

802 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.

B 900 Gas detection in cargo pump room for flammable liquids with flashpoint not exceeding 60°C

901 A system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted according to SOLAS II-2 Reg.5.10.1.3.

902 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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SECTION 14

TESTS AFTER INSTALLATION

A. General

A 100 Application

101 All systems covered by this chapter shall be tested in operation. As far as practicable, the tests shall be performed at the building yard.

102 Remaining function tests, which cannot be carried out without cargo on board, may be carried out in connection with the first cargo loading and transport with a representative cargo.

SECTION 15

ADDITIONAL REQUIREMENTS FOR CERTAIN CARGOES

A. General Requirements

A 100 Application

101 The provisions of this section are applicable where specific reference is made in the IBC Code Ch.17 column **o** to corresponding parts of the Code.

The requirements are mainly of constructional nature or of a nature affecting both construction and operation. Specific operational requirements for some of the products are given in the IBC Code. It is assumed that the operational requirements are complied with during operation of the ship.

A 200 Materials of construction

201 When cargo tanks are intended for carriage of acids/corrosive products, which in the IBC Code Ch.17 column **o** have a reference to 15.11 (or to 15.11.2 or .3), the tanks and associated pipe-lines, valves, fittings and other items of equipment which may come in contact with the cargo, are to be constructed of stainless steel unless fitted with an approved lining.

A 300 Segregation of cargo from bunker tanks

301 Products which in the IBC Code Ch.17 column **o** have a reference to 15.12 or 15.12.3, shall not be carried in tanks adjacent to bunker tanks.

A 400 Separate piping systems

401 Products which in the IBC Code Ch.17 column **o** have a reference to 15.12 or 15.12.3, shall be carried in tanks with separate piping systems and with vent systems separate from tanks containing other products.

A 500 Cargo contamination

501 Water shall not be allowed to contaminate products which in the IBC Code Ch.17 column **o** have a reference to 15.16.2. In addition the following provisions apply:

- Air inlets to pressure/vacuum relief valves of tanks containing this cargo shall be situated at least 2 m above the weather deck.
- Water or steam shall not be used as the heat transfer media in a cargo temperature control system.
- This cargo shall not be carried in tanks adjacent to permanent ballast or water tanks unless the tanks are empty and dry.
- This cargo shall not be carried in tanks adjacent to sea chests, slop tanks, cargo tanks containing ballast or slops or other cargoes containing water which may react in a dangerous manner. Pumps, pipes or vent lines serving such tanks shall be separate from similar equipment serving tanks containing this cargo. Pipelines from slop tanks or ballast lines shall not pass through tanks containing this cargo unless in a tunnel.

A 600 Inert gas

601 For products which in the IBC Code Ch.17 column **h** are assigned "Inert", the cargo tank vapour space and associated piping systems shall be filled and maintained with a gas (inert) which will not support combustion and which will not react with the cargo.

602 An adequate supply of inert gas for use in filling and discharging shall be carried or shall be manufactured on board unless a shore supply is available.

In addition, sufficient inert gas shall be available on the ship to compensate for normal losses during transportation.

603 The inert gas system on board the ship shall be able to maintain at least 0.07 bar over-pressure within the containment system at all times. In addition, the inert gas system shall not raise the cargo tank pressure to more than the tank's relief valve setting.

604 Means shall be provided for monitoring ullage spaces containing a gas blanket to ensure that the correct atmosphere is being maintained.

605 Inerting arrangements where used with flammable cargoes shall be such as to minimise the creation of static electricity during the admission of the inerting media.

A 700 Moisture control (Drying)

701 For products which in the IBC Code Ch.17 column **h** are assigned "Dry", the cargo tank vapour space and associated piping systems shall be filled and maintained with a moisture free gas or vapour which will prevent the access of water or water vapour to the cargo. For the purpose of this paragraph, "moisture free" gas or vapour is that which has a dewpoint of -40°C or below at atmospheric pressure.

702 Where dry nitrogen is used as the medium, similar arrangements for supply of the drying medium shall be made as required in 602, 603 and 605 above. Where drying agents are used as the drying medium on all air inlets to the tank, sufficient media shall be carried for the duration of the voyage taking into consideration the diurnal temperature range and the expected humidity.

A 800 Cargo pumps in tank

801 For products which in the IBC Code Ch.17 column **o** have a reference to 15.18, cargo pumps shall be located in the cargo tank or the cargo pump room shall be located on the weather deck level. Special consideration by the Society is required for other locations of the pump room.

A 900 Products not to be exposed to excessive heat

901 Products which in the IBC Code Ch.17 column **o** have a reference to 16.6 or 16.6.3, are due to their heat sensitive nature, not to be carried in uninsulated deck tanks.

902 Products which in the IBC Code Ch.17 column **o** have a reference to 16.6 or 16.6.4, are due to their heat sensitive nature, not to be carried in deck tanks.

A 1000 Cargo pump temperature sensors

1001 For products which in the IBC Code Ch.17 column **o** have a reference to 15.21, temperature sensors shall be used to monitor cargo pumps located in pump rooms, to detect overheating due to pump failure.

A 1100 Increased ventilation of cargo handling spaces

1101 For products which in the IBC Code Ch.17 column **o** have a reference to 15.17, the ventilation system as described in Sec.10 B301, shall have a capacity of at least 45 air changes per hour. The ventilation exhaust outlets shall be situated at least 10 m from ventilation inlets to the accommodation and other non-hazardous spaces and at least 4 m above the tank deck.

B. Additional Requirements for Certain Groups of Products

B 100 Acids

101 No electrical equipment or other sources of ignition are permitted in enclosed spaces adjacent to cargo tanks, except as specified in Sec.12.

102 The ship's shell plating shall not form any boundaries of tanks containing mineral acids.

103 Materials of construction of the tanks shall be approved in each case.

104 Unless constructed completely of corrosion-resistant materials or fitted with an approved lining, the plating thickness shall take into account the corrosiveness of the cargo.

105 Flanges of the loading and discharge manifold connections shall be provided with shields which may be portable to guard against the danger of the cargo being sprayed. Drip trays shall be provided to guard against leakage on to the deck.

106 Means for detecting leakage of cargo into adjacent spaces shall be provided.

107 Bilge pumping arrangements and drainage arrangements in pump rooms shall be of corrosion resistant materials.

B 200 Products which have a vapour pressure greater than 1.013 bar at 37.8°C

201 Unless the tank is designed to withstand the vapour pressure of the cargo, provisions shall be made to maintain the temperature of the cargo below its boiling point at atmospheric pressure.

202 Valved connections for returning gas ashore during loading shall be provided.

203 Each tank shall be provided with a pressure gauge indicating the pressure in the vapour space above the cargo.

204 Where the cargo is being cooled, each tank shall be provided with thermometers at the top and bottom of the tank.

C. Additional Requirements for Certain Chemicals

C 100 Ammonium nitrate solution, 93% or less

101 For applicable requirements, see the IBC Code 15.2.

C 200 Carbon disulphide

201 For applicable requirements, see the IBC Code 15.3.

C 300 Diethyl ether

301 Unless inerted, natural ventilation shall be provided for the voids around the cargo tanks while the vessel is under way. If a mechanical ventilation system is installed, all blowers shall be of non-sparking construction. Mechanical ventilation equipment shall not be located in the void spaces surrounding the cargo tanks.

302 Pressure relief valve settings shall not be less than 0.2 bar.

303 Inert gas displacement may be used for discharging cargo from pressure vessel tanks provided the cargo system is designed for the expected pressure.

304 No electrical equipment except for approved lighting fixtures shall be installed in enclosed spaces adjacent to cargo tanks. Lighting fixtures shall be approved for use in diethyl ether vapours. The installation of electrical equipment on the weather deck shall comply with the requirements of Sec.12.

305 In view of the fire hazard provisions shall be made to avoid any ignition source and/or heat generation in the cargo area.

306 Pumps may be used for discharging cargo provided that they are of a type designed to avoid liquid pressure against the shaft gland or are of a submerged type and are suitable for use with the cargo.

307 Provisions shall be made to maintain the inert gas pad in the cargo tank during loading, unloading and during transit.

C 400 Hydrogen peroxide solutions of 60% but not over 70% by mass

401 For applicable requirements, see the IBC Code 15.5.1.

C 500 Hydrogen peroxide solutions over 8% but not over 60% by mass

501 For applicable requirements, see the IBC Code 15.5.2 and 15.5.3.

C 600 Phosphorus, yellow or white

601 For applicable requirements, see the IBC Code 15.7.

C 700 Propylene oxide and mixtures of ethylene oxide/propylene oxide with ethylene oxide content of not more than 30% by weight

701 Propylene oxide transported under the provisions of this section shall be acetylene free.

702 Tanks for the carriage of propylene oxide shall be of steel or stainless steel construction.

703 Materials

- 1) All valves, flanges, fittings and accessory equipment shall be of a type suitable for use with propylene oxide and shall be constructed of steel or stainless steel or other material acceptable to the Society. The chemical composition of all material used should be submitted for approval prior to fabrication. Discs or disc faces, seats and other wearing parts of valves shall be made of stainless steel containing not less than 11% chromium.
- 2) Gaskets shall be constructed of materials which do not react with, dissolve in or lower the auto-ignition temperature of these products and which are fire resistant and possess adequate mechanical behaviour. The surface presented to the cargo shall be polytetrafluoroethylene (PTFE) or materials giving a similar degree of safety by their inertness. Spirally-wound stainless steel with a filler of PTFE or similar fluorinated polymer will be accepted.
- 3) Insulation and packing, if used, shall be of a material which does not react with, dissolve in, or lower the auto-ignition temperature of these products.
- 4) The following materials are generally found unsatisfactory for gaskets, packing and similar uses in containment systems for these products and would require testing before being approved:
 - neoprene or natural rubber if it contacts propylene oxide
 - materials containing oxides of magnesium, such as mineral wools.

The use of asbestos is generally prohibited (see Pt.4 Ch.1 Sec.2 A200).

704 Threaded joints are not permitted in the cargo liquid and vapour lines.

705 Filling and discharge piping shall extend to within 100 mm of the bottom of the tank or any sump pit.

706 Containment system

- 1) The containment system for a tank containing these products shall have a valved vapour return connection.
- 2) The products shall be loaded and discharged in such a

manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a propylene oxide containment system for these products shall be independent from all other containment systems.

- 3) During discharging operations, the pressure in the cargo tank must be maintained above 0.07 bar gauge.

707 Tanks carrying these products shall be vented independently of tanks carrying other products. Facilities shall be provided for sampling the tank contents without opening the tank to the atmosphere.

708 The cargo may be discharged only by deepwell pumps, hydraulically operated submerged pumps, or inert gas displacement. Each cargo pump shall be arranged to ensure that the oxide does not heat significantly if the discharge line from the pump is shut off or otherwise blocked.

709 Cargo hoses used for transfer of these products shall be marked:

FOR ALKYLENE OXIDE TRANSFER ONLY

710 Cargo tanks, void spaces and other enclosed spaces, adjacent to an integral gravity cargo tank, shall either contain a compatible cargo or be inerted by injection of a suitable inert gas. Any enclosed space in which an independent cargo tank is located shall be inerted. Such inerted spaces and tanks shall be monitored for propylene oxide and oxygen. The oxygen content of these spaces shall be maintained below 2%.

711 In no case is air to be allowed to enter the cargo pump or piping system while these products are contained within the system.

712 Prior to disconnecting shore-lines, the pressure in liquid and vapour lines shall be relieved through suitable valves installed at the loading header. Liquid and vapour from these lines shall not be discharged to atmosphere.

713 Propylene oxide may be carried in pressure tanks (**a4**) or in independent (**a3**) or in integral (**a2**) gravity tanks. Ethylene oxide/propylene oxide mixtures shall be carried in independent gravity tanks (**a3**) or in pressure tanks (**a4**). Tanks shall be designed for the maximum pressure expected to be encountered during loading, conveying and discharging cargo.

714 Tanks

- 1) Cargo tanks with a design pressure less than 0.6 bar gauge and tanks for the carriage of ethylene oxide/ propylene oxide mixtures with a design pressure less than 1.2 bar gauge shall have a cooling system to maintain the propylene oxide below the reference temperature (See Sec.1 B119).
- 2) The refrigeration requirement for tanks with a design pressure less than 0.6 bar gauge may be waived by the Society for ships operating in restricted areas or in voyages of restricted duration and account may be taken in such cases of any insulation of the tanks. The area and times of year where and for which such carriage would be permitted will be included in the conditions of carriage in the Appendix to the classification certificate.

715 Cooling

- 1) Any cooling system shall maintain the liquid temperature below the boiling temperature at the containment pressure. At least two complete cooling plants automatically regulated by variations within the tanks shall be provided. Each cooling plant shall be complete with the necessary auxiliaries for proper operation. The control system is also to be capable of being manually operated. An alarm shall be provided to indicate malfunctioning of the temperature controls. The capacity of each cooling system shall be sufficient to maintain the temperature of the liquid cargo below the reference temperature (see Sec.1 B119) of the

system.

- 2) An alternative arrangement may consist of three cooling plants, any two of which shall be sufficient to maintain the liquid temperatures below the reference temperature.
- 3) Cooling media which are separated from the products by a single wall only shall be non-reactive with the propylene oxide.
- 4) Cooling systems requiring compression of propylene oxide shall not be used.

716 Pressure relief valve settings shall not be less than 0.2 bar gauge, nor greater than 7.0 bar gauge for pressure tanks intended for the carriage of propylene oxide and not greater than 5.3 bar for the carriage of propylene oxide/ethylene oxide mixtures.

717 Piping

- 1) The piping system for tanks to be loaded with these products shall be completely separate from piping systems for all other tanks, including empty tanks, and from all cargo compressors. If the piping system for the tanks to be loaded is not independent as defined in Sec.1 B117, the required piping separation shall be accomplished by the removal of spool pieces, valves, or other pipe sections, and the installation of blank flanges at these locations. The required separation applies to any other possible connections such as common inert gas supply lines.
- 2) These products may be transported only in accordance with cargo handling plans that have been approved by the Society. Each intended loading arrangement shall be shown on a separate cargo handling plan. Cargo handling plans shall show the entire cargo piping system and the locations for installation of blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan shall be maintained on board the ship.

Guidance note:

When a ship carries propylene oxide or mixtures of ethylene oxide and propylene oxide under IMO's Certificate of Fitness, the Administration or delegated body issuing the certificate will be required to include a reference to the approved cargo handling plans in the certificate.

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- 3) Before loading propylene oxide, certification verifying that the required piping separation has been achieved shall be obtained from a representative of the Society and carried on board the ship. Each connection between a blank flange and pipeline flange shall be fitted with a wire and seal by the Society's representative to ensure that inadvertent removal of the blank flange is impossible.

718 The maximum allowable tank filling limits for each cargo tank shall be indicated for each loading temperature which may be applied and for the applicable maximum reference temperature, on a list to be approved by the Society. A copy of the list shall be permanently kept on board by the master.

719 The cargo shall be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system shall be installed to prevent the tank pressure falling below 0.07 bar gauge in the event of product temperature fall due to ambient conditions or maloperation of refrigeration systems. Sufficient nitrogen shall be available on board to satisfy the demand of the automatic pressure control. Nitrogen of acceptable purity shall be used for padding.

720 The nitrogen system shall be capable of inerting the tank vapour space to an oxygen content of less than 2% prior to loading and maintaining this content during the voyage.

721 A water-spray system shall be provided in the area

where loading and unloading operations are conducted. The capacity and arrangement shall be such as to blanket effectively the area surrounding the loading manifold and the exposed deck pipework associated with product handling. The arrangement of piping and nozzles shall be such as to give a uniform distribution over the entire area protected at a discharge rate of 10 l/m²/minute. Remote manual operation should be arranged such that remote starting of pumps supplying the water spray system and remote operation of any normally closed valves in the system can be carried out from a suitable location outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected. The water-spray system shall be capable of both local and remote manual operation and the arrangement shall ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle, when atmospheric temperatures permit, shall be connected ready for immediate use during loading and unloading operations.

722 A remote operational, controlled closing-rate shut-off valve shall be provided at each cargo hose connection used during cargo transfer.

C 800 Sulphuric acid

801 The following sulphuric acids will be accepted for the carriage in unlined mild steel tanks:

- 96% (66° Be) or higher concentrations
- 78% (60° Be) or higher with or without an inhibitor, provided the corrosive effect on mild steel at 25°C is not higher than that of 96% (66° Be) commercial sulphuric acid
- spent sulphuric acid from industrial processes, provided the corrosive effect is not higher than that stated above.

802 Sulphuric acid of other qualities and concentrations than stated in 801, shall be carried in tanks lined or made from suitable acid-resistant materials. These will be subject to special consideration by the Society.

803 Cargo pumps, piping and valves made from nodular cast iron, will be accepted for the following sulphuric acids:

- 65% (51.7° Be) or higher concentrations
- spent sulphuric acid from industrial processes, provided the corrosive effect is not higher than that stated above.

804 P/V-valves and vent pipes from the cargo tank shall be

made of or protected by acid-resistant materials. Vent pipes to unprotected cargo tanks shall extend about 50 mm into the tank.

805 Drip pans shall be provided below pump glands and at shore connections.

806 The bilge piping and pumping system in pump rooms shall be made of or lined with corrosion-resistant material.

C 900 Sulphur liquid

901 Cargo tank ventilation shall be provided to maintain the concentration of H₂S below one half of its lower explosive limit throughout the cargo tank vapour space for all conditions of carriage, i.e. below 1.85% by volume.

902 Where mechanical ventilation systems are used for maintaining low gas concentrations in cargo tanks, ventilation failure alarm shall be provided.

903 Ventilation systems shall be designed and arranged to preclude depositing of sulphur within the system.

904 Openings to void spaces adjacent to cargo tanks shall be designed and fitted to prevent the entry of water, sulphur or cargo vapour.

905 Connections shall be provided to enable sampling and analysis of vapour in void spaces.

906 An automatic temperature control system for the cargo shall be fitted in order to ensure that the temperature of the sulphur does not exceed 155°C.

A high temperature alarm shall be fitted.

C 1000 Alkyl (C₇ — C₉) nitrates

1001 The carriage temperature on the cargo shall be maintained below 100°C to prevent the occurrence of a self-sustained, exothermic decomposition reaction.

1002 The cargo may not be carried in independent pressure tanks (a4) permanently affixed to the ship's deck unless:

- 1) the tanks are sufficiently insulated from fire, and
- 2) the ship has a water deluge system for the tanks such that the cargo temperature is maintained below 100°C and the temperature rise in the tanks does not exceed 1.5°C/hour for a fire of 650°C.

SECTION 16 INERT GAS PLANTS

A. General

A 100 Application

101 Chemical tankers of deadweight in excess of 20 000 tons having individual cargo tanks exceeding 3 000 m³ or cargo tanks fitted with washing machines with a nozzle capacity exceeding 17.5 m³/h or a total through put per tank of 110 m³/h shall be fitted with an inert gas system complying with the rules in Ch.3 Sec.11, if the vessel is intended for carriage of chemicals with flash point not exceeding 60°C.

Guidance note:

Chemical tankers when transporting oil with flashpoint not exceeding 60°C shall comply with the inert gas requirements of SOLAS Reg. II-2/4.5.5.

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A 200 Documentation

201 Documentation in accordance with Ch.3 Sec.11 shall be submitted for approval.

B. Materials, Arrangement and Design

B 100 General

101 Inert gas systems shall satisfy the requirements of Ch.3 Sec.11 to the extent these requirements are applicable. Alternative solutions to specific requirements in above rules may be accepted as follows:

- 1) The water seal required by Ch.3 Sec.11 C602 may be replaced by an alternative arrangement consisting of two automatically operated shut-off valves in series with a venting valve in between (double block and bleed). The following conditions apply:
 - The operation of the valve shall be automatically executed. Signals for opening and closing shall be taken from the process directly, e.g. inert gas flow or differential pressure.
 - An alarm for faulty operation of the valves shall be provided, e.g. the operational status of "Blower stop" and "Supply valve(s) open" is an alarm condition.
- 2) A lower capacity of the system than that required by Ch.3 Sec.11 D100 may be accepted on the condition that the cargo discharge rate from tanks being protected is restricted to 80% of the inert gas capacity. An entry to this effect will be made in the "Appendix to the classification certificate".

102 An inert gas system based on production of inert gas by other means than combustion of hydrocarbons may be accepted upon special considerations.

B 200 Inert gas systems based on other means than combustion of hydrocarbons

201 The requirements of 200 are specific for the gas genera-

tor system and apply when inert gas is produced by passing compressed air through hollow fibres, semi-permeable membranes or adsorber materials.

202 The system shall be provided with at least two air compressors.

203 The air compressor and the nitrogen generator may be installed in the engine room or in a separate compartment. A separate compartment shall be treated as one of *other machinery spaces* with respect to fire protection.

204 Where a separate compartment is provided, it shall be positioned outside the cargo area and shall be fitted with an independent mechanical extraction ventilation system, providing 6 air changes per hour. A low oxygen alarm shall be fitted. The compartment shall have no direct access to accommodation spaces, service spaces or control stations.

205 Where fitted, a nitrogen receiver or buffer tank may be installed in a dedicated compartment or in the separate compartment containing the air compressor and the generator, or may be located in the cargo area. Where the nitrogen receiver or buffer tank is installed in an enclosed space, the access shall be arranged only from the open deck and the access door shall open outwards. Permanent ventilation and alarm shall be fitted as required in 204.

206 Nitrogen separating systems that may be destroyed by high temperature in the supply air shall be arranged with an alarm and automatic shutdown of the system upon alarm conditions.

Table B1 Certification of Nitrogen generator system components

Component	Certificate	Comment
Membrane separation vessels	NV	Pressure vessels
Air compressor	W	NV if power >200 kW
Control & monitoring system	W	
NV = DNV product certificate W = Maker's (Works) certificate T = Type approval		

B 300 Nitrogen inert gas systems fitted for other purposes

301 If an inert gas system is fitted for other applications than stated in A101, the requirements in 200 apply. However, only one air compressor is required and a permanent recording of the parameters in Ch.3 Sec.11 E202 is not mandatory.

302 Where the connections to the hold spaces or to the cargo piping are not permanent, two non-return valves may substitute the non-return devices required in Ch.3 Sec.11 C602 and C603.

(IACS URF20)

Guidance note:

Cargo tank connections for inert gas padding, as required for the carriage of certain products, are considered as permanent for the purpose of this requirement.

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SECTION 17 PERSONNEL PROTECTION

A. General Requirements

A 100 Protective equipment

101 For the protection of crew members who are engaged in loading and discharging operations, the ship shall have on board suitable protective equipment consisting of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant material, and tight-fitting goggles or face shields or both. The protective clothing and equipment shall cover all skin so that no part of the body is unprotected.

Six (6) sets of protective clothing and equipment shall be carried onboard.

102 Work clothes and protective equipment shall be kept in easily accessible places and in special lockers. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. Storage rooms for such equipment may, however, upon special consideration be approved within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.

B. Safety Equipment

B 100 Safety equipment

101 Ships intended for carriage of toxic products for which the IBC Code Ch.17 column **o** refers to 15.12, 15.12.1 or 15.12.3, shall have on board sufficient, but not less than three complete sets of safety equipment each permitting personnel to enter a gas filled compartment and perform work there for at least 20 minutes. Such equipment shall be in addition to that required by SOLAS regulation II-2/10.10.

102 One complete set of safety equipment shall consist of:

- 1) One self-contained air-breathing apparatus (not using stored oxygen),
- 2) protective clothing, boots, gloves and tight-fitting goggles,
- 3) fireproof lifeline with belt resistant to the cargoes carried, and
- 4) explosion-proof lamp.

103 For the safety equipment required in 101, all ships shall carry the following, either:

- 1) one set of fully charged spare air bottles for each breathing apparatus;
- 2) a special air compressor suitable for the supply of high-pressure air of the required purity;
- 3) a charging manifold capable of dealing with sufficient spare breathing apparatus air bottles for the breathing apparatus;
or
- 4) fully charged spare air bottles with a total free air capacity of at least 6 000 l for each breathing apparatus on board in excess of the requirements of SOLAS regulation II-2/10.10.

104 A cargo pump-room on ships carrying cargoes which are subject to the requirements of Sec.15 A800 or cargoes for which in the IBC Code Ch.17 column **k**, toxic vapour detection equipment is required, but is not available shall have either:

- 1) a low-pressure line system with hose connections suitable for use with the breathing apparatus required by 101. This system shall provide sufficient high-pressure air capacity to supply, through pressure reduction devices, enough low-pressure air to enable two men to work in a hazardous space for at least 1 h without using the air bottles and breathing apparatus air bottles from a special air compressor suitable for the supply of high-pressure air of the required purity;
or
- 2) an equivalent quantity of spare bottled air in lieu of the low-pressure air line.

105 At least one set of safety equipment as required by 102 shall be kept in a suitable clearly marked locker in a readily accessible place near the cargo pump-room. The other sets of safety equipment should also be kept in suitable, clearly marked, easily accessible, place.

106 A stretcher which is suitable for hoisting an injured person up from spaces such as the cargo pump-room shall be placed in a readily accessible location.

107 Ships intended for the carriage of products which in the IBC Code Ch.17 column **n** are assigned "Yes", shall be provided with suitable respiratory and eye protection sufficient for every person on board for emergency escape purposes, subject to the following:

- 1) self-contained breathing apparatus shall normally have a duration of service of at least 15 min:
- 2) emergency escape respiratory protection shall not be used for fire-fighting or cargo handling purposes and should be marked to that effect.

C. Medical First-aid Equipment

C 100 General

101 The ship shall have on board medical first-aid equipment including oxygen resuscitation equipment and antidotes for cargoes carried based on the guidelines developed by IMO.

Guidance note:

See the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) which provides advice on the treatment of casualties in accordance with the symptoms exhibited as well as equipment and antidotes that may be appropriate for treating the casualty.

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D. Decontamination Showers and Eye Washes

D 100 General

101 Suitably marked decontamination showers and eyewashes shall be available on deck in convenient locations. The showers and eyewashes shall be operable in all ambient conditions.

Guidance note:

Decontamination shower and eye wash units should be located on both sides of the ship in the cargo manifold area and at the aft end of the cargo area. A heating system with temperature control is considered required. Water supply capacity should be sufficient for simultaneous use of at least two units.

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