

IBC CODE

INTERNATIONAL CODE FOR THE CONSTRUCTION
AND EQUIPMENT OF SHIPS CARRYING
DANGEROUS CHEMICALS IN BULK

AND

INDEX OF DANGEROUS CHEMICALS
CARRIED IN BULK

2004 Edition



International Maritime Organization

TEXT OF THE REVISED IBC CODE

Preamble

1 The purpose of this Code is to provide an international standard for the safe carriage, in bulk by sea, of Dangerous Chemicals and Noxious Liquid Substances listed in Chapter 17 of the Code by prescribing the design and construction standards of ships, regardless of tonnage, involved in such carriage and the equipment they shall carry to minimize the risk to the ship, its crew and the environment, having regard to the nature of the products involved.

2 The basic philosophy is to assign, to each chemical tanker, one of the ship types according to the degree of the hazards of the products carried by such ships. Each of the products may have one or more hazardous properties, including flammability, toxicity, corrosivity and reactivity, as well as the hazard they may present to the environment.

3 Throughout the development of the Code it was recognized that it must be based upon sound naval architectural and engineering principles and the best understanding available as to the hazards of the various products covered; furthermore that chemical tanker design technology is not only a complex technology but is rapidly evolving and that the Code shall not remain static. Therefore the Organization will periodically review the Code, taking into account both experience and technical development.

4 Amendments to the Code involving requirements for new products and their conditions of carriage will be circulated as recommendations, on an interim basis, when adopted by the Maritime Safety Committee (MSC) and the Marine Environment Protection Committee (MEPC) of the Organization, in accordance with the provisions of article VIII of the International Convention for the Safety of Life at Sea, 1974 (SOLAS 74), and article 16 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol relating thereto (MARPOL 73/78), respectively, pending the entry into force of these amendments.

5 The Code primarily deals with ship design and equipment. In order to ensure the safe transport of the products, the total system must, however, be appraised. Other important facets of the safe transport of the products, such as training, operation, traffic control and handling in port, are being, or will be, examined further by the Organization.

6 The development of the Code has been greatly assisted by relevant work of the International Association of Classification Societies (IACS) and of the International Electrotechnical Commission (IEC).

7 Chapter 16 of the Code, dealing with operational requirements of chemical tankers, highlights the regulations in other Chapters that are operational in nature and mentions those other important safety features that are peculiar to chemical tanker operation.

8 The layout of the Code is in line with the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code), adopted by the Maritime Safety Committee at its forty-eighth session. Gas carriers may also carry in bulk liquid chemicals covered by this Code, as prescribed in the IGC Code.

9 The 1998 edition of the Code was based on the original text as adopted by MSC resolution MSC.4(48). In response to resolution 15 of the International Conference on Marine Pollution, 1973, the MEPC, at its twenty-second session, adopted, by resolution MEPC.19(22), the IBC Code extended to cover marine pollution prevention aspects for the implementation of Annex II to MARPOL 73/78.

10 This edition of the Code includes amendments adopted by the following resolutions:

	Resolution	Adoption	Deemed acceptance	Entry into force
1	MSC.10(54)	29 April 1987	29 April 1988	30 October 1988
2	MSC.14(57) MEPC.32(27)	11 April 1989 17 March 1989	12 April 1990 12 April 1990	13 October 1990 13 October 1990
3	MSC.28(61) MEPC.55(33)	11 December 1992 30 October 1992	1 January 1994 1 January 1994	1 July 1994 1 July 1994
4	MSC.50(66) MEPC.69(38)	4 June 1996 10 July 1996	1 January 1998 1 January 1998	1 July 1998 1 July 1998
5	MSC.58(67) MEPC.73(39)	5 December 1996 10 March 1997	1 January 1998 10 January 1998	1 July 1998 10 July 1998
6	MSC MEPC			1 January 2007 1 January 2007

11 As from the date of entry into force of the 1983 amendments to SOLAS 74 (i.e. 1 July 1986) and the date of implementation of Annex II of MARPOL 73/78 (i.e. 6 April 1987), this Code became subject to mandatory requirements under these Conventions. Amendments to the Code, whether from the point of view of safety or of marine pollution, must therefore be adopted and brought into force in accordance with the procedures laid down in article VIII of SOLAS 74 and article 16 of MARPOL 73/78 respectively.

Chapter 1

General

1.1 Application

1.1.1 The Code applies to ships regardless of size, including those of less than 500 tons gross tonnage, engaged in the carriage of bulk cargoes of Dangerous Chemicals or Noxious Liquid Substances, other than petroleum or similar flammable products as follows:

- .1 products having significant fire hazards in excess of those of petroleum products and similar flammable products;
- .2 products having significant hazards in addition to or other than flammability.

1.1.2 Products that have been reviewed and determined not to present safety and pollution hazards to such an extent as to warrant the application of the Code are found in Chapter 18.

1.1.3 Liquids covered by the Code are those having a vapour pressure not exceeding 0.28 MPa absolute at a temperature of 37.8°C.

1.1.4 For the purpose of the 1974 SOLAS Convention, the Code does not apply to ships which are engaged in the carriage of products included in Chapter 17 solely on the basis of their pollution characteristics and identified as such by an entry of P only in *column d*.

1.1.5 For the purposes of MARPOL 73/78, the Code applies only to NLS tankers, as defined in regulation 1.10 of Annex II thereof, which are engaged in the carriage of Noxious Liquid Substances identified as such by an entry of X, Y or Z in *column c* of Chapter 17.

1.1.6 For a product proposed for carriage in bulk, but not listed in Chapter 17 or 18, the Administration and port Administrations involved in such carriage shall prescribe the preliminary suitable conditions for the carriage, having regard to the criteria for hazard evaluation of bulk chemicals. For the evaluation of the pollution hazard of such a product and assignment of its Pollution Category, the procedure specified in regulation 6.3 of Annex II of MARPOL 73/78 must be followed. The Organization shall be notified of the conditions for consideration for inclusion of the product in the Code.

1.1.7 Unless expressly provided otherwise, the Code applies to ships, the keels of which are laid or which are at the stage where:

- .1 construction identifiable with the ship begins; and
- .2 assembly has commenced comprising at least 50 tonnes or 1% of the estimated mass of all structural material, whichever is less;

on or after 1 July 1986.

1.1.8 A ship, irrespective of the date of construction, which is converted to a chemical tanker on or after 1 July 1986 shall be treated as a chemical tanker constructed on the date on which

such conversion commences. This conversion provision does not apply to the modification of a ship referred to in regulation 1(15) of Annex II of MARPOL 73/78.

1.1.9 Where reference is made in the Code to a paragraph, all the provisions of the subparagraphs of that designation shall apply.

1.2 Hazards

Hazards of products covered by the Code include:

1.2.1 *Fire hazard*, defined by flashpoint, flammability limits and autoignition temperature of the chemical.

1.2.2 *Health hazard*, defined by:

.1 corrosive effects on the skin in the liquid state; or

.2 acute toxic effect, taking into account values of:

LD₅₀ (oral): a dose, which is lethal to 50% of the test subjects when administered orally;

LD₅₀ (dermal): a dose, which is lethal to 50% of the test subjects when administered to the skin;

LC₅₀ (inhalation): the concentration which is lethal by inhalation to 50% of the test subjects; or

.3 Other health effects such as carcinogenicity and sensitization.

1.2.3 *Reactivity hazard*, defined by reactivity:

.1 with water;

.2 with air;

.3 with other products; or

.4 of the product itself (e.g. polymerization).

1.2.4 *Marine pollution hazard*, as defined by:

.1 bioaccumulation

.2 lack of ready biodegradability;

.3 acute toxicity to aquatic organisms;

.4 chronic toxicity to aquatic organisms;

- .5 long term human health effects; and
- .6 physical properties resulting in the product floating or sinking and so adversely affecting marine life.

1.3 Definitions

The following definitions apply unless expressly provided otherwise. (Additional definitions are given in individual Chapters).

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

1.3.2 *Administration* means the Government of the State whose flag the ship is entitled to fly. For *Administration (Port)* see *Port Administration*.

1.3.3 *Anniversary date* means the day and the month of each year, which will correspond to the date of expiry of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

1.3.4 *Boiling point* is the temperature at which a product exhibits a vapour pressure equal to the atmospheric pressure.

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

1.3.6 *Cargo area* is that part of the ship that contains cargo tanks, slop tanks, cargo pumprooms including pumprooms, cofferdams, ballast or void spaces adjacent to cargo tanks or slop tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces. Where independent tanks are installed in hold spaces, cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forward-most hold space are excluded from the cargo area.

1.3.7 *Cargo pumproom* is a space containing pumps and their accessories for the handling of the products covered by the Code.

1.3.8 *Cargo service spaces* are spaces within the cargo area used for workshops, lockers and store-rooms of more than 2 m² in area, used for cargo-handling equipment.

1.3.9 *Cargo tank* is the envelope designed to contain the cargo.

1.3.10 *Chemical tanker* is a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product listed in Chapter 17.

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

1.3.12 *Control stations* are those spaces in which 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 centralized. This does not include special fire-control equipment which can be most practically located in the cargo area.

1.3.13 *Dangerous chemicals* means any liquid chemicals designated as presenting a safety hazard, based on the safety criteria for assigning products to Chapter 17.

1.3.14 *Density* is the ratio of the mass to the volume of a product, expressed in terms of kilograms per cubic metre. This applies to liquids, gases and vapours.

1.3.15 *Flammability limits* are the conditions defining the state of fuel-oxidant mixture at which application of an adequately strong external ignition source is only just capable of producing flammability in a given test apparatus.

1.3.16 *Flashpoint* is the temperature in degrees Celsius at which a product will give off enough flammable vapour to be ignited. Values given in the Code are those of "closed-cup test" determined by an approved flashpoint apparatus.

1.3.17 *Hold space* is the space enclosed by the ship's structure in which an independent cargo tank is situated.

1.3.18 *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.

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

1.3.20 *Machinery spaces of category A* are those spaces and trunks to such spaces which contain:

- .1 internal-combustion machinery used for main propulsion; or
- .2 internal-combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; or
- .3 any oil-fired boiler or oil fuel unit or any oil fired equipment other than boilers, such as inert gas generators, incinerators etc.

1.3.21 *Machinery spaces* are all machinery spaces of category A and all other spaces containing propelling machinery, boilers, oil fuel units, steam and internal-combustion engines, generators and major electrical machinery, oil filling station, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.

1.3.22 *MARPOL 73/78* means the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, as amended.

1.3.23 *Noxious Liquid Substance* means any substance indicated in the Pollution Category column of Chapter 17 or 18 of the International Bulk Chemical Code, or the current MEPC.2/Circular or provisionally assessed under the provisions of regulation 6.3 as falling into Category X, Y or Z.

1.3.24 *Oil fuel unit* is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal-combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a gauge pressure of more than 0.18 MPa.

1.3.25 *Organization* is the International Maritime Organization (IMO).

1.3.26 *Permeability* of a space means the ratio of the volume within that space which is assumed to be occupied by water to the total volume of that space.

1.3.27 *Port administration* means the appropriate authority of the country in the port of which the ship is loading or unloading.

1.3.28 *Products* is the collective term used to cover both Noxious Liquid Substances and Dangerous Chemicals.

1.3.29 *Pumproom* is a space, located in the cargo area, containing pumps and their accessories for the handling of ballast and oil fuel.

1.3.30 *Recognized standards* are applicable international or national standards acceptable to the Administration or standards laid down and maintained by an organization which complies with the standards adopted by the Organization and which is recognized by the Administration.

1.3.31 *Reference temperature* is the temperature at which the vapour pressure of the cargo corresponds to the set pressure of the pressure-relief valve.

1.3.32 *Separate* means that a cargo piping system or cargo vent system, for example, is not connected to another cargo piping or cargo vent system.

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

1.3.34 *SOLAS* means the International Convention for the Safety of Life at Sea, 1974, as amended.

1.3.35 *Vapour pressure* is the equilibrium pressure of the saturated vapour above a liquid expressed in Pascals (Pa) at a specified temperature.

1.3.36 *Void space* is an enclosed space in the cargo area external to a cargo tank, other than a hold space, ballast space, oil fuel tank, cargo pumproom, pumproom, or any space in normal use by personnel.

1.4 Equivalents

1.4.1 Where the Code requires that a particular fitting, material, appliance, apparatus, item of equipment or type thereof shall be fitted or carried in a ship, or that any particular provision shall be made, or any procedure or arrangement shall be complied with, the Administration may allow any other fitting, material, appliance, apparatus, item of equipment or type thereof to be fitted or carried, or any other provision, procedure or arrangement to be made in that ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance, apparatus, item of equipment or type thereof or that any particular provision, procedure or arrangement is at least as effective as that required by the Code. However, the Administration may not allow operational methods or procedures to be made an alternative to a particular fitting, material, appliance, apparatus, item of equipment, or type thereof, which are prescribed by the Code, unless such substitution is specifically allowed by the Code.

1.4.2 When the Administration allows any fitting, material, appliance, apparatus, item of equipment, or type thereof, or provision, procedure, or arrangement, or novel design or application to be substituted, it shall communicate to the Organization the particulars thereof, together with a report on the evidence submitted, so that the Organization may circulate the same to other Contracting Governments to SOLAS and Parties to MARPOL 73/78 for the information of their officers.

1.5 Surveys and certification

1.5.1 Survey procedure

1.5.1.1 The survey of ships, so far as regards the enforcement of the provisions of the regulations and granting of exemptions therefrom, shall be carried out by officers of the Administration. The Administration may, however, entrust the surveys either to surveyors nominated for the purpose or to organizations recognized by it.

1.5.1.2 The recognized organization, referred to in paragraph 2.1 of regulation 8 of Annex II to MARPOL 73/78 shall comply with the Guidelines adopted by the Organization by resolution A.739(18), as may be amended by the Organization, and the specification adopted by the Organization by resolution A.789(19), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article 16 of MARPOL 73/78 and article VIII of SOLAS concerning the amendment procedures applicable to this Code.

1.5.1.3 The Administration nominating surveyors or recognizing organizations to conduct surveys shall, as a minimum, empower any nominated surveyor or recognized organization to:

- .1 require repairs to a ship; and
- .2 carry out surveys if requested by the appropriate authorities of a port State.

The Administration shall notify the Organization of the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognized organizations for circulation to the Contracting Governments.

1.5.1.4 When a nominated surveyor or recognized organization determines that the condition of a ship or its equipment does not correspond substantially with the particulars of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, or is such that the ship is not fit to proceed to sea without danger to the ship, or persons on board, or without presenting unreasonable threat of harm to the marine environment, such surveyor or organization shall immediately ensure that corrective action is taken and shall, in due course, notify the Administration. If such corrective action is not taken the Certificate shall be withdrawn and the Administration shall be notified immediately. If the ship is in a port of another Contracting Government, the appropriate authorities of the port State shall also be notified immediately. When an officer of the Administration, a nominated surveyor or a recognized organization has notified the appropriate authorities of the port State, the Government of the port State concerned shall give such officer, surveyor or organization any necessary assistance to carry out their obligations under this paragraph. When applicable, the Government of the port State concerned shall take such steps as will ensure that the ship does not sail until it can proceed to sea or leave the port for the purpose of proceeding to the nearest appropriate repair yard available without danger to the ship or persons on board or without presenting an unreasonable threat of harm to the marine environment.

1.5.1.5 In every case, the Administration shall guarantee the completeness and efficiency of the survey, and shall undertake to ensure the necessary arrangements to satisfy this obligation.

1.5.2 Survey requirements

1.5.2.1 The structure, equipment, fittings, arrangements and material (other than items in respect of which a Cargo Ship Safety Construction Certificate, Cargo Ship Safety Equipment Certificate and Cargo Ship Safety Radio Certificate or Cargo Ship Safety Certificate are issued) of a chemical tanker shall be subjected to the following surveys:

- .1 An initial survey before the ship is put in service or before the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk is issued for the first time, which shall include a complete examination of its structure, equipment, fittings, arrangements and material in so far as the ship is covered by the Code. This survey shall be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code.
- .2 A renewal survey at intervals specified by the Administration, but not exceeding 5 years, except where 1.5.6.2.2, 1.5.6.5, 1.5.6.6 or 1.5.6.7 is applicable. The renewal survey shall be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code.
- .3 An intermediate survey within 3 months before or after the second anniversary date or within 3 months before or after the third anniversary date of the Certificate, which shall take the place of one of the annual surveys specified in 1.5.2.1.4. The intermediate survey shall be such as to ensure that the safety equipment, and other equipment, and associated pump and piping systems fully comply with the applicable provisions of the Code and are in good working order. Such intermediate surveys shall be endorsed on the Certificate issued under 1.5.4 or 1.5.5.
- .4 An annual survey within 3 months before or after each anniversary date of the Certificate, including a general inspection of the structure, equipment, fittings, arrangements and material referred to in 1.5.2.1.1 to ensure that they have been

maintained in accordance with 1.5.3 and that they remain satisfactory for the service for which the ship is intended. Such annual surveys shall be endorsed on the Certificate issued under 1.5.4 or 1.5.5.

- .5 An additional survey, either general or partial according to the circumstances, shall be made when required after an investigation prescribed in 1.5.3.3, or whenever any important repairs or renewals are made. Such a survey shall ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are satisfactory; and that the ship is fit to proceed to sea without danger to the ship or persons on board or without presenting unreasonable threat of harm to the marine environment.

1.5.3 Maintenance of conditions after survey

1.5.3.1 The conditions of the ship and its equipment shall be maintained to conform with the provisions of the Code to ensure that the ship will remain fit to proceed to sea without danger to the ship or persons on board or without presenting an unreasonable threat of harm to the marine environment.

1.5.3.2 After any survey of the ship under 1.5.2 has been completed, no change shall be made in the structure, equipment, fittings, arrangements and material covered by the survey, without the sanction of the Administration, except by direct replacement.

1.5.3.3 Whenever an accident occurs to a ship or a defect is discovered, either of which affects the safety of the ship or the efficiency or completeness of its life-saving appliances or other equipment covered by the Code, the master or owner of the ship shall report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible for issuing the Certificate, who shall cause investigations to be initiated to determine whether a survey, as required by 1.5.2.1.5, is necessary. If the ship is in a port of another Contracting Government, the master or owner shall also report immediately to the appropriate authorities of the port State and the nominated surveyor or recognized organization shall ascertain that such a report has been made.

1.5.4 Issue or endorsement of International Certificate of Fitness

1.5.4.1 An International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be issued after an initial or renewal survey to a chemical tanker engaged in international voyages which complies with the relevant provisions of the Code.

1.5.4.2 Such a Certificate shall be drawn up in the form corresponding to the model given in the appendix. If the language used is not English, French or Spanish, the text shall include the translation into one of these languages.

1.5.4.3 The Certificate issued under provisions of this section shall be available on board for examination at all times.

1.5.4.4 Notwithstanding any other provisions of the amendments to this Code adopted by the Marine Environment Protection Committee (MEPC) by resolution MEPC.40(29) and the Maritime Safety Committee (MSC) by resolution MSC16(58), any International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, which is current when these amendments enter into force, shall remain valid until it expires under the terms of this Code prior to the amendments entering into force.

1.5.5 Issue or endorsement of International Certificate of Fitness by another Government

1.5.5.1 A Government that is both a Contracting Government to the 1974 SOLAS Convention and a Party to MARPOL 73/78 may, at the request of another such Government, cause a ship entitled to fly the flag of the other State to be surveyed and, if satisfied that the provisions of the Code are complied with, issue or authorize the issue of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk to the ship, and, where appropriate, endorse or authorize the endorsement of the Certificate on board the ship in accordance with the Code. Any Certificate so issued shall contain a statement to the effect that it has been issued at the request of the Government of the State whose flag the ship is entitled to fly.

1.5.6 Duration and validity of International Certificate of Fitness

1.5.6.1 An International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be issued for a period specified by the Administration which shall not exceed 5 years.

1.5.6.2.1 Notwithstanding the provisions of 1.5.6.1, when the renewal survey is completed within 3 months before the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.5.6.2.2 When the renewal survey is completed after the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.5.6.2.3 When the renewal survey is completed more than 3 months before the expiry date of the existing Certificate, the new Certificate shall be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of completion of the renewal survey.

1.5.6.3 If a Certificate is issued for a period of less than 5 years, the Administration may extend the validity of the Certificate beyond the expiry date to the maximum period specified in 1.5.6.1, provided that the surveys referred to in 1.5.2.1.3 and 1.5.2.1.4, applicable when a Certificate is issued for a period of 5 years, are carried out as appropriate.

1.5.6.4 If a renewal survey has been completed and a new Certificate cannot be issued or placed on board the ship before the expiry date of the existing Certificate, the person or organization authorized by the Administration may endorse the existing Certificate. Such a Certificate shall be accepted as valid for a further period which shall not exceed 5 months from the expiry date.

1.5.6.5 If a ship, at the time when a Certificate expires, is not in a port in which it is to be surveyed, the Administration may extend the period of validity of the Certificate but this extension shall be granted only for the purpose of allowing the ship to complete its voyage to the port in which it is to be surveyed, and then only in cases where it appears proper and reasonable to do so.

1.5.6.6 A Certificate, issued to a ship engaged on short voyages which has not been extended under the foregoing provisions of this section, may be extended by the Administration for a period of grace of up to one month from the date of expiry stated on it. When the renewal survey is completed, the new Certificate shall be valid to a date not exceeding 5 years from the date of expiry of the existing Certificate before the extension was granted.

1.5.6.7 In special circumstances, as determined by the Administration, a new Certificate need not be dated from the date of expiry of the existing Certificate as required by 1.5.6.2.2, 1.5.6.5 or 1.5.6.6. In

these special circumstances, the new Certificate shall be valid to a date not exceeding 5 years from the date of completion of the renewal survey.

1.5.6.8 If an annual or intermediate survey is completed before the period specified in 1.5.2, then:

- .1 the anniversary date shown on the Certificate shall be amended by endorsement to a date which shall not be more than 3 months later than the date on which the survey was completed;
- .2 the subsequent annual or intermediate survey required by 1.5.2 shall be completed at the intervals prescribed by that section using the new anniversary date;
- .3 the expiry date may remain unchanged provided one or more annual or intermediate surveys, as appropriate, are carried out so that the maximum intervals between the surveys prescribed by 1.5.2 are not exceeded.

1.5.6.9 A Certificate issued under 1.5.4 or 1.5.5 shall cease to be valid in any of the following cases:

- .1 if the relevant surveys are not completed within the periods specified under 1.5.2;
- .2 if the Certificate is not endorsed in accordance with 1.5.2.1.3 or 1.5.2.1.4;
- .3 upon transfer of the ship to the flag of another State. A new certificate shall only be issued when the Government issuing the new Certificate is fully satisfied that the ship is in compliance with the requirements of 1.5.3.1 and 1.5.3.2. In the case of a transfer between Governments that are both a Contracting Government to the 1974 SOLAS Convention and a Party to MARPOL 73/78, if requested within 3 months after the transfer has taken place, the Government of the State whose flag the ship was formerly entitled to fly shall, as soon as possible, transmit to the Administration copies of the Certificate carried by the ship before the transfer and, if available, copies of the relevant survey reports.

Chapter 2

Ship survival capability and location of cargo tanks

2.1 General

2.1.1 Ships, subject to the Code, shall survive the normal effects of flooding following assumed hull damage caused by some external force. In addition, to safeguard the ship and the environment, the cargo tanks of certain types of ships shall be protected from penetration in the case of minor damage to the ship resulting, for example, from contact with a jetty or tug, and given a measure of protection from damage in the case of collision or stranding, by locating them at specified minimum distances inboard from the ship's shell plating. Both the assumed damage and the proximity of the cargo tanks to the ship's shell shall be dependent upon the degree of hazard presented by the products to be carried.

2.1.2 Ships subject to the Code shall be designed to one of the following standards:

- .1 A type 1 ship is a chemical tanker intended to transport Chapter 17 products with very severe environmental and safety hazards which require maximum preventive measures to preclude an escape of such cargo.
- .2 A type 2 ship is a chemical tanker intended to transport Chapter 17 products with appreciably severe environmental and safety hazards which require significant preventive measures to preclude an escape of such cargo.
- .3 A type 3 ship is a chemical tanker intended to transport Chapter 17 products with sufficiently severe environmental and safety hazards which require a moderate degree of containment to increase survival capability in a damaged condition.

Thus a type 1 ship is a chemical tanker intended for the transportation of products considered to present the greatest overall hazard and type 2 and type 3 for products of progressively lesser hazards. Accordingly, a type 1 ship shall survive the most severe standard of damage and its cargo tanks shall be located at the maximum prescribed distance inboard from the shell plating.

2.1.3 The ship type required for individual products is indicated in *column e* in the table of Chapter 17.

2.1.4 If a ship is intended to carry more than one product listed in Chapter 17, the standard of damage shall correspond to that product having the most stringent ship type requirement. The requirements for the location of individual cargo tanks, however, are those for ship types related to the respective products intended to be carried.

2.2 Freeboard and intact stability

2.2.1 Ships subject to the Code may be assigned the minimum freeboard permitted by the International Convention on Load Lines in force. However, the draught associated with the assignment shall not be greater than the maximum draught otherwise permitted by this Code.

2.2.2 The stability of the ship in all seagoing conditions shall be to a standard which is acceptable to the Administration.

2.2.3 When calculating the effect of free surfaces of consumable liquids for loading conditions it shall be assumed that, for each type of liquid, at least one transverse pair or a single centre tank has a free surface and the tank or combination of tanks to be taken into account shall be those where the effect of free surfaces is the greatest. The free surface effect in undamaged compartments shall be calculated by a method acceptable to the Administration.

2.2.4 Solid ballast shall not normally be used in double-bottom spaces in the cargo area. Where, however, because of stability considerations, the fitting of solid ballast in such spaces becomes unavoidable, then its disposition shall be governed by the need to ensure that the impact loads resulting from bottom damage are not directly transmitted to the cargo tank structure.

2.2.5 The master of 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.

2.3 Shiplside discharges below the freeboard deck

2.3.1 The provision and control of valves fitted to discharges led through the shell from spaces below the freeboard deck or from within the super-structures and deck-houses on the freeboard deck fitted with weathertight doors shall comply with the requirements of the relevant regulation of the International Convention on Load Lines in force, except that the choice of valves shall be limited to:

- .1 one automatic non-return valve with a positive means of closing from above the freeboard deck; or
- .2 where the vertical distance from the summer load waterline to the inboard end of the discharge pipe exceeds $0.01L$, two automatic non-return valves without positive means of closing, provided that the inboard valve is always accessible for examination under service conditions.

2.3.2 For the purpose of this Chapter, “summer load line” and “freeboard deck” have the meanings as defined in the International Convention on Load Lines in force.

2.3.3 The automatic non-return valves referred to in 2.3.1.1 and 2.3.1.2 shall be fully effective in preventing admission of water into the ship, taking into account the sinkage, trim and heel in survival requirements in 2.9, and shall comply with recognized standards.

2.4 Conditions of loading

Damage survival capability shall be investigated on the basis of loading information submitted to the Administration for all anticipated conditions of loading and variations in draught and trim. Ballast conditions where the chemical tanker is not carrying products covered by the Code, or is carrying only residues of such products, need not be considered.

2.5 Damage assumptions

2.5.1 The assumed maximum extent of damage shall be:

.1	Side damage:		
.1.1	Longitudinal extent:	$1/3L^{2/3}$ or 14.5 m, whichever is less	
.1.2	Transverse extent	$B/5$ or 11.5 m, whichever is less	
.1.3	Vertical extent:	upwards without limit (measured from the moulded line of the bottom shell plating at centreline)	
.2	Bottom damage:	For $0.3L$ from the forward perpendicular of the ship	Any other part of the ship
.2.1	Longitudinal extent:	$1/3L^{2/3}$ or 14.5 m, whichever is less	$1/3L^{2/3}$ or 5 m, whichever is less
.2.2	Transverse extent:	$B/6$ or 10 m, whichever is less	$B/6$ or 5 m, whichever is less
.2.3	Vertical extent:	$B/15$ or 6 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline (see 2.6.2))	$B/15$ or 6 m, whichever is less (measured from the moulded line of the bottom shell plating at centreline (see 2.6.2))

2.5.2 If any damage of a lesser extent than the maximum damage specified in 2.5.1 would result in a more severe condition, such damage shall be considered.

2.6 Location of cargo tanks

2.6.1 Cargo tanks shall be located at the following distances inboard:

- .1 Type 1 ships: from the side shell plating, not less than the transverse extent of damage specified in 2.5.1.1.2, and from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.
- .2 Type 2 ships: from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.
- .3 Type 3 ships: no requirement.

2.6.2 Except for type 1 ships, suction wells installed in cargo tanks may protrude into the vertical extent of bottom damage specified in 2.5.1.2.3 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. Suction wells installed in accordance with this paragraph may be ignored in determining the compartments affected by damage.

2.7 Flooding assumptions

2.7.1 The requirements of 2.9 shall be confirmed by calculations which take into consideration the design characteristics of the ship; the arrangements, configuration and contents of the damaged compartments; the distribution, relative densities and the free surface effects of liquids; and the draught and trim for all conditions of loading.

2.7.2 The permeabilities of spaces assumed to be damaged shall be as follows:

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

* The permeability of partially filled compartments shall be consistent with the amount of liquid carried in the compartment.

2.7.3 Wherever damage penetrates a tank containing liquids it shall be assumed that the contents are completely lost from that compartment and replaced by salt water up to the level of the final plane of equilibrium.

2.7.4 Every watertight division within the maximum extent of damage defined in 2.5.1 and considered to have sustained damage in positions given in 2.8.1 shall be assumed to be penetrated. Where damage less than the maximum is being considered in accordance with 2.5.2, only watertight divisions or combinations of watertight divisions within the envelope of such lesser damage shall be assumed to be penetrated.

2.7.5 The ship shall be so designed as to keep unsymmetrical flooding to the minimum consistent with efficient arrangements.

2.7.6 Equalization arrangements requiring mechanical aids such as valves or cross-levelling pipes, if fitted, shall not be considered for the purpose of reducing an angle of heel or attaining the minimum range of residual stability to meet the requirements of 2.9 and sufficient residual stability shall be maintained during all stages where equalization is used. Spaces which are linked by ducts of large cross-sectional area may be considered to be common.

2.7.7 If pipes, ducts, trunks or tunnels are situated within the assumed extent of damage penetration, as defined in 2.5, arrangements shall be such that progressive flooding cannot thereby extend to compartments other than those assumed to be flooded for each case of damage.

2.7.8 The buoyancy of any superstructure directly above the side damage shall be disregarded. The unflooded parts of superstructures beyond the extent of damage, however, may be taken into consideration provided that:

- .1 they are separated from the damaged space by watertight divisions and the requirements of 2.9.3 in respect of these intact spaces are complied with; and
- .2 openings in such divisions are capable of being closed by remotely operated sliding watertight doors and unprotected openings are not immersed within the minimum range of residual stability required in 2.9; however, the immersion of any other openings capable of being closed weathertight may be permitted.

2.8 Standard of damage

2.8.1 Ships shall be capable of surviving the damage indicated in 2.5 with the flooding assumptions in 2.7 to the extent determined by the ship's type according to the following standards:

- .1 A type 1 ship shall be assumed to sustain damage anywhere in its length;
- .2 A type 2 ship of more than 150 m in length shall be assumed to sustain damage anywhere in its length;
- .3 A type 2 ship of 150 m in length or less shall be assumed to sustain damage anywhere in its length except involving either of the bulkheads bounding a machinery space located aft;
- .4 A type 3 ship of more than 225 m in length shall be assumed to sustain damage anywhere in its length;
- .5 A type 3 ship of 125 m in length or more but not exceeding 225 m in length shall be assumed to sustain damage anywhere in its length except involving either of the bulkheads bounding a machinery space located aft;
- .6 A type 3 ship below 125 m in length shall be assumed to sustain damage anywhere in its length except involving damage to the machinery space when located aft. However, the ability to survive the flooding of the machinery space shall be considered by the Administration.

2.8.2 In the case of small type 2 and type 3 ships which do not comply in all respects with the appropriate requirements of 2.8.1.3 and 2.8.1.6, special dispensation may only be considered by the Administration provided that alternative measures can be taken which maintain the same degree of safety. The nature of the alternative measures shall be approved and clearly stated and be available to the port Administration. Any such dispensation shall be duly noted on the International Certificate of Fitness referred to in 1.5.4.

2.9 Survival requirements

2.9.1 Ships subject to the Code shall be capable of surviving the assumed damage specified in 2.5 to the standard provided in 2.8 in a condition of stable equilibrium and shall satisfy the following criteria.

2.9.2 In any stage of flooding:

- .1 the waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding or downflooding may take place. Such openings shall include air pipes and openings which are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and watertight flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors, and sidescuttles of the non-opening type;
- .2 the maximum angle of heel due to unsymmetrical flooding shall not exceed 25°, except that this angle may be increased to 30° if no deck immersion occurs;
- .3 the residual stability during intermediate stages of flooding shall be to the satisfaction of the Administration. However, it shall never be significantly less than that required by 2.9.3.

2.9.3 At final equilibrium after flooding:

- .1 the righting-lever curve shall have a minimum range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 m within the 20° range; the area under the curve within this range shall not be less than 0.0175 m radians. Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. Within this range, the immersion of any of the openings listed in 2.9.2.1 and other openings capable of being closed weathertight may be permitted; and
- .2 the emergency source of power shall be capable of operating.

Chapter 3

Ship arrangements

3.1 Cargo segregation

3.1.1 Unless expressly provided otherwise, tanks containing cargo or residues of cargo subject to the Code shall be segregated from accommodation, service and machinery spaces and from drinking water and stores for human consumption by means of a cofferdam, void space, cargo pumproom, pumproom, empty tank, oil fuel tank or other similar space.

3.1.2 Cargo piping shall not pass through any accommodation, service or machinery space other than cargo pumprooms or pumprooms.

3.1.3 Cargoes, residues of cargoes or mixtures containing cargoes, which react in a hazardous manner with other cargoes, residues or mixtures, shall:

- .1 be segregated from such other cargoes by means of a cofferdam, void space, cargo pumproom, pumproom, empty tank, or tank containing a mutually compatible cargo;
- .2 have separate pumping and piping systems which shall not pass through other cargo tanks containing such cargoes, unless encased in a tunnel; and
- .3 have separate tank venting systems.

3.1.4 If cargo piping systems or cargo ventilation systems are to be separated. 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:

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

3.1.5 Cargoes subject to the Code shall not be carried in either the fore or aft peak tank.

3.2 Accommodation, service and machinery spaces and control stations

3.2.1 No accommodation or service spaces or control stations shall be located within the cargo area except over a cargo pumproom recess or pumproom recess that complies with regulation II-2/56 of the 1983 SOLAS amendments and no cargo or slop tank shall be aft of the forward end of any accommodation.

3.2.2 In order to guard against the danger of hazardous vapours, due consideration shall be given to the location of air intakes and openings into accommodation, service and machinery spaces and control stations in relation to cargo piping and cargo vent systems.

3.2.3 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall not face the cargo area. They shall be located on the end bulkhead not facing the cargo area and/or on the outboard side of the superstructure or deck-house at a distance of at least 4% of the length (L) of the ship but not less than 3 m from the end of the superstructure or deck-house facing the cargo area. This distance, however, need not exceed 5 m. No doors shall be permitted within the limits mentioned above, except that doors to those spaces not having access to accommodation and service spaces and control stations, such as cargo control stations and store-rooms, may be fitted. Where such doors are fitted, the boundaries of the space shall be insulated to “A-60” standard. Bolted plates for removal of machinery may be fitted within the limits specified above. Wheelhouse doors and wheelhouse windows may be located within the limits specified above so long as they are so designed that a rapid and efficient gas- and vapour-tightening of the wheelhouse can be ensured. Windows and sidescuttles facing the cargo area and on the sides of the superstructures and deck-houses within the limits specified above shall be of the fixed (non-opening) type. Such sidescuttles in the first tier on the main deck shall be fitted with inside covers of steel or equivalent material.

3.3 Cargo pumprooms

3.3.1 Cargo pumprooms shall be so arranged as to ensure:

- .1 unrestricted passage at all times from any ladder platform and from the floor; and
- .2 unrestricted access to all valves necessary for cargo handling for a person wearing the required personnel protective equipment.

3.3.2 Permanent arrangements shall be made for hoisting an injured person with a rescue line while avoiding any projecting obstacles.

3.3.3 Guard railings shall be installed on all ladders and platforms.

3.3.4 Normal access ladders shall not be fitted vertical and shall incorporate platforms at suitable intervals.

3.3.5 Means shall be provided to deal with drainage and any possible leakage from cargo pumps and valves in cargo pumprooms. The bilge system serving the cargo pumproom shall be operable from outside the cargo pumproom. One or more slop tanks for storage of contaminated bilge water or tank washings shall be provided. A shore connection with a standard coupling or other facilities shall be provided for transferring contaminated liquids to onshore reception facilities.

3.3.6 Pump discharge pressure gauges shall be provided outside the cargo pumproom.

3.3.7 Where machinery is driven by shafting passing through a bulkhead or deck, gastight seals with efficient lubrication or other means of ensuring the permanence of the gas seal shall be fitted in way of the bulkhead or deck.

3.4 Access to spaces in the cargo area

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

3.4.2 For access through horizontal openings, hatches or manholes, the dimensions shall be sufficient to allow a person wearing a self-contained air-breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also 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 by 600 mm.

3.4.3 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 by 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

3.4.4 Smaller dimensions may be approved by the Administration in special circumstances, if the ability to traverse such openings or to remove an injured person can be proved to the satisfaction of the Administration.

3.5 Bilge and ballast arrangements

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

3.5.2 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.

3.5.3 Bilge pumping arrangements for cargo pumprooms, pumprooms, void spaces, slop tanks, double-bottom tanks and similar spaces shall be situated entirely within the cargo area except for void spaces, double-bottom tanks and ballast tanks where such spaces are separated from tanks containing cargo or residues of cargo by a double bulkhead.

3.6 Pump and pipeline identification

Provisions shall be made for the distinctive marking of pumps, valves and pipelines to identify the service and tanks which they serve.

3.7 Bow or stern loading and unloading arrangements

3.7.1 Cargo piping may be fitted to permit bow or stern loading and unloading. Portable arrangements shall not be permitted.

3.7.2 Bow or stern loading and unloading lines shall not be used for the transfer of products required to be carried in type 1 ships. Bow and stern loading and unloading lines shall not be used for the transfer of cargoes emitting toxic vapours required to comply with 15.12.1, unless specifically approved by the Administration.

3.7.3 In addition to 5.1, the following provisions apply:

- .1 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 shutoff 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.
- .2 The shore connection shall be fitted with a shutoff valve and a blank flange.
- .3 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.
- .4 Spray shields shall be provided at the connections specified in 3.7.3.1 as well as collecting trays of sufficient capacity, with means for the disposal of drainage.
- .5 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 Administration.
- .6 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 shutoff valve and blank flange.

3.7.4 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations shall not face the cargo shore-connection location of bow or stern loading and unloading arrangements. They shall be located on the outboard side of the superstructure or deck-house 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 bow or stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore-connection location and on the sides of the superstructure or deck-house within the distance mentioned above shall be of the fixed (non-opening) type. In addition, during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deck-house side shall be kept closed. Where, in the case of small ships, compliance with 3.2.3 and this paragraph is not possible, the Administration may approve relaxations from the above requirements.

3.7.5 Air pipes and other openings to enclosed spaces not listed in 3.7.4 shall be shielded from any spray which may come from a burst hose or connection.

3.7.6 Escape routes shall not terminate within the coamings required by 3.7.7 or within a distance of 3 m beyond the coamings.

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

3.7.8 Electrical equipment within the coamings required by 3.7.7 or within a distance of 3 m beyond the coamings shall be in accordance with the requirements of Chapter 10.

3.7.9 Fire-fighting arrangements for the bow or stern loading and unloading areas shall be in accordance with 11.3.16.

3.7.10 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 of cargo pumps from the cargo shore-connection location.

Chapter 4

Cargo containment

4.1 Definitions

4.1.1 *Independent tank* means a cargo-containment envelope, which is not contiguous with, or part of, the hull structure. An independent tank is built and installed so as to eliminate whenever possible (or in any event to minimize) its stressing as a result of stressing or motion of the adjacent hull structure. An independent tank is not essential to the structural completeness of the ship's hull.

4.1.2 *Integral tank* means a cargo-containment envelope which forms part of the ship's hull and which may be stressed in the same manner and by the same loads which stress the contiguous hull structure and which is normally essential to the structural completeness of the ship's hull.

4.1.3 *Gravity tank* means a tank having a design pressure not greater than 0.07 MPa gauge at the top of the tank. A gravity tank may be independent or integral. A gravity tank shall be constructed and tested according to recognized standards, taking account of the temperature of carriage and relative density of the cargo.

4.1.4 *Pressure tank* means a tank having a design pressure greater than 0.07 MPa gauge. A pressure tank shall be an independent tank and shall be of a configuration permitting the application of pressure-vessel design criteria according to recognized standards.

4.2 Tank type requirements for individual products

Requirements for both installation and design of tank types for individual products are shown in *column f* in the table of Chapter 17.

Chapter 5

Cargo transfer

5.1 Piping scantlings

5.1.1 Subject to the conditions stated in 5.1.4, the wall thickness (t) of, pipes shall not be less than:

$$t = \frac{t_0 + b + c}{1 - \frac{a}{100}} (mm)$$

where:

t_0 = theoretical thickness

$$t_0 = PD/(2Ke+P) (mm)$$

with

P = design pressure (MegaPascals) referred to in 5.1.2

D = outside diameter (mm)

K = allowable stress (N/mm²) referred to in 5.1.5

e = efficiency factor equal to 1.0 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, which are considered equivalent to seamless pipes when non-destructive testing on welds is carried out in accordance with recognized standards. In other cases, an efficiency factor of less than 1.0, in accordance with recognized standards, may be required depending on the manufacturing process.

b = allowance for bending (mm). The value of b shall be chosen so that the calculated stress in the bend, due to internal pressure only, does not exceed the allowable stress. Where such justification is not given, b shall be not less than:

$$b = \frac{Dt_o}{2.5r} (mm)$$

with

r = mean radius of the bend (mm).

c = corrosion allowance (mm). If corrosion or erosion is expected, the wall thickness of piping shall be increased over that required by the other design requirements.

a = negative manufacturing tolerance for thickness (%).

5.1.2 The design pressure P in the formula for t_o in 5.1.1 is the maximum gauge pressure to which the system may be subjected in service, taking into account the highest set pressure on any relief valve on the system.

5.1.3 Piping and piping-system components which are not protected by a relief valve, or which may be isolated from their relief valve, shall be designed for at least the greatest of:

- .1 for piping systems or components, which may contain some liquid, the saturated vapour pressure at 45°C;
- .2 the pressure setting of the associated pump discharge relief valve;
- .3 the maximum possible total pressure head at the outlet of the associated pumps when a pump discharge relief valve is not installed.

5.1.4 The design pressure shall not be less than 1 MPa gauge except for open-ended lines, where it shall be not less than 0.5 MPa gauge.

5.1.5 For pipes, the allowable stress K to be considered in the formula for t_o in 5.1.1 is the lower of the following values:

$$\frac{R_m}{A} \text{ or } \frac{R_e}{B}$$

where:

R_m = specified minimum tensile strength at ambient temperature (N/mm²)

R_e = specified minimum yield stress at ambient temperature (N/mm²). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.

A and B shall have values of at least $A = 2.7$ and $B = 1.8$.

5.1.6.1 The minimum wall thickness shall be in accordance with recognized standards.

5.1.6.2 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to weight of pipes and content and to superimposed loads from supports, ship deflection or other causes, the wall thickness shall be increased over that required by 5.1.1

or, if this is impracticable or would cause excessive local stresses, these loads shall be reduced, protected against or eliminated by other design methods.

5.1.6.3 Flanges, valves and other fittings shall be in accordance with recognized standards, taking into account the design pressure defined under 5.1.2.

5.1.6.4 For flanges not complying with a standard, the dimensions for flanges and associated bolts shall be to the satisfaction of the Administration.

5.2 Piping fabrication and joining details

5.2.1 The requirements of this section apply to piping inside and outside the cargo tanks. However, relaxations from these requirements may be accepted in accordance with recognized standards for open-ended piping and for piping inside cargo tanks except for cargo piping serving other cargo tanks.

5.2.2 Cargo piping shall be joined by welding except:

- .1 for approved connections to shutoff valves and expansion joints; and
- .2 for other exceptional cases specifically approved by the Administration.

5.2.3 The following direct connections of pipe lengths without flanges may be considered:

- .1 Butt-welded joints with complete penetration at the root may be used in all applications.
- .2 Slip-on welded joints with sleeves and related welding having dimensions in accordance with recognized standards shall only be used for pipes with an external diameter of 50 mm or less. This type of joint shall not be used when crevice corrosion is expected to occur.
- .3 Screwed connections, in accordance with recognized standards, shall only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.

5.2.4 Expansion of piping shall normally be allowed for by the provision of expansion loops or bends in the piping system.

- .1 Bellows, in accordance with recognized standards, may be specially considered.
- .2 Slip joints shall not be used.

5.2.5 Welding, post-weld heat treatment and non-destructive testing shall be performed in accordance with Recognized Standards.

5.3 Flange connections

5.3.1 Flanges shall be of the welded-neck, slip-on or socket-welded type. However, socket-welded-type flanges shall not be used in nominal size above 50 mm.

5.3.2 Flanges shall comply with recognized standards as to their type, manufacture and test.

5.4 Test requirements for piping

5.4.1 The test requirements of this section apply to piping inside and outside cargo tanks. However, relaxations from these requirements may be accepted in accordance with recognized standards for piping inside tanks and open-ended piping.

5.4.2 After assembly, each cargo piping system shall be subject to a hydrostatic test to at least 1.5 times the design pressure. When piping systems or parts of systems are completely manufactured and equipped with all fittings, the hydrostatic test may be conducted prior to installation aboard the ship. Joints welded on board shall be hydrostatically tested to at least 1.5 times the design pressure.

5.4.3 After assembly on board, each cargo piping system shall be tested for leaks to a pressure depending on the method applied.

5.5 Piping arrangements

5.5.1 Cargo piping shall not be installed under deck between the out-board side of the cargo-containment spaces and the skin of the ship unless clearances required for damage protection (see 2.6) are maintained; but such distances may be reduced where damage to the pipe would not cause release of cargo provided that the clearance required for inspection purposes is maintained.

5.5.2 Cargo piping located below the main deck may run from the tank it serves and penetrate tank bulkheads or boundaries common to longitudinally or transversally adjacent cargo tanks, ballast tanks, empty tanks, pumprooms or cargo pumprooms provided that inside the tank it serves it is fitted with a stop-valve operable from the weather deck and provided cargo compatibility is assured in the event of piping failure. As an exception, where a cargo tank is adjacent to a cargo pumproom, the stop valve operable from the weather deck may be situated on the tank bulkhead on the cargo pumproom side, provided an additional valve is fitted between the bulkhead valve and the cargo pump. A totally enclosed hydraulically operated valve located outside the cargo tank may, however, be accepted, provided that the valve is:

- .1 designed to preclude the risk of leakage;
- .2 fitted on the bulkhead of the cargo tank which it serves;
- .3 suitably protected against mechanical damage;
- .4 fitted at a distance from the shell as required for damage protection; and
- .5 operable from the weather deck.

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

5.5.4 Cargo piping installed in pipe tunnels shall also comply with the requirements of 5.5.1 and 5.5.2. Pipe tunnels shall satisfy all tank requirements for construction, location and

ventilation and electrical hazard requirements. Cargo compatibility shall be assured in the event of a piping failure. The tunnel shall not have any other openings except to the weather deck and cargo pumproom or pumproom.

5.5.5 Cargo piping passing through bulkheads shall be so arranged as to preclude excessive stresses at the bulkhead and shall not utilize flanges bolted through the bulkhead.

5.6 Cargo-transfer control systems

5.6.1 For the purpose of adequately controlling the cargo, cargo-transfer systems shall be provided with:

- .1 one stop-valve capable of being manually operated on each tank filling and discharge line, located near the tank penetration; if an individual deepwell pump is used to discharge the contents of a cargo tank, a stop-valve is not required on the discharge line of that tank;
- .2 one stop valve at each cargo-hose connection;
- .3 remote shutdown devices for all cargo pumps and similar equipment.

5.6.2 The controls necessary during transfer or transport of cargoes covered by the Code other than in cargo pumprooms which have been dealt with elsewhere in the Code shall not be located below the weather deck.

5.6.3 For certain products, additional cargo-transfer control requirements are shown in *column o* in the table of Chapter 17.

5.7 Ship's cargo hoses

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

5.7.2 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.

5.7.3 For cargo hoses installed on board ships on or after 1 July 2002, each new 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 in 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 1 MPa gauge.

Chapter 6

Materials of construction, protective linings and coatings

[6.1 Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, shall be suitable at the temperature and pressure for the cargo to be carried in accordance with recognized standards. Steel is assumed to be the normal material of construction.

6.2 Where applicable, the following shall be taken into account in selecting the material of construction:

- .1 notch ductility at the operating temperature;
- .2 corrosive effect of the cargo;
- .3 possibility of hazardous reactions between the cargo and the material of construction; and
- .4 suitability of linings.

6.3 The shipper of the cargo is responsible for providing, in a timely manner, all information necessary for the safe carriage of the product, in order to enable the ship operator and/or Master to establish that all materials of construction are compatible with the cargo.]

To be considered by MSC

Chapter 7

Cargo temperature control

7.1 General

7.1.1 When provided, any cargo heating or cooling systems shall be constructed, fitted and tested to the satisfaction of the Administration. Materials used in the construction of temperature-control systems shall be suitable for use with the product intended to be carried.

7.1.2 Heating or cooling media shall be of a type approved for use with the specific cargo. Consideration shall be given to the surface temperature of heating coils or ducts to avoid dangerous reactions from localized overheating or overcooling of cargo. (See also 15.13.6.)

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

7.1.4 In any heating or cooling system, means shall be provided to ensure that, when in any condition other than empty, a higher pressure can be maintained within the system than the maximum pressure head that could be exerted by the cargo tank contents on the system.

7.1.5 Means shall be provided for measuring the cargo temperature.

- .1 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 *column j* in the table of Chapter 17.
- .2 A restricted temperature-measuring device is subject to the definition for a restricted gauging device in 13.1.1.2, e.g. a portable thermometer lowered inside a gauge tube of the restricted type.
- .3 A closed temperature-measuring device is subject to the definition for a closed gauging device in 13.1.1.3, e.g. a remote-reading thermometer of which the sensor is installed in the tank.
- .4 When overheating or overcooling could result in a dangerous condition, an alarm system which monitors the cargo temperature shall be provided. (See also operational requirements in 16.6.)

7.1.6 When products for which 15.12, 15.12.1 or 15.12.3 are listed in *column o* in the table of Chapter 17 are being heated or cooled, the heating or cooling medium shall operate in a circuit:

- .1 which is independent of other ship's services, except for another cargo heating or cooling system, and which does not enter the machinery space; or
- .2 which is external to the tank carrying toxic products; or

- .3 where the medium is sampled to check for the presence of cargo before it is recirculated to other services of the ship or into the machinery space. 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. Where this method is used, the coil return shall be tested not only at the commencement of heating or cooling of a toxic product, but also on the first occasion the coil is used subsequent to having carried an unheated or uncooled toxic cargo.

7.2 Additional requirements

For certain products, additional requirements contained in Chapter 15 are shown in *column o* in the table of Chapter 17.

Chapter 8

Cargo tank venting and gas-freeing arrangements

8.1 Application

8.1.1 Unless expressly provided otherwise, this Chapter applies to ships constructed on or after 1 January 1994.

8.1.2 Ships constructed before 1 January 1994 shall comply with the requirements of Chapter 8 of this Code which were in force prior to the said date.

8.1.3 For the purpose of this regulation, the term “ship constructed” is as defined in regulation II-1/1.3.1 of SOLAS.

8.1.4 Ships constructed on or after 1 July 1986 but before 1 January 1994 which fully comply with the requirements of the Code applicable at that time may be regarded as complying with the requirements of regulation II-2/59 of SOLAS.

8.1.5 For ships to which the Code applies, the requirements of this Chapter shall apply in lieu of regulation II-2/59.1 and 59.2 of SOLAS.

8.1.6 Ships constructed on or after 1 July 1986, but before 1 July 2002 shall comply with the requirements of paragraph 8.3.3.

8.2 Cargo tank venting

8.2.1 All cargo tanks shall be provided with a venting system appropriate to the cargo being carried and these systems shall be independent of the air pipes and venting systems of all other compartments of the ship. Tank venting systems shall be designed so as to minimize the possibility of cargo vapour accumulating about the decks, entering accommodation, service and machinery spaces and control stations and, in the case of flammable vapours, entering or collecting in spaces or areas containing sources of ignition. Tank venting systems shall be arranged to prevent entrance of water into the cargo tanks and, at the same time, vent outlets shall direct the vapour discharge upwards in the form of unimpeded jets.

8.2.2 The venting systems shall be connected to the top of each cargo tank and as far as practicable the cargo vent lines shall be self-draining back to the cargo tanks under all normal operational conditions of list and trim. Where it is necessary to drain venting systems above the level of any pressure/vacuum valve, capped or plugged drain cocks shall be provided.

8.2.3 Provision shall be made to ensure that the liquid head in any tank does not exceed the design head of the tank. Suitable high-level alarms, overflow control systems or spill valves, together with gauging and tank filling procedures, may be accepted for this purpose. Where the means of limiting cargo tank overpressure includes an automatic closing valve, the valve shall comply with the appropriate provisions of 15.19.

8.2.4 Tank venting systems shall be designed and operated so as to ensure that neither pressure nor vacuum created in the cargo tanks during loading or unloading exceeds tank design parameters. The main factors to be considered in the sizing of a tank venting system are as follows:

- .1 design loading and unloading rate;
- .2 gas evolution during loading: this shall be taken account of by multiplying the maximum loading rate by a factor of at least 1.25;
- .3 density of the cargo vapour mixture;
- .4 pressure loss in vent piping and across valves and fittings;
- .5 pressure/vacuum settings of relief devices.

8.2.5 Tank vent piping connected to cargo tanks of corrosion-resistant material, or to tanks which are lined or coated to handle special cargoes as required by the Code, shall be similarly lined or coated or constructed of corrosion-resistant material.

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

8.3 Types of tank venting systems

8.3.1 An open tank venting system is a system which offers no restriction except for friction losses to the free flow of cargo vapours to and from the cargo tanks during normal operations. An open venting system may consist of individual vents from each tank, or such individual vents may be combined into a common header or headers, with due regard to cargo segregation. In no case shall shutoff valves be fitted either to the individual vents or to the header.

8.3.2 A controlled tank venting system is a system in which pressure- and vacuum-relief valves or pressure/vacuum valves are fitted to each tank to limit the pressure or vacuum in the tank. A controlled venting system may consist of individual vents from each tank or such individual vents on the pressure side only as may be combined into a common header or headers, with due regard to cargo segregation. In no case shall shut-off valves be fitted either above or below pressure- or vacuum-relief valves or pressure/vacuum valves. Provision may be made for bypassing a pressure- or vacuum-relief valve or pressure/vacuum valve under certain operating conditions provided that the requirement of 8.3.6 is maintained and that there is suitable indication to show whether or not the valve is bypassed.

8.3.3 Controlled tank venting systems shall consist of a primary and a secondary means of allowing full flow relief of vapour to prevent over-pressure or under-pressure in the event of failure of one means. Alternatively, the secondary means may consist of pressure sensors fitted in each tank with a monitoring system in the ship's cargo control room or position from which cargo operations are normally carried out. Such monitoring equipment shall also provide an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a tank.

8.3.4 The position of vent outlets of a controlled tank venting system shall be arranged:

- .1 at a height of not less than 6 m above the weather deck or above a raised walkway if fitted within 4 m of the raised walkway;
- .2 at a distance of at least 10 m measured horizontally from the nearest air intake or opening to accommodation, service and machinery spaces and ignition sources.

8.3.5 The vent outlet height referred to in 8.3.4.1 may be reduced to 3 m above the deck or a raised walkway, as applicable, provided that high-velocity venting valves of an approved type, directing the vapour/air mixture upwards in an unimpeded jet with an exit velocity of at least 30 m/s, are fitted.

8.3.6 Controlled tank venting systems fitted to tanks to be used for cargoes having a flashpoint not exceeding 60°C (closed-cup test) shall be provided with devices to prevent the passage of flame into the cargo tanks. The design, testing and locating of the devices shall comply with the requirements of the Administration, which shall contain at least the standards adopted by the Organization.

8.3.7 In designing venting systems and in the selection of devices to prevent the passage of flame for incorporation into the tank venting system, due attention shall be paid to the possibility of the blockage of these systems and fittings by, for example, the freezing of cargo vapour, polymer build-up, atmospheric dust or icing up in adverse weather conditions. In this context it shall be noted that flame arresters and flame screens are more susceptible to blockage. Provisions shall be made such that the system and fittings may be inspected, operationally checked, cleaned or renewed as applicable.

8.3.8 Reference in 8.3.1 and 8.3.2 to the use of shutoff valves in the venting lines shall be interpreted to extend to all other means of stoppage, including spectacle blanks and blank flanges.

8.4 Venting requirements for individual products

Venting requirements for individual products are shown in *column g*, and additional requirements in *column o* in the table of Chapter 17.

8.5 Cargo tank gas-freeing

8.5.1 The arrangements for gas-freeing cargo tanks used for cargoes other than those for which open venting is permitted 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. Accordingly, gas-freeing operations shall be carried out such that vapour is initially discharged:

- .1 through the vent outlets specified in 8.3.4 and 8.3.5; 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.

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.

8.5.2 The outlets referred to in 8.5.1.2 and 8.5.1.3 may be fixed or portable pipes.

8.5.3 In designing a gas-freeing system in conformity with 8.5.1, particularly in order to achieve the required exit velocities of 8.5.1.2 and 8.5.1.3, due consideration shall be given to the following:

- .1 materials of construction of system;
- .2 time to gas-free;
- .3 flow characteristics of fans to be used;
- .4 the pressure losses created by ducting, piping, cargo tank inlets and outlets;
- .5 the pressure achievable in the fan driving medium (e.g. water or compressed air);
and
- .6 the densities of the cargo vapour/air mixtures for the range of cargoes to be carried.

Chapter 9

Environmental control

9.1 General

9.1.1 Vapour spaces within cargo tanks and, in some cases, spaces surrounding cargo tanks may require to have specially controlled atmospheres.

9.1.2 There are four different types of control for cargo tanks, as follows:

- .1 *Inerting* - by filling the cargo tank and associated piping systems and, where specified in Chapter 15, the spaces surrounding the cargo tanks, with a gas or vapour which will not support combustion and which will not react with the cargo, and maintaining that condition.
- .2 *Padding* - by filling the cargo tank and associated piping systems with a liquid, gas or vapour which separates the cargo from the air, and maintaining that condition.
- .3 *Drying* - by filling the cargo tank and associated piping systems with moisture-free gas or vapour with a dewpoint of -40°C or below at atmospheric pressure, and maintaining that condition.
- .4 *Ventilation* - forced or natural.

9.1.3 Where inerting or padding of cargo tanks is required:

- .1 An adequate supply of inert gas for use in filling and discharging the cargo tanks 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.
- .2 The inert gas system on board the ship shall be able to maintain a pressure of at least 0.007MPa gauge 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.
- .3 Where padding is used, similar arrangements for supply of the padding medium shall be made as required for inert gas in 9.1.3.1 and 9.1.3.2.
- .4 Means shall be provided for monitoring ullage spaces containing a gas blanket to ensure that the correct atmosphere is being maintained.
- .5 Inerting or padding arrangements or both, where used with flammable cargoes, shall be such as to minimize the creation of static electricity during the admission of the inerting medium.

9.1.4 Where drying is used and dry nitrogen is used as the medium, similar arrangements for supply of the drying agent shall be made to those required in 9.1.3. Where drying agents are used as the drying medium on all air inlets to the tank, sufficient medium shall be carried for the duration of the voyage, taking into consideration the diurnal temperature range and the expected humidity.

9.2 Environmental control requirements for individual products

The required types of environmental control for certain products are shown in *column h* in the table of Chapter 17.

Chapter 10

Electrical installations

10.1 General

10.1.1 The provisions of this Chapter are applicable to ships carrying cargoes which are inherently, or due to their reaction with other substances, flammable or corrosive to the electrical equipment, and shall be applied in conjunction with applicable electrical requirements of part D of Chapter II-1 of SOLAS.

10.1.2.1 Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products. Electrical installations complying with this Chapter shall not be considered a source of ignition for the purposes of 10.2.2.3, having regard to 10.1.4.

10.1.2.2 Where the specific cargo is liable to damage the materials normally used in electrical apparatus, due consideration shall be given to the particular characteristics of the materials chosen for conductors, insulation, metal parts, etc. As far as necessary, these components shall be protected to prevent contact with gases or vapours liable to be encountered.

10.1.3 The Administration shall take appropriate steps to ensure uniformity in the implementation and the application of the provisions of this Chapter in respect of electrical installations*.

10.1.4 Electrical equipment and wiring shall not be installed in the hazardous locations referred to in 10.2 unless essential for operational purposes, when the exceptions listed in 10.2.3 are permitted.

10.1.5 Where electrical equipment is installed in hazardous locations, as permitted in this Chapter, it shall be to the satisfaction of the Administration and certified by the relevant authorities recognized by the Administration for operation in the flammable atmosphere concerned, as indicated in *column i* in the table of Chapter 17.

10.1.6 Absence of information on temperature class and apparatus group in *column i* in the table of Chapter 17 means that data are not currently available, and this shall not be confused with the non-flammable (NF) notation describing some substances. For guidance, indication is given if the flashpoint of a substance is in excess of 60°C. In the case of heated cargo, carriage conditions might need to be established and the requirements of 10.2.2 applied.

10.2 Hazardous locations and types of equipment and wiring

10.2.1 The restrictions in this section do not preclude the use of intrinsically safe systems and circuits in all hazardous locations including cargo piping. It is particularly recommended that intrinsically safe systems and circuits are used for measurement, monitoring, control and communication purposes.

* Reference is made to the recommendations published by the International Electrotechnical Commission and in particular to Publication 92-502, *Electrical Installations in Ships* - Part 502: Special features - Tankers.

10.2.2 Cargoes with a flashpoint exceeding 60°C:

- .1 Cargo tanks and cargo piping are the only hazardous locations for such cargoes which have no qualification in *column o* in the table of Chapter 17. Submerged cargo-pump motors and their associated cables may, in exceptional circumstances for a specific cargo or for a clearly defined range of cargoes, be permitted by the Administration, due consideration having been given to the chemical and physical characteristics of the products. Arrangements shall be made to prevent the energizing of motors and cables in flammable gas/air mixtures and to de-energize the motors and cables in the event of low liquid level. Such a shutdown shall be indicated by an alarm at the cargo control station.
- .2 Where electrical equipment is located in a cargo pumproom, due consideration shall be given to the use of types of apparatus which ensure the absence of arcs or sparks and hot spots during normal operation, or which are of a certified safe type.
- .3 Where the cargo is heated to within 15°C of its flashpoint value, the cargo pumproom shall be considered as a hazardous area as well as areas within 3 m of openings from tanks where the cargo is so heated, and within 3 m of the entrance or ventilation openings to cargo pumprooms. Electrical equipment installed within these locations shall be of a certified safe type.
- .4 Where the cargo is heated above its flashpoint value, the requirements of 10.2.3 are applicable.

10.2.3 For cargoes with a flashpoint not exceeding 60°C without qualification in *column o* in the table of Chapter 17, the hazardous locations are given below. In addition to intrinsically safe systems and circuits, the only electrical installations permitted in hazardous locations are the following:

- .1 Cargo tanks and cargo piping:
 - .1.1 No additional electrical equipment is permitted.
- .2 Void spaces adjacent to, above or below integral tanks:
 - .2.1 Through runs of cables. Such cables shall be installed in heavy gauge steel pipes with gastight joints. Expansion bends shall not be fitted in such spaces.
 - .2.2 Electrical depth-sounding or log devices and impressed-current cathodic protection system anodes or electrodes. These devices shall be housed in gastight enclosures; associated cables shall be protected as referred to in 10.2.3.2.1.
- .3 Hold spaces containing independent cargo tanks:
 - .3.1 Through runs of cable without any additional protection.

- .3.2 Lighting fittings with pressurized enclosure or of the flameproof type. The lighting system shall be divided between at least two branch circuits. All switches and protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
- .3.3 Electrical depth-sounding or log devices and impressed-current cathodic protection system anodes or electrodes. These devices shall be housed in gastight enclosures.
- .4 Cargo pumprooms and pumprooms in the cargo area:
 - .4.1 Lighting fittings with pressurized enclosures or of the flameproof type. The lighting system shall be divided between at least two branch circuits. All switches and all protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
 - .4.2 Electrical motors for driving cargo pumps and any associated auxiliary pumps. These shall be separated from these spaces by a gastight bulkhead or deck. Flexible couplings, or other means of maintaining alignment, shall be fitted to the shafts between the driven equipment and its motors, and in addition, glands shall be provided in accordance with recognized standards where the shafts pass through the bulkhead or deck. Such electrical motors shall be located in a compartment having positive-pressure ventilation.
 - .4.3 Flameproof general alarm audible indicator.
- .5 Zones on open deck, or semi-enclosed spaces on open deck, within 3 m of any cargo tank outlet, gas or vapour outlet, cargo-pipe flange, cargo valve or entrance and ventilation opening to cargo pumprooms; cargo area on open deck over all cargo tanks and cargo tank holds, including all ballast tanks and cofferdams within the cargo tank block, to the full width of the ship, plus 3 m fore and aft and up to a height of 2.4 m above the deck:
 - .5.1 Equipment of a certified safe type, adequate for open deck use.
 - .5.2 Through runs of cables.
- .6 Enclosed or semi-enclosed spaces in which pipes containing cargoes are located; enclosed or semi-enclosed spaces immediately above cargo tanks (e.g. between decks) or having bulkheads above and in line with cargo tank bulkheads; enclosed or semi-enclosed spaces immediately above cargo pumprooms or above vertical cofferdams adjoining cargo tanks, unless separated by a gastight deck and suitably ventilated; and compartments for cargo hoses:
 - .6.1 Lighting fittings of a certified safe type. The lighting system shall be divided between at least two branch circuits. All switches and protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
 - .6.2 Through runs of cables.

- .7 Enclosed or semi-enclosed spaces having a direct opening into any hazardous location referred to above shall have electrical installations complying with the requirements for the space or zone into which the opening leads.

10.3 Bonding

Independent cargo tanks shall be electrically bonded to the hull. All gasketed cargo-pipe joints and hose connections shall be electrically bonded.

10.4 Electrical requirements for individual products

Electrical requirements for individual products are shown in *column i* in the table of Chapter 17.

Chapter 11

Fire protection and fire extinction

11.1 Application

11.1.1 The requirements for tankers in Chapter II-2 of the 1983 SOLAS amendments shall apply to ships covered by the Code, irrespective of tonnage, including ships of less than 500 tons gross tonnage, except that:

- .1 regulations 60, 61, 62 and 63 shall not apply;
- .2 regulation 56.2, i.e. the requirements for location of the main cargo control station, need not apply;
- .3 regulation 4, as applicable to cargo ships and regulation 7 shall apply as they would apply to tankers of 2,000 tons gross tonnage and over;
- .4 the provisions of 11.3 shall apply in lieu of regulation 61; and
- .5 the provisions of 11.2 shall apply in lieu of regulation 63.

11.1.2 Notwithstanding the provisions of 11.1.1, ships engaged solely in the carriage of products which are non-flammable (entry NF in *column i* of the table of minimum requirements) need not comply with part D of Chapter II-2 of the 1983 SOLAS amendments, provided that they comply with part C of that Chapter, except that regulation 53 need not apply to such ships and 11.2 and 11.3, hereunder, need not apply.

11.1.3 For ships engaged solely in the carriage of products with flashpoint above 60°C (entry “yes” in *column i* of the table of minimum requirements), the requirements of Chapter II-2 of the 1983 SOLAS amendments may apply as specified in regulation II-2/55.4 in lieu of the provisions of this Chapter.

11.2 Cargo pumprooms

11.2.1 The cargo pumproom of any ship shall be provided with a fixed fire-extinguishing system as follows:

- .1 a carbon dioxide system as specified in regulation II-2/5.1 and .2 of the 1983 SOLAS amendments. A notice shall be exhibited at the controls stating that the system is only to be used for fire-extinguishing and not for inerting purposes, due to the electrostatic ignition hazard. The alarms referred to in regulation II-2/5.1.6 of the 1983 SOLAS amendments shall be safe for use in a flammable cargo vapour/air mixture. For the purpose of this requirement, an extinguishing system shall be provided which would be suitable for machinery spaces. However, 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 pumproom in all cases; or

- .2 a halogenated hydrocarbon system as specified in regulation II-2/5.1 and .3 of the 1983 SOLAS amendments. A notice shall be exhibited at the controls stating that the system is only to be used for fire-extinguishing and not for inerting purposes, due to the electrostatic ignition hazard. The alarms referred to in regulation II-2/5.1.6 of the 1983 SOLAS amendments shall be safe for use in a flammable cargo vapour/air mixture. For the purpose of this requirement, an extinguishing system shall be provided which would be suitable for machinery spaces but utilizing the following minimum design quantities, based on the gross volume of the cargo pumproom:

Halon 1301	75
Halon 1211	5.5%
Halon 2402	0.3 kg.m ³

11.2.2 Cargo pumprooms of ships which are dedicated to the carriage of a restricted number of cargoes shall be protected by an appropriate fire-extinguishing system approved by the Administration.

11.2.3 A fire-extinguishing system consisting of either a fixed pressure water-spray system or a high-expansion foam system could be provided for a cargo pumproom if cargoes will be carried which are not suited to extinguishment by carbon dioxide or equivalent media. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall reflect this conditional requirement.

11.3 Cargo area

11.3.1 Every ship shall be provided with a fixed deck foam system in accordance with the requirements of 11.3.2 to 11.3.12.

11.3.2 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 Administration shall be provided. Regular protein foam shall not be used.

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

11.3.4 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 area, adjacent to the accommodation spaces and readily accessible and operable in the event of fires in the areas protected.

11.3.5 The rate of supply of foam solution shall be not less than the greatest of the following:

- .1 2 l/min per square metre of the cargo tanks deck area, where cargo tanks deck area means the maximum breadth of the ship times the total longitudinal extent of the cargo tank spaces;
- .2 20 l/min per square metre of the horizontal sectional area of the single tank having the largest such area;

- .3 10 l/min per square metre of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1,250 l/min. For ships of less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Administration.

11.3.6 Sufficient foam concentrate shall be supplied to ensure at least 30 minutes of foam generation when using the highest of the solution rates stipulated in 11.3.5.1, 11.3.5.2 and 11.3.5.3.

11.3.7 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 11.3.5.1 or 11.3.5.2 shall be delivered from each monitor. The capacity of any monitor shall be at least 10 l/min 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/min. For ships of less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Administration.

11.3.8 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.

11.3.9 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 area.

11.3.10 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/min 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 tanks deck area.

11.3.11 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.

11.3.12 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.

11.3.13 Ships which are dedicated to the carriage of a restricted number of cargoes shall be protected by alternative provisions to the satisfaction of the Administration when they are just as effective for the products concerned as the deck foam system required for the generality of flammable cargoes.

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

11.3.15 Where flammable cargoes are to be carried, all sources of ignition shall be excluded from hazardous locations referred to in 10.2.

11.3.16 Ships fitted with bow or stern loading and unloading arrangements shall be provided with one additional foam monitor meeting the requirements of 11.3.7 and one additional applicator meeting the requirements of 11.3.10. The additional monitor shall be located to protect the bow or stern loading and unloading arrangements. The area of the cargo line forward or aft of the cargo area shall be protected by the above-mentioned applicator.

11.4 Special requirements

All fire-extinguishing media determined to be effective for each product are listed in *column l* in the table of Chapter 17.

Chapter 12

Mechanical ventilation in the cargo area

For ships to which the Code applies, the requirements of this chapter replace the requirements of regulation II-2/59.3 of the 1983 SOLAS amendments.

However, for products addressed under paragraphs 11.1.2 and 11.1.3, except acids and products for which paragraph 15.17 applies, regulation II-2/59.3 of the 1983 SOLAS amendments may apply in lieu of the provisions of this chapter.

12.1 Spaces normally entered during cargo-handling operations

12.1.1 Cargo pumprooms and other enclosed spaces which contain cargo-handling equipment and similar spaces in which work is performed on the cargo shall be fitted with mechanical ventilation systems, capable of being controlled from outside such spaces.

12.1.2 Provision shall be made to ventilate such spaces prior to entering the compartment and operating the equipment and a warning notice requiring the use of such ventilation shall be placed outside the compartment.

12.1.3 Mechanical ventilation inlets and outlets shall be arranged to ensure sufficient air movement through the space to avoid the accumulation of toxic or flammable vapours or both (taking into account their vapour densities) and to ensure sufficient oxygen to provide a safe working environment, but in no case shall the ventilation system have a capacity of less than 30 changes of air per hour, based upon the total volume of the space. For certain products, increased ventilation rates for cargo pumprooms are prescribed in 15.17.

12.1.4 Ventilation systems shall be permanent and shall normally be of the extraction type. Extraction from above and below the floor plates shall be possible. In rooms housing motors driving cargo pumps, the ventilation shall be of the positive-pressure type.

12.1.5 Ventilation exhaust ducts from spaces within the cargo area shall discharge upwards in locations at least 10 m in the horizontal direction from ventilation intakes and openings to accommodation, service and machinery spaces and control stations and other spaces outside the cargo area.

12.1.6 Ventilation intakes shall be so arranged as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening.

12.1.7 Ventilation ducts shall not be led through accommodation, service and machinery spaces or other similar spaces.

12.1.8 Electric motors driving fans shall be placed outside the ventilation ducts if the carriage of flammable products is intended. Ventilation fans and fan ducts, in way of fans only, for hazardous locations referred to in Chapter 10 shall be of non-sparking construction, defined as:

- .1 impellers or housing of non-metallic construction, due regard being paid to the elimination of static electricity;

- .2 impellers and housing of non-ferrous materials;
- .3 impellers and housing of austenitic stainless steel; and
- .4 ferrous impellers and housing with not less than 13 mm design tip clearance.

Any combination of an aluminium or a 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.

12.1.9 Sufficient spare parts shall be carried for each type of fan on board required by this Chapter.

12.1.10 Protection screens of not more than 13 mm square mesh shall be fitted in outside openings of ventilation ducts.

12.2 Pumprooms and other enclosed spaces normally entered

Pumprooms and other enclosed spaces normally entered which are not covered by 12.1.1 shall be fitted with mechanical ventilation systems, capable of being controlled from outside such spaces and complying with the requirements of 12.1.3, except that the capacity shall not be less than 20 changes of air per hour, based upon the total volume of the space. Provision shall be made to ventilate such spaces prior to personnel entering.

12.3 Spaces not normally entered

Double bottoms, cofferdams, duct keels, pipe tunnels, hold spaces and other spaces where cargo may accumulate shall be capable of being ventilated to ensure a safe environment when entry into the spaces is necessary. Where a permanent ventilation system is not provided for such spaces, approved means of portable mechanical ventilation shall be provided. Where necessary, owing to the arrangement of spaces, for instance hold spaces, essential ducting for ventilation shall be permanently installed. For permanent installations the capacity of eight air changes per hour shall be provided and for portable systems the capacity of 16 air changes per hour. Fans or blowers shall be clear of personnel access openings, and shall comply with 12.1.8.

Chapter 13

Instrumentation

13.1 Gauging

13.1.1 Cargo tanks shall be fitted with one of the following types of gauging devices:

- .1 *Open device* - which makes use of an opening in the tanks and may expose the gauger to the cargo or its vapour. An example of this is the ullage opening.
- .2 *Restricted device* - which penetrates the tank and which, when in use, permits a small quantity of cargo vapour or liquid to be exposed to the atmosphere. When not in use, the device is completely closed. The design shall ensure that no dangerous escape of tank contents (liquid or spray) can take place in opening the device.
- .3 *Closed device* - which penetrates the tank, but which is part of a closed system and keeps tank contents from being released. Examples are the float-type systems, electronic probe, magnetic probe and protected sight-glass. Alternatively, an *indirect device* which does not penetrate the tank shell and which is independent of the tank may be used. Examples are weighing of cargo, pipe flow meter.

13.1.2 Gauging devices shall be independent of the equipment required under 15.19.

13.1.3 Open gauging and restricted gauging shall be allowed only where:

- .1 open venting is allowed by the Code; or
- .2 means are provided for relieving tank pressure before the gauge is operated.

13.1.4 Types of gauging for individual products are shown in *column j* in the table of Chapter 17.

13.2 Vapour detection

13.2.1 Ships carrying toxic or flammable products or both 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.

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

13.2.3 When toxic-vapour-detection equipment is not available for some products which require such detection, as indicated in *column k* in the table of Chapter 17, the Administration may exempt the ship from the requirement, provided an appropriate entry is made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk. When granting such an exemption, the Administration shall recognize the necessity for additional breathing-air supply

and an entry shall be made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk drawing attention to the provisions of 14.2.4 and 16.4.2.2.

13.2.4 Vapour-detection requirements for individual products are shown in *column k* in the table of Chapter 17.

Chapter 14

Personnel protection

14.1 Protective equipment

14.1.1 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.

14.1.2 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. The Administration may, however, approve storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.

14.1.3 Protective equipment shall be used in any operation, which may entail danger to personnel.

14.2 Safety equipment

14.2.1 Ships carrying cargoes for which 15.12, 15.12.1 or 15.12.3 is listed in *column o* in the table of Chapter 17 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 min. Such equipment shall be in addition to that required by regulation II-2/17 of the 1983 SOLAS amendments.

14.2.2 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.

14.2.3 For the safety equipment required in 14.2.1, all ships shall carry 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 air bottles for the breathing apparatus; or

- .4 fully charged spare air bottles with a total free air capacity of at least 6,000 litres for each breathing apparatus on board in excess of the requirements of regulation II-2/17 of the 1983 SOLAS amendments.

14.2.4 A cargo pumproom on ships carrying cargoes which are subject to the requirements of 15.18 or cargoes for which in *column k* in the table of Chapter 17 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 14.2.1. 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 gas-dangerous space for at least 1 h without using the air bottles of the breathing apparatus. Means shall be provided for recharging the fixed air bottles and the 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.

14.2.5 At least one set of safety equipment as required by 14.2.2 shall be kept in a suitable clearly marked locker in a readily accessible place near the cargo pumproom. The other sets of safety equipment shall also be kept in suitable, clearly marked, easily accessible places.

14.2.6 The breathing apparatus shall be inspected at least once a month by a responsible officer, and the inspection recorded in the ship's log-book. The equipment shall be inspected and tested by an expert at least once a year.

14.3 Emergency equipment

14.3.1 Ships carrying cargoes, for which "Yes" is indicated in *column n* of Chapter 17, shall be provided with suitable respiratory and eye protection sufficient for every person on board for emergency escape purposes, subject to the following:

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

14.3.2 The ship shall have on board medical first-aid equipment, including oxygen resuscitation equipment and antidotes for cargoes to be carried, based on the guidelines developed by the Organization*.

* Reference is made to 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.

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

14.3.4 Suitably marked decontamination showers and an eyewash shall be available on deck in convenient locations. The showers and eyewash shall be operable in all ambient conditions.

Chapter 15

Special requirements

15.1 The provisions of this chapter are applicable where specific reference is made in *column o* in the table of Chapter 17. These requirements are additional to the general requirements of the Code.

15.2 Ammonium nitrate solution (93% or less)

15.2.1 The ammonium nitrate solution shall contain at least 7% by weight of water. The acidity (pH) of the cargo when diluted with ten parts of water to one part of cargo by weight shall be between 5.0 and 7.0. The solution shall not contain more than 10 ppm chloride ions, 10 ppm ferric ions, and shall be free of other contaminants.

15.2.2 Tanks and equipment for ammonium nitrate solution shall be independent of tanks and equipment containing other cargoes or combustible products. Equipment which may, in service or when defective, release combustible products into the cargo, e.g. lubricants, shall not be used. Tanks shall not be used for seawater ballast.

15.2.3 Except where expressly approved by the Administration, ammonium nitrate solutions shall not be transported in tanks which have previously contained other cargoes unless tanks and associated equipment have been cleaned to the satisfaction of the Administration.

15.2.4 The temperature of the heat-exchanging medium in the tank heating system shall not exceed 160°C. The heating system shall be provided with a control system to keep the cargo at a bulk mean temperature of 140°C. High-temperature alarms at 145°C and 150°C and a low-temperature alarm at 125°C shall be provided. Where the temperature of the heat-exchanging medium exceeds 160°C, an alarm shall also be given. Temperature alarms and controls shall be located on the navigating bridge.

15.2.5 If the bulk mean cargo temperature reaches 145°C, a cargo sample shall be diluted with ten parts of distilled or demineralized water to one part of cargo by weight and the pH shall be determined by means of a narrow-range indicator paper or stick. Acidity measurements shall then be taken every 24 hours. If the pH is found to be below 4.2, ammonia gas shall be injected into the cargo until the pH of 5.0 is reached.

15.2.6 A fixed installation shall be provided to inject ammonia gas into the cargo. Controls for this system shall be located on the navigation bridge. For this purpose, 300 kg of ammonia per 1,000 tonnes of ammonium nitrate solution shall be available on board.

15.2.7 Cargo pumps shall be of the centrifugal deepwell type or of the centrifugal type with water-flushed seals.

15.2.8 Vent piping shall be fitted with approved weatherhoods to prevent clogging. Such weatherhoods shall be accessible for inspection and cleaning.

15.2.9 Hot work on tanks, piping and equipment which have been in contact with ammonium nitrate solution shall only be done after all traces of ammonium nitrate have been removed, inside as well as outside.

15.3 Carbon disulphide

Carbon disulphide may be carried either under a water pad or under a suitable inert gas pad as specified in the following paragraphs.

Carriage under water pad

15.3.1 Provision shall be made to maintain a water pad in the cargo tank during loading, unloading and transit. In addition, an inert-gas pad shall be maintained in the ullage space during transit.

15.3.2 All openings shall be in the top of the tank, above the deck.

15.3.3 Loading lines shall terminate near the bottom of the tank.

15.3.4 A standard ullage opening shall be provided for emergency sounding.

15.3.5 Cargo piping and vent lines shall be independent of piping and vent lines used for other cargo.

15.3.6 Pumps may be used for discharging cargo, provided they are of the deepwell or hydraulically driven submersible types. The means of driving a deepwell pump shall not present a source of ignition for carbon disulphide and shall not employ equipment that may exceed a temperature of 80°C.

15.3.7 If a cargo discharge pump is used, it shall be inserted through a cylindrical well extending from the tank top to a point near the tank bottom. A water pad shall be formed in this well before attempting pump removal unless the tank has been certified as gas-free.

15.3.8 Water or inert-gas displacement may be used for discharging cargo, provided the cargo system is designed for the expected pressure and temperature.

15.3.9 Safety relief valves shall be of stainless steel construction.

15.3.10 Because of its low ignition temperature and close clearances required to arrest its flame propagation, only intrinsically safe systems and circuits are permitted in the hazardous locations described in 10.2.3.

Carriage under suitable inert gas pad

15.3.11 Carbon disulphide shall be carried in independent tanks with a design pressure of not less than 0.06 MPa gauge.

15.3.12 All openings shall be located on the top of the tank, above the deck.

15.3.13 Gaskets used in the containment system shall be of a material which does not react with, or dissolve in, carbon disulphide.

15.3.14 Threaded joints shall not be permitted in the cargo containment system, including the vapour lines.

15.3.15 Prior to loading, the tank(s) shall be inerted with suitable inert gas until the oxygen level is 2% by volume or lower. Means shall be provided to automatically maintain a positive pressure in the tank using suitable inert gas during loading, transport and discharge. The system shall be able to maintain this positive pressure between 0.01 and 0.02 MPa, and shall be remotely monitored and fitted with over/underpressure alarms.

15.3.16 Hold spaces surrounding an independent tank carrying carbon disulphide shall be inerted by a suitable inert gas until the oxygen level is 2% or less. Means shall be provided to monitor and maintain this condition throughout the voyage. Means shall also be provided to sample these spaces for carbon disulphide vapour.

15.3.17 Carbon disulphide shall be loaded, transported and discharged in such a manner that venting to the atmosphere does not occur. If carbon disulphide vapour is returned to shore during loading or to the ship during discharge, the vapour return system shall be independent of all other containment systems.

15.3.18 Carbon disulphide shall be discharged only by submerged deepwell pumps or by a suitable inert gas displacement. The submerged deepwell pumps shall be operated in a way that prevents heat build-up in the pump. The pump shall also be equipped with a temperature sensor in the pump housing with remote readout and alarm in the cargo control room. The alarm shall be set at 80°C. The pump shall also be fitted with an automatic shut-down device to be activated if the tank pressure falls below atmospheric pressure during the discharge.

15.3.19 Air shall not be allowed to enter the cargo tank, cargo pump or lines while carbon disulphide is contained in the system.

15.3.20 No other cargo handling, tank cleaning or deballasting shall take place concurrent with loading or discharge of carbon disulphide.

15.3.21 A water spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling and the tank domes. The arrangement of piping and nozzles shall be such as to give an uniform distribution rate of 10 l/m²/min. Remote manual operation shall 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 temperature permits, shall be connected ready for immediate use during loading and unloading operations.

15.3.22 No cargo tanks shall be more than 98% liquid-full at the reference temperature (R).

15.3.23 The maximum volume (V_L) of cargo to be loaded in a tank shall be:

$$V_L = 0.98 V \frac{\rho_R}{\rho_L}$$

where:

- V = volume of the tank
- ρ_R = density of cargo at the reference temperature (R)
- ρ_L = density of cargo at the loading temperature
- R = reference temperature

15.3.24 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 approved by the Administration. A copy of the list shall be permanently kept on board by the master.

15.3.25 Zones on open deck, or semi-enclosed spaces on open deck within three metres of a tank outlet, gas or vapour outlet, cargo pipe flange or cargo valve of a tank certified to carry carbon disulphide, shall comply with the electrical equipment requirements specified for carbon disulphide in *column i*, Chapter 17. Also, within the specified zone, no other heat sources, like steam piping with surface temperatures in excess of 80°C shall be allowed.

15.3.26 Means shall be provided to ullage and sample the cargo without opening the tank or disturbing the positive suitable inert gas blanket.

15.3.27 The product shall be transported only in accordance with a cargo handling plan that has been approved by the Administration. Cargo handling plans shall show the entire cargo piping system. A copy of the approved cargo handling plan shall be available on board. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be endorsed to include reference to the approved cargo handling plan.

15.4 Diethyl ether

15.4.1 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.

15.4.2 Pressure-relief-valve settings shall not be less than 0.02 MPa gauge for gravity tanks.

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

15.4.4 In view of the fire hazard, provision shall be made to avoid any ignition source or heat generation or both in the cargo area.

15.4.5 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 hydraulically operated submerged type and are suitable for use with the cargo.

15.4.6 Provision shall be made to maintain the inert-gas pad in the cargo tank during loading, unloading and transit.

15.5 Hydrogen peroxide solutions

15.5.1 Hydrogen peroxide solutions over 60% but not over 70% by mass

15.5.1.1 Hydrogen peroxide solutions over 60% but not over 70% by mass shall be carried in dedicated ships only and no other cargoes shall be carried.

15.5.1.2 Cargo tanks and associated equipment shall be either pure aluminium (99.5%) or solid stainless steel (304L, 316, 316L or 316Ti), and passivated in accordance with approved procedures. Aluminium shall not be used for piping on deck. All nonmetallic materials of construction for the containment system shall neither be attacked by hydrogen peroxide nor contribute to its decomposition.

15.5.1.3 Pumprooms shall not be used for cargo-transfer operations.

15.5.1.4 Cargo tanks shall be separated by cofferdams from oil fuel tanks or any other space containing flammable or combustible materials.

15.5.1.5 Tanks intended for the carriage of hydrogen peroxide shall not be used for seawater ballast.

15.5.1.6 Temperature sensors shall be installed at the top and bottom of the tank. Remote temperature readouts and continuous monitoring shall be located on the navigating bridge. If the temperature in the tanks rises above 35°C, visible and audible alarms shall be activated on the navigating bridge.

15.5.1.7 Fixed oxygen monitors (or gas-sampling lines) shall be provided in void spaces adjacent to tanks to detect leakage of the cargo into these spaces. Remote readouts, continuous monitoring (if gas-sampling lines are used, intermittent sampling is satisfactory) and visible and audible alarms similar to those for the temperature sensors shall also be located on the navigating bridge. The visible and audible alarms shall be activated if the oxygen concentration in these void spaces exceeds 30% by volume. Two portable oxygen monitors shall also be available as back-up systems.

15.5.1.8 As a safeguard against uncontrolled decomposition, a cargo-jettisoning system shall be installed to discharge the cargo overboard. The cargo shall be jettisoned if the temperature rise of the cargo exceeds a rate of 2°C per hour over a 5-hour period or when the temperature in the tank exceeds 40°C.

15.5.1.9 Cargo tank venting systems shall have pressure/vacuum-relief valves for normal controlled venting, and rupture discs or a similar device for emergency venting, should tank pressure rise rapidly as a result of uncontrolled decomposition. Rupture discs shall be sized on the basis of tank design pressure, tank size and anticipated decomposition rate.

15.5.1.10 A fixed water-spray system shall be provided for diluting and washing away any concentrated hydrogen peroxide solution spilled on deck. The areas covered by the water-spray shall include the manifold/hose connections and the tank tops of those tanks designated for carrying hydrogen peroxide solutions. The minimum application rate shall satisfy the following criteria:

- .1 The product shall be diluted from the original concentration to 35% by mass within 5 minutes of the spill.
- .2 The rate and estimated size of the spill shall be based upon maximum anticipated loading and discharge rates, the time required to stop flow of cargo in the event of tank overfill or a piping/hose failure, and the time necessary to begin application of dilution water with actuation at the cargo control location or on the navigating bridge.

15.5.1.11 Only those hydrogen peroxide solutions which have a maximum decomposition rate of 1% per year at 25°C shall be carried. Certification from the shipper that the product meets this standard shall be presented to the master and kept on board. A technical representative of the manufacturer shall be on board to monitor the transfer operations and have the capability to test the stability of the hydrogen peroxide. He shall certify to the master that the cargo has been loaded in a stable condition.

15.5.1.12 Protective clothing that is resistant to hydrogen peroxide solutions shall be provided for each crew member involved in cargo-transfer operations. Protective clothing shall include nonflammable coveralls, suitable gloves, boots and eye protection.

15.5.2 *Hydrogen peroxide solutions over 8% but not over 60% by mass*

15.5.2.1 The ship's shell plating shall not form any boundaries of tanks containing this product.

15.5.2.2 Hydrogen peroxide shall be carried in tanks thoroughly and effectively cleaned of all traces of previous cargoes and their vapours or ballast. Procedures for inspection, cleaning, passivation and loading of tanks shall be in accordance with MSC/Circ. 394. A certificate shall be on board the vessel indicating that the procedures in the circular have been followed. The passivation requirement may be waived by an Administration for domestic shipments of short duration. Particular care in this respect is essential to ensure the safe carriage of hydrogen peroxide:

- .1 When hydrogen peroxide is carried no other cargoes shall be carried simultaneously.
- .2 Tanks which have contained hydrogen peroxide may be used for other cargoes after cleaning in accordance with the procedures outlined in MSC/Circ. 394.
- .3 Consideration in design shall provide minimum internal tank structure, free draining, no entrapment and ease of visual inspection.

15.5.2.3 Cargo tanks and associated equipment shall be either pure aluminium (99.5%) or solid stainless steel of types suitable for use with hydrogen peroxide (e.g. 304, 304L, 316, 316L, 316Ti). Aluminium shall not be used for piping on deck. All nonmetallic materials of construction for the containment system shall neither be attacked by hydrogen peroxide nor contribute to its decomposition.

15.5.2.4 Cargo tanks shall be separated by a cofferdam from fuel oil tanks or any other space containing materials incompatible with hydrogen peroxide.

15.5.2.5 Temperature sensors shall be installed at the top and bottom of the tank. Remote temperature readouts and continuous monitoring shall be located on the navigating bridge. If the temperature in the tank rises above 35°C, visible and audible alarms shall activate on the navigating bridge.

15.5.2.6 Fixed oxygen monitors (or gas-sampling lines) shall be provided in void spaces adjacent to tanks to detect leakage of the cargo into these spaces. The enhancement of flammability by oxygen enrichment shall be recognized. Remote readouts, continuous monitoring (if gas-sampling lines are used, intermittent sampling is satisfactory) and visible and audible alarms similar to those for the temperature sensors shall also be located on the navigating bridge. The visible and audible alarms shall activate if the oxygen concentration in these void spaces exceeds 30% by volume. Two portable oxygen monitors shall also be available as back-up systems.

15.5.2.7 As a safeguard against uncontrolled decomposition, a cargo-jettisoning system shall be installed to discharge the cargo overboard. The cargo shall be jettisoned if the temperature rise of the cargo exceeds a rate of 2°C per hour over a 5-hour period or when the temperature in the tank exceeds 40°C.

15.5.2.8 Cargo tank venting systems with filtration shall have pressure/vacuum-relief valves for normal controlled venting, and a device for emergency venting, should tank pressure rise rapidly as a result of an uncontrolled decomposition rate, as stipulated in 15.5.2.7. These venting systems shall be designed in such a manner that there is no introduction of seawater into the cargo tank even under heavy sea conditions. Emergency venting shall be sized on the basis of tank design pressure and tank size.

15.5.2.9 A fixed water-spray system shall be provided for diluting and washing away any concentrated solution spilled on deck. The areas covered by the water-spray shall include the manifold/hose connections and the tank tops of those tanks designated for the carriage of hydrogen peroxide solutions. The minimum application rate shall satisfy the following criteria:

- .1 The product shall be diluted from the original concentration to 35% by mass within 5 minutes of the spill.
- .2 The rate and estimated size of the spill shall be based upon maximum anticipated loading and discharge rates, the time required to stop flow of the cargo in the event of tank overfill or a piping/hose failure, and the time necessary to begin application of dilution water with actuation at the cargo control location or on the navigating bridge.

15.5.2.10 Only those hydrogen peroxide solutions which have a maximum decomposition rate of 1% per year at 25°C shall be carried. Certification from the shipper that the product meets this standard shall be presented to the master and kept on board. A technical representative of the manufacturer shall be on board to monitor the transfer operations and have the capability to test the stability of the hydrogen peroxide. He shall certify to the master that the cargo has been loaded in a stable condition.

15.5.2.11 Protective clothing that is resistant to hydrogen peroxide shall be provided for each crew member involved in cargo-transfer operations. Protective clothing shall include coveralls that are nonflammable, suitable gloves, boots and eye protection.

15.5.2.12 During transfer of hydrogen peroxide the related piping system shall be separated from all other systems. Cargo hoses used for transfer of hydrogen peroxide shall be marked "FOR HYDROGEN PEROXIDE TRANSFER ONLY".

15.5.3 Procedures for inspection, cleaning, passivation and loading of tanks for the carriage of hydrogen peroxide solutions 8-60%, which have contained other cargoes, or for the carriage of other cargoes after the carriage of hydrogen peroxide

15.5.3.1 Tanks having contained cargoes other than hydrogen peroxide shall be inspected, cleaned and passivated before re-use for the transport of hydrogen peroxide solutions. The procedures for inspection and cleaning, as given in paragraphs 15.5.3.2 to 15.5.3.8 below, apply to both stainless steel and pure aluminium tanks (see paragraph 15.5.2.2 of the IBC Code). Procedures for passivation are given in paragraph 15.5.3.9 for stainless steel and 15.5.3.10 for aluminium. Unless otherwise specified, all steps apply to the tanks and to all associated equipment having been in contact with the other cargo.

15.5.3.2 After unloading the previous cargo the tank shall be rendered safe and inspected for any residues, scale and rust.

15.5.3.3 Tanks and associated equipment shall be washed with clean filtered water. The water to be used shall at least have the quality of potable water with a low chlorine content.

15.5.3.4 Trace residues and vapours of the previous cargo shall be removed by steaming of tank and equipment.

15.5.3.5 Tank and equipment are washed again with clean water (quality as above) and dried, using filtered, oil-free air.

15.5.3.6 The atmosphere in the tank shall be sampled and investigated for the presence of organic vapours and oxygen concentration.

15.5.3.7 The tank shall be checked again by visual inspection for residues of the previous cargo, scale and rust as well as for any smell of the previous cargo.

15.5.3.8 If inspection or measurements indicate the presence of residues of the previous cargo or its vapours, actions described in paragraphs 15.5.3.3 to 15.5.3.5 shall be repeated.

15.5.3.9 Tank and equipment made from stainless steel which have contained other cargoes than hydrogen peroxide or which have been under repair shall be cleaned and passivated, regardless of any previous passivation, according to the following procedure:

- .1 New welds and other repaired parts shall be cleaned and finished using stainless steel wire brush, chisel, sandpaper or buff. Rough surfaces shall be given a smooth finish. A final polishing is necessary.
- .2 Fatty and oily residues shall be removed by the use of appropriate organic solvents or detergent solutions in water. The use of chlorine-containing compounds shall be avoided as they can seriously interfere with passivation.
- .3 The residues of the degreasing agent shall be removed, followed by a washing with water.
- .4 In the next step, scale and rust shall be removed by the application of acid (e.g. a mixture of nitric and hydrofluoric acids), followed again by a washing with clean water.
- .5 All the metal surfaces which can come into contact with hydrogen peroxide shall be passivated by the application of nitric acid of a concentration between 10 and 35% by mass. The nitric acid must be free from heavy metals, other oxidizing agents or hydrogen fluoride. The passivation process shall continue for 8 to 24 hours, depending upon the concentration of acid, the ambient temperature and other factors. During this time a continuous contact between the surfaces to be passivated and the nitric acid shall be ensured. In the case of large surfaces this may be achieved by recirculating the acid. Hydrogen gas may be evolved in the passivation process, leading to the presence of an explosive atmosphere in the tanks. Therefore, appropriate measures must be taken to avoid the build-up or the ignition of such an atmosphere.
- .6 After passivation the surfaces shall be thoroughly washed with clean filtered water. The washing process shall be repeated until the effluent water has the same pH value as the incoming water.
- .7 Surfaces treated according to the above steps may cause some decomposition when coming into contact with hydrogen peroxide for the first time. This decomposition will cease after a short time (usually within two or three days). Therefore an additional flushing with hydrogen peroxide for a period of at least two days is recommended.
- .8 Only degreasing agents and acid cleaning agents which have been recommended for this purpose by the manufacturer of the hydrogen peroxide shall be used in the process.

15.5.3.10 Tanks and equipment made from aluminium and which have contained cargoes other than hydrogen peroxide, or which have been under repair, shall be cleaned and passivated. The following is an example of a recommended procedure:

- .1 The tank shall be washed with a solution of a sulphonated detergent in hot water, followed by a washing with water.
- .2 The surface shall then be treated for 15 to 20 minutes with a solution of sodium hydroxide of a concentration of 7% by mass or treated for a longer period with a less concentrated solution (e.g. for 12 hours with 0.4 to 0.5% sodium hydroxide). To prevent excessive corrosion at the bottom of the tank when treating with more concentrated solutions of sodium hydroxide, water shall be added continuously to dilute the sodium hydroxide solution which collects there.
- .3 The tank shall be thoroughly washed with clean, filtered water. As soon as possible after washing, the surface shall be passivated by the application of nitric acid of a concentration between 30 and 35% by mass. The passivation process shall continue for 16 to 24 hours. During this time a continuous contact between the surfaces to be passivated and the nitric acid shall be ensured.
- .4 After passivation the surfaces shall be thoroughly washed with clean, filtered water. The washing process shall be repeated until the effluent water has the same pH value as the incoming water.
- .5 A visual inspection shall be made to ensure that all surfaces have been treated. It is recommended that an additional flushing is carried out for a minimum of 24 hours with dilute hydrogen peroxide solution of a concentration approximately 3% by mass.

15.5.3.11 The concentration and stability of the hydrogen peroxide solution to be loaded shall be determined.

15.5.3.12 The hydrogen peroxide is loaded under intermittent visual supervision of the interior of the tank from an appropriate opening.

15.5.3.13 If substantial bubbling is observed which does not disappear within 15 minutes after the completion of loading, the contents of the tank shall be unloaded and disposed of in an environmentally safe manner. The tank and equipment shall then be repassivated as described above.

15.5.3.14 The concentration and stability of the hydrogen peroxide solution shall be determined again. If the same values are obtained within the limits of error as in paragraph 15.5.3.10, the tank is considered to be properly passivated and the cargo ready for shipment.

15.5.3.15 Actions described in paragraphs 15.5.3.2 to 15.5.3.8 shall be carried out under the supervision of the master or shipper. Actions described in paragraphs 15.5.3.9 to 15.5.3.15 shall be carried out under the on-site supervision and responsibility of a representative of the hydrogen peroxide manufacturer or under supervision and responsibility of another person familiar with the safety-relevant properties of hydrogen peroxide.

15.5.3.16 The following procedure shall be applied when tanks having contained hydrogen peroxide solution are to be used for other products (unless otherwise specified, all steps apply to the tanks and to all associated equipment having been in contact with hydrogen peroxide):

- .1 Hydrogen peroxide cargo residue shall be drained as completely as possible from tanks and equipment.
- .2 Tanks and equipment shall be rinsed with clean water, and subsequently thoroughly washed with clean water.
- .3 The interior of the tank shall be dried and inspected for any residues.

Steps .1 to .3, in 15.5.3.16, shall be carried out under the supervision of the master or the shipper. Step .3 in paragraph 15.5.3.16 shall be carried out by a person familiar with the safety-relevant properties of the chemical to be transported and of hydrogen peroxide.

- SPECIAL CAUTIONS :
- 1 Hydrogen peroxide decomposition may enrich the atmosphere with oxygen and appropriate precautions shall be observed.
 - 2 Hydrogen gas may be evolved in the passivation processes described in paragraphs 15.5.3.9.5, 15.5.3.10.2 and 15.5.3.10.4, leading to the presence of an explosive atmosphere in the tank. Therefore, appropriate measures must be taken to avoid the build-up or the ignition of such an atmosphere.

15.6 Motor fuel anti-knock compounds (containing lead alkyls)

15.6.1 Tanks used for these cargoes shall not be used for the transportation of any other cargo except those commodities to be used in the manufacture of motor fuel anti-knock compounds containing lead alkyls.

15.6.2 If a cargo pumproom is located on deck level according to 15.18, the ventilation arrangements shall be in compliance with 15.17.

15.6.3 Entry into cargo tanks used for the transportation of these cargoes is not permitted unless approved by the Administration.

15.6.4 Air analysis shall be made for lead content to determine if the atmosphere is satisfactory prior to allowing personnel to enter the cargo pumproom or void spaces surrounding the cargo tank.

15.7 Phosphorus, yellow or white

15.7.1 Phosphorus shall, at all times, be loaded, carried and discharged under a water pad of 760 mm minimum depth. During discharge operations, arrangements shall be made to ensure that water occupies the volume of phosphorus discharged. Any water discharged from a phosphorus tank shall be returned only to a shore installation.

15.7.2 Tanks shall be designed and tested to a minimum equivalent water head of 2.4 m above the top of the tank, under designed loading conditions, taking into account the depth, relative density and method of loading and discharge of the phosphorus.

15.7.3 Tanks shall be so designed as to minimize the interfacial area between the liquid phosphorus and its water pad.

15.7.4 A minimum ullage space of 1% shall be maintained above the water pad. The ullage space shall be filled with inert gas or naturally ventilated by two cowled standpipes terminating at different heights but at least 6 m above the deck and at least 2 m above the pump-house top.

15.7.5 All openings shall be at the top of cargo tanks, and fittings and joints attached thereto shall be of materials resistant to phosphorus pentoxide.

15.7.6 Phosphorus shall be loaded at a temperature not exceeding 60°C.

15.7.7 Tank heating arrangements shall be external to tanks and have a suitable method of temperature control to ensure that the temperature of the phosphorus does not exceed 60°C. A high-temperature alarm shall be fitted.

15.7.8 A water drench system acceptable to the Administration shall be installed in all void spaces surrounding the tanks. The system shall operate automatically in the event of an escape of phosphorus.

15.7.9 Void spaces referred to in 15.7.8 shall be provided with effective means of mechanical ventilation which shall be capable of being sealed off quickly in an emergency.

15.7.10 Loading and discharge of phosphorus shall be governed by a central system on the ship which, in addition to incorporating high-level alarms, shall ensure that no overflow of tanks is possible and that such operations can be stopped quickly in an emergency from either ship or shore.

15.7.11 During cargo transfer, a water hose on deck shall be connected to a water supply and kept flowing throughout the operation so that any spillage of phosphorus may be washed down with water immediately.

15.7.12 Ship-to-shore loading and discharge connections shall be of a type approved by the Administration.

15.8 Propylene oxide and mixtures of ethylene oxide/propylene oxide with an ethylene oxide content of not more than 30% by mass

15.8.1 Products transported under the provisions of this section shall be acetylene-free.

15.8.2 Unless cargo tanks are properly cleaned, these products shall not be carried in tanks which have contained as one of the three previous cargoes any products known to catalyse polymerization, such as:

- .1 mineral acids (e.g. sulphuric, hydrochloric, nitric);
- .2 carboxylic acids and anhydrides (e.g. formic, acetic);
- .3 halogenated carboxylic acids (e.g. chloracetic);

- .4 sulphonic acids (e.g. benzenesulphonic);
- .5 caustic alkalis (e.g. sodium hydroxide, potassium hydroxide);
- .6 ammonia and ammonia solutions;
- .7 amines and amine solutions;
- .8 oxidizing substances.

15.8.3 Before loading, tanks shall be thoroughly and effectively cleaned, to remove all traces of previous cargoes from tanks and associated pipework, except where the immediately prior cargo has been propylene oxide or ethylene oxide/propylene oxide mixtures. Particular care shall be taken in the case of ammonia in tanks made of steel other than stainless steel.

15.8.4 In all cases, the effectiveness of cleaning procedures for tanks and associated pipework shall be checked by suitable testing or inspection, to ascertain that no traces of acidic or alkaline materials remain that might create a hazardous situation in the presence of these products.

15.8.5 Tanks shall be entered and inspected prior to each initial loading of these products to ensure freedom from contamination, heavy rust deposits and visible structural defects. When cargo tanks are in continuous service for these products, such inspections shall be performed at intervals of not more than two years.

15.8.6 Tanks for the carriage of these products shall be of steel or stainless steel construction.

15.8.7 Tanks for the carriage of these products may be used for other cargoes after thorough cleaning of tanks and associated pipework systems by washing or purging.

15.8.8 All valves, flanges, fittings and accessory equipment shall be of a type suitable for use with the products and shall be constructed of steel or stainless steel in accordance with recognized standards. Discs or disc faces, seats and other wearing parts of valves shall be made of stainless steel containing not less than 11% chromium.

15.8.9 Gaskets shall be constructed of materials which do not react with, dissolve in, or lower the autoignition 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, may be accepted.

15.8.10 Insulation and packing, if used, shall be of a material which does not react with, dissolve in, or lower the autoignition temperature of these products.

15.8.11 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 by the Administration:

- .1 neoprene or natural rubber, if it comes into contact with the products.
- .2 asbestos, or binders used with asbestos.

- .3 materials containing oxides of magnesium, such as mineral wools.
- 15.8.12 Threaded joints shall not be permitted in the cargo liquid and vapour lines.
- 15.8.13 Filling and discharge piping shall extend to within 100 mm of the bottom of the tank or any sump pit.
- 15.8.14.1 The containment system for a tank containing these products shall have a valved vapour-return connection.
- 15.8.14.2 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 containment system for the product shall be independent of all other containment systems.
- 15.8.14.3 During discharge operations, the pressure in the cargo tank must be maintained above 0.007 MPa gauge.
- 15.8.15 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 product does not heat significantly if the discharge line from the pump is shut off or otherwise blocked.
- 15.8.16 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 atmosphere.
- 15.8.17 Cargo hoses used for transfer of these products shall be marked "FOR ALKYLENE OXIDE TRANSFER ONLY".
- 15.8.18 Cargo tanks, void spaces and other enclosed spaces adjacent to an integral gravity cargo tank carrying propylene oxide shall either contain a compatible cargo (those cargoes specified in 15.8.2 are examples of substances considered incompatible) or be inerted by injection of a suitable inert gas. Any hold space in which an independent cargo tank is located shall be inerted. Such inerted spaces and tanks shall be monitored for these products and oxygen. The oxygen content of these spaces shall be maintained below 2%. Portable sampling equipment is satisfactory.
- 15.8.19 In no case shall air be allowed to enter the cargo pump or piping system while these products are contained within the system.
- 15.8.20 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.
- 15.8.21 Propylene oxide may be carried in pressure tanks or in independent or integral gravity tanks. Ethylene oxide/propylene oxide mixtures shall be carried in independent gravity tanks or pressure tanks. Tanks shall be designed for the maximum pressure expected to be encountered during loading, conveying and discharging cargo.

15.8.22.1 Tanks for the carriage of propylene oxide with a design pressure less than 0.06 MPa gauge and tanks for the carriage of ethylene oxide/propylene oxide mixtures with a design pressure of less than 0.12 MPa gauge shall have a cooling system to maintain the cargo below the reference temperature.

15.8.22.2 The refrigeration requirement for tanks with a design pressure less than 0.06 MPa gauge may be waived by the Administration for ships operating in restricted areas or on voyages of restricted duration, and account may be taken in such cases of any insulation of the tanks. The area and times of year for which such carriage would be permitted shall be included in the conditions of carriage of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

15.8.23.1 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 shall also 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 of the system.

15.8.23.2 An alternative arrangement may consist of three cooling plants, any two of which shall be sufficient to maintain the liquid temperature below the reference temperature.

15.8.23.3 Cooling media which are separated from the products by a single wall only shall be nonreactive with the products.

15.8.23.4 Cooling systems requiring compression of the products shall not be used.

15.8.24 Pressure-relief-valve settings shall not be less than 0.02 MPa gauge and for pressure tanks not greater than 0.7 MPa gauge for the carriage of propylene oxide and not greater than 0.53 MPa gauge for the carriage of propylene oxide/ethylene oxide mixtures.

15.8.25.1 The piping system for tanks to be loaded with these products shall be separated (as defined in 3.1.4) from piping systems for all other tanks, including empty tanks. If the piping system for the tanks to be loaded is not independent (as defined in 1.3.18), the required piping separation shall be accomplished by the removal of spool-pieces, valves, or other pipe section and the installation of blank flanges at these locations. The required separation applies to all liquid and vapour piping, liquid and vapour vent lines and any other possible connections, such as common inert-gas supply lines.

15.8.25.2 These products may be transported only in accordance with cargo-handling plans that have been approved by the Administration. 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. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be endorsed to include reference to the approved cargo-handling plans.

15.8.25.3 Before each initial loading of these products and before every subsequent return to such service, certification verifying that the required piping separation has been achieved shall be obtained from a responsible person acceptable to the port Administration and carried on board the ship. Each connection between a blank flange and a pipeline flange shall be fitted with a wire and seal by the responsible person to ensure that in-advertent removal of the blank flange is impossible.

15.8.26.1 No cargo tanks shall be more than 98% liquid-full at the reference temperature.

15.8.26.2 The maximum volume to which a cargo tank shall be loaded is:

$$V_L = 0.98V \frac{\rho_R}{\rho_L}$$

Where V_L = maximum volume to which the tank may be loaded

V = volume of the tank

ρ_R = density of cargo at the reference temperature

ρ_L = density of cargo at the loading temperature and pressure

15.8.26.3 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 Administration. A copy of the list shall be permanently kept on board by the master.

15.8.27 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 0.007 MPa 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 commercially pure quality (99.9% by volume) shall be used for padding. A battery of nitrogen bottles connected to the cargo tanks through a pressure-reduction valve satisfies the intention of the expression “automatic” in this context.

15.8.28 The cargo tank vapour space shall be tested prior to and after loading to ensure that the oxygen content is 2% by volume or less.

15.8.29 A water-spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling, and the tank domes. The arrangement of piping and nozzles shall be such as to give a uniform distribution rate of 10 l/m²/min. Remote manual operation shall 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.

15.8.30 A remotely operated, controlled closing-rate, shutoff valve shall be provided at each cargo-hose connection used during cargo transfer.

15.9 Sodium chlorate solution (50% or less by mass)

15.9.1 Tanks and associated equipment, which have contained this product may be used for other cargoes after thorough cleaning by washing or purging.

15.9.2 In the event of spillage of this product, all spilled liquid shall be thoroughly washed away without delay. To minimize fire risk, spillage shall not be allowed to dry out.

15.10 Sulphur (molten)

15.10.1 Cargo tank ventilation shall be provided to maintain the concentration of hydrogen sulphide below one half of its lower explosive limit through-out the cargo tank vapour space for all conditions of carriage, i.e. below 1.85% by volume.

15.10.2 Where mechanical ventilation systems are used for maintaining low gas concentrations in cargo tanks, an alarm system shall be provided to give warning if the system fails.

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

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

15.10.5 Connections shall be provided to permit sampling and analysing of vapour in void spaces.

15.10.6 Cargo temperature controls shall be provided to ensure that the temperature of the sulphur does not exceed 155°C.

15.10.7 Sulphur (molten) has a flashpoint above 60°C ; however, electrical equipment shall be certified safe for gases evolved

15.11 Acids

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

15.11.2 Proposals for lining steel tanks and related piping systems with corrosion-resistant materials may be considered by the Administration. The elasticity of the lining shall not be less than that of the supporting boundary plating.

15.11.3 Unless constructed wholly of corrosion-resistant materials or fitted with an approved lining, the plating thickness shall take into account the corrosivity of the cargo.

15.11.4 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; and in addition, drip trays shall also be provided to guard against leakage on to the deck.

15.11.5 Because of the danger of evolution of hydrogen when these substances are being carried, the electrical arrangements shall comply with 10.4. The certified safe type equipment shall be suitable for use in hydrogen/air mixtures. Other sources of ignition shall not be permitted in such spaces.

15.11.6 Substances subjected to the requirements of this section shall be segregated from oil fuel tanks, in addition to the segregation requirements in 3.1.1.

15.11.7 Provision shall be made for suitable apparatus to detect leakage of cargo into adjacent spaces.

15.11.8 The cargo pumproom bilge pumping and drainage arrangements shall be of corrosion-resistant materials.

15.12 Toxic products

15.12.1 Exhaust openings of tank vent systems shall be located:

- .1 at a 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;
- .2 not less than 6 m above the fore-and-aft gangway, if fitted within 6 m of the gangway;
- .3 15 m from any opening or air intake to any accommodation and service spaces; and
- .4 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/air mixture upwards in an unimpeded jet with an exit velocity of at least 30 m/s, are fitted.

15.12.2 Tank venting systems shall be provided with a connection for a vapour-return line to the shore installation.

15.12.3 Products shall:

- .1 not be stowed adjacent to oil fuel tanks;
- .2 have separate piping systems; and
- .3 have tank vent systems separate from tanks containing nontoxic products.

(See also 3.7.2)

15.12.4 Cargo tank relief-valve settings shall be a minimum of 0.02 MPa gauge.

15.13 Cargoes protected by additives

15.13.1 Certain cargoes with a reference in *column o* in the table of Chapter 17, by the nature of their chemical make-up, tend, under certain conditions of temperature, exposure to air or contact with a catalyst, to undergo polymerization, decomposition, oxidation or other chemical changes. Mitigation of this tendency is carried out by introducing small amounts of chemical additives into the liquid cargo or controlling the cargo tank environment.

15.13.2 Ships carrying these cargoes shall be so designed as to eliminate from the cargo tanks and cargo-handling system any material of construction or contaminants which could act as a catalyst or destroy the inhibitor.

15.13.3 Care shall be taken to ensure that these cargoes are sufficiently protected to prevent deleterious chemical change at all times during the voyage. Ships carrying such cargoes shall be provided with a certificate of protection from the manufacturer, and kept during the voyage, specifying:

- .1 the name and amount of additive present;
- .2 whether the additive is oxygen-dependent;
- .3 date additive was put in the product and duration of effectiveness;
- .4 any temperature limitations qualifying the additives' effective lifetime; and
- .5 the action to be taken shall the length of voyage exceed the effective lifetime of the additives.

15.13.4 Ships using the exclusion of air as the method of preventing oxidation of the cargo shall comply with 9.1.3.

15.13.5 A product containing an oxygen-dependent additive shall be carried without inertion (in tanks of a size not greater than 3,000 m³). Such cargoes shall not be carried in a tank requiring inertion under the requirements of SOLAS Chapter II-2*.

15.13.6 Venting systems shall be of a design that eliminates blockage from polymer build-up. Venting equipment shall be of a type that can be checked periodically for adequacy of operation.

15.13.7 Crystallization or solidification of cargoes normally carried in the molten state can lead to depletion of inhibitor in parts of the tank's contents. Subsequent remelting can thus yield pockets of uninhibited liquid, with the accompanying risk of dangerous polymerization. To prevent this, care shall be taken to ensure that at no time are such cargoes allowed to crystallize or solidify, either wholly or partially, in any part of the tank. Any required heating arrangements shall be such as to ensure that in no part of the tank does cargo become overheated to such an

* For Equivalency arrangements for the carriage of styrene monomer, see MSC/Circ.879 and MSC/Circ.879/Corr.1

extent that any dangerous polymerization can be initiated. If the temperature from steam coils would induce overheating, an indirect low-temperature heating system shall be used.

15.14 Cargoes with a vapour pressure greater than 0.1013 MPa absolute at 37.8°C

15.14.1 For a cargo referenced in *column o* in the table of Chapter 17 to this section, a mechanical refrigeration system shall be provided unless the cargo system is designed to withstand the vapour pressure of the cargo at 45°C. Where the cargo system is designed to withstand the vapour pressure of the cargo at 45°C, and no refrigeration system is provided, a notation shall be made in the conditions of carriage on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk to indicate the required relief-valve setting for the tanks.

15.14.2 A mechanical refrigeration system shall maintain the liquid temperature below the boiling temperature at the cargo tank design pressure.

15.14.3 When ships operate in restricted areas and at restricted times of the year, or on voyages of limited duration, the Administration involved may agree to waive requirements for a refrigeration system. A notation of any such agreement, listing geographic area restrictions and times of the year, or voyage duration limitations, shall be included in the conditions of carriage on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

15.14.4 Connections shall be provided for returning expelled gases to shore during loading.

15.14.5 Each tank shall be provided with a pressure gauge which indicates the pressure in the vapour space above the cargo.

15.14.6 Where the cargo needs to be cooled, thermometers shall be provided at the top and bottom of each tank.

15.14.7.1 No cargo tanks shall be more than 98% liquid-full at the reference temperature (R).

15.14.7.2 The maximum volume (V_L) of cargo to be loaded in a tank shall be:

$$V_L = 0.98V \frac{\rho_R}{\rho_L}$$

Where V = volume of the tank

ρ_R = density of cargo at the reference temperature (R)

ρ_L = density of cargo at the loading temperature

R = reference temperature

15.14.7.3 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 approved by the Administration. A copy of the list shall be permanently kept on board by the master.

15.15 Cargoes with low ignition temperature and wide flammability range

Deleted

15.16 Cargo contamination

15.16.1 Where *column o* in the table of Chapter 17 refers to this section, alkaline or acidic materials, such as caustic soda or sulphuric acid, shall not be allowed to contaminate the cargo.

15.16.2 Where *column o* in the table of Chapter 17 refers to this section, water shall not be allowed to contaminate this cargo. In addition, the following provisions apply:

- .1 Air inlets to pressure/vacuum-relief valves of tanks containing the cargo shall be situated at least 2 m above the weather deck.
- .2 Water or steam shall not be used as the heat-transfer media in a cargo temperature control system required by Chapter 7.
- .3 The cargo shall not be carried in cargo tanks adjacent to permanent ballast or water tanks unless the tanks are empty and dry.
- .4 The cargo shall not be carried in tanks adjacent to slop tanks or 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 the cargo. Pipelines from slop tanks or ballast lines shall not pass through tanks containing the cargo unless encased in a tunnel.

15.17 Increased ventilation requirements

For certain products, the ventilation system as described in 12.1.3 shall have a minimum capacity of at least 45 changes of air per hour, based upon the total volume of space. The ventilation system exhaust ducts shall discharge at least 10 m away from openings into accommodation spaces, work areas or other similar spaces, and intakes to ventilation systems, and at least 4 m above the tank deck.

15.18 Special cargo pumproom requirements

For certain products, the cargo pumproom shall be located on the deck level or cargo pumps shall be located in the cargo tank. The Administration may give special consideration to cargo pumprooms below deck.

15.19 Overflow control

15.19.1 The provisions of this section are applicable where specific reference is made in *column o* in the table of Chapter 17, and are in addition to the requirements for gauging devices.

15.19.2 In the event of a power failure on any system essential for safe loading, an alarm shall be given to the operators concerned.

15.19.3 Loading operations shall be terminated at once in the event of any system essential for safe loading becoming inoperative.

15.19.4 Level alarms shall be capable of being tested prior to loading.

15.19.5 The high-level alarm system required under 15.19.6 shall be independent of the overflow-control system required by 15.19.7 and shall be independent of the equipment required by 13.1.

15.19.6 Cargo tanks shall be fitted with a visual and audible high-level alarm which complies with 15.19.1 to 15.19.5 and which indicates when the liquid level in the cargo tank approaches the normal full condition.

15.19.7 A tank overflow-control system required by this section shall:

- .1 come into operation when the normal tank loading procedures fail to stop the tank liquid level exceeding the normal full condition;
- .2 give a visual and audible tank-overflow alarm to the ship's operator; and
- .3 provide an agreed signal for sequential shutdown of onshore pumps or valves or both and of the ship's valves. The signal, as well as the pump and valve shutdown, may be dependent on operator's intervention. The use of shipboard automatic closing valves shall be permitted only when specific approval has been obtained from the Administration and the port State authority concerned.

15.19.8 The loading rate (LR) of the tank shall not exceed:

$$LR = \frac{3600U}{t} (m^3 / h)$$

where U = ullage volume (m³) at operating signal level;

t = time(s) needed from the initiating signal to fully stopping the cargo flow into the tank, being the sum of times needed for each step in sequential operations such as operator's responses to signals, stopping pumps and closing valves;

and shall also take into account the pipeline system design pressure.

15.20 Alkyl (C₇-C₉) nitrates, all isomers

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

15.20.2 The cargo may not be carried in independent pressure vessels permanently affixed to the vessel's deck unless:

- .1 the tanks are sufficiently insulated from fire; and
- .2 the vessel 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 .

15.21 Temperature sensors

Temperature sensors shall be used to monitor the cargopump temperature to detect overheating due to pump failures.

Chapter 16

Operational requirements

16.1 Maximum allowable quantity of cargo per tank

16.1.1 The quantity of a cargo required to be carried in a type 1 ship shall not exceed 1,250 m³ in any one tank.

16.1.2 The quantity of cargo required to be carried in a type 2 ship shall not exceed 3,000 m³ in any one tank.

16.1.3 Tanks carrying liquids at ambient temperatures shall be so loaded as to avoid the tank becoming liquid-full during the voyage, having due regard to the highest temperature which the cargo may reach.

16.2 Cargo information

16.2.1 A copy of this Code, or national regulations incorporating the provisions of this Code, shall be on board every ship covered by this Code.

16.2.2 Any cargo offered for bulk shipment shall be indicated in the shipping documents by the name, under which it is listed in the Code or under which it has been provisionally assessed. Where the cargo is a mixture, an analysis indicating the dangerous components contributing significantly to the total hazard of the product shall be provided, or a complete analysis if this is available. Such an analysis shall be certified by the manufacturer or by an independent expert acceptable to the Administration.

16.2.3 Information shall be on board, and available to all concerned, giving the necessary data for the safe carriage of the cargo in bulk. Such information shall 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 stabilized or inhibited, the cargo shall be refused if the certificate required by these paragraphs is not supplied.

16.2.4 If sufficient information, necessary for the safe transportation of the cargo, is not available, the cargo shall be refused.

16.2.5 Cargoes which evolve highly toxic imperceptible vapours shall not be transported unless perceptible additives are introduced into the cargo.

16.2.6 Where *column o* in the table of Chapter 17 refers to this paragraph, the cargo's viscosity at 20°C shall be specified on a shipping document, and if the cargo's viscosity exceeds 50 mPa.s at 20°C, the temperature at which the cargo has a viscosity of 50 mPa.s shall be specified in the shipping document.

16.2.7 Deleted

16.2.8 Deleted

16.2.9 Where *column o* in the table of Chapter 17 refers to this paragraph, the cargo's melting point shall be indicated in the shipping document.

16.3 Personnel training

16.3.1 All personnel shall be adequately trained in the use of protective equipment and have basic training in the procedures appropriate to their duties necessary under emergency conditions.

16.3.2 Personnel involved in cargo operations shall be adequately trained in handling procedures.

16.3.3 Officers shall be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo and a sufficient number of them shall be instructed and trained in essential first aid for cargoes carried, based on the guidelines developed by the Organization*.

16.4 Opening of and entry into cargo tanks

16.4.1 During handling and carriage of cargoes producing flammable and/or toxic vapours or when ballasting after the discharge of such cargo, or when loading or unloading cargo, cargo tank lids shall always be kept closed. With any hazardous cargo, cargo tank lids, ullage and sighting ports and tank washing access covers shall be open only when necessary.

16.4.2 Personnel shall not enter cargo tanks, void spaces around such tanks, cargo-handling spaces or other enclosed spaces unless:

- .1 the compartment is free of toxic vapours and not deficient in oxygen; or
- .2 personnel wear breathing apparatus and other necessary protective equipment, and the entire operation is under the close supervision of a responsible officer.

16.4.3 Personnel shall not enter such spaces when the only hazard is of a purely flammable nature, except under the close supervision of a responsible officer.

* Refer to 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 and to the relevant provisions of the STCW Code, parts A and B.

16.5 Stowage of cargo samples

16.5.1 Samples which have to be kept on board shall be stowed in a designated space situated in the cargo area or, exceptionally, elsewhere, subject to the approval of the Administration.

16.5.2 The stowage space shall be:

- .1 cell-divided in order to avoid shifting of the bottles at sea;
- .2 made of material fully resistant to the different liquids intended to be stowed; and
- .3 equipped with adequate ventilation arrangements.

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

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

16.6 Cargoes not to be exposed to excessive heat

16.6.1 Where the possibility exists of a dangerous reaction of a cargo, such as polymerization, decomposition, thermal instability or evolution of gas, resulting from local overheating of the cargo in either the tank or associated pipelines, such cargo shall be loaded and carried adequately segregated from other products whose temperature is sufficiently high to initiate a reaction of such cargo (see 7.1.5.4).

16.6.2 Heating coils in tanks carrying this product shall be blanked off or secured by equivalent means.

16.6.3 Heat-sensitive products shall not be carried in deck tanks, which are not insulated.

16.6.4 In order to avoid elevated temperatures, this cargo shall not be carried in deck tanks.

Chapter 17

Summary of minimum requirements

Mixtures of noxious liquid substances presenting pollution hazards only, and which are provisionally assessed under regulation 6.3 of Annex II of MARPOL 73/78, may be carried under the requirements of the Code applicable to the appropriate position of the entry in this chapter for Noxious Liquid Substances, not otherwise specified (n.o.s.).

EXPLANATORY NOTES

Product name (column a)	In some cases, the product names are not identical with the names given in previous issues of the Code.
UN Number (column b)	Deleted
Pollution Category (column c)	The letter X, Y, Z means the Pollution Category assigned to each product under MARPOL Annex II
Hazards (column d)	“S” means that the product is included in the Code because of its safety hazards; “P” means that the product is included in the Code because of its pollution hazards; and “S/P” means that the product is included in the Code because of both its safety and pollution hazards.
Ship type (column e)	1: ship type 1 (2.1.2) 2: ship type 2 (2.1.2) 3: ship type 3 (2.1.2)
Tank type (column f)	1: independent tank (4.1.1) 2: integral tank (4.1.2) G: gravity tank (4.1.3) P: pressure tank (4.1.4)
Tank vents (column g)	Open: open venting Cont.: controlled venting SR: safety relief valve
Tank environmental control (column h)	Inert: inerting (9.1.2.1) Pad: liquid or gas padding (9.1.2.2) Dry: drying (9.1.2.3) Vent: natural or forced ventilation (9.1.2.4)
Electrical equipment (column i)	T1 to T6: temperature classes* IIA, IIB or IIC: apparatus groups* NF: nonflammable product (10.1.6) Yes: flashpoint exceeding 60°C (10.1.6) No: flashpoint not exceeding 60°C (10.1.6)
Gauging (column j)	O: open gauging (13.1.1.1) R: restricted gauging (13.1.1.2) C: closed gauging (13.1.1.3) I: indirect gauging (13.1.1.3)

* Temperature classes and apparatus groups as defined in the International Electrotechnical Commission Publication 79 (part 1, appendix D, parts 4,8 and 12). A ‘-’ indicates that no special class or group is required.

Vapour detection (column k)	F: flammable vapours T: toxic vapours No: indicates no requirements
Fire protection (column l)	A: alcohol-resistant foam or multi-purpose foam B: regular foam; encompasses all foams that are not of an alcohol-resistant type, including fluoro-protein and aqueous-film-forming foam (AFFF) C: water-spray D: dry chemical** No: no special requirements under this Code
Materials of construction (column m)	Deleted
Emergency escape (column n)	Yes: see 14.3.1 No: no special requirements under this Code

**

Dry chemical powder systems, when used, may require an additional water system for boundary cooling. This normally provided in sufficient quantities by the standard fire-main system required by regulation II-2/4 of SOLAS.

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Acetic acid	Z	S	3	2G	Cont	No	T1	IIA	No	R	F	A	Y1,Z	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8, 15.19.6
Acetic anhydride	Z	S	2	2G	Cont	No	T2	IIA	No	R	F-T	A	Y1	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8, 15.19.6
Acetone cyanohydrin	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A	Y1	E	15.1, 15.12, 15.17 to 15.19, 16.6.1 to 16.6.3
Acetonitrile	Z	S	2	2G	Cont	No	T2	IIA	No	R	F-T	A		No	15.12, 15.19.6
Acrylamide solution (50% or less)	Y	S	2	2G	Open	No			NF	C	No	No		No	15.12.3, 15.13, 15.16.1, 15.19.6, 16.6.1
Acrylic acid	Y	S	2	2G	Cont	No	T2	IIA	No	R	F-T	A	Y1	No	15.13, 15.19.6, 16.6.1
Acrylonitrile	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	F-T	A	N3,Z	E	15.12, 15.13, 15.17, 15.19
Acrylonitrile-Styrene copolymer dispersion in polyether polyol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Adiponitrile	Y	S	3	2G	Cont	No		IIB	Yes	R	T	A		No	
Alachlor technical (90% or more)	X	S/P	2	2G	Open	No			Yes	O	No	A,C	Y1	No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Alcohol (C9-C11) poly(2.5-9) ethoxylate	Y	P	3	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
Alcohol (C6-C17) (secondary) poly(3-6)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Alcohol (C6-C17) (secondary) poly(7-12)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9
Alcohol (C12-C16) poly(1-6)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Alcohol (C12-C16) poly(20+)ethoxylates	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Alcohol (C12-C16) poly(7-19)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16A.2.2
Alcohols (C13+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkanes (C6-C9)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Iso- and cyclo-alkanes (C10-C11)	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Iso- and cyclo-alkanes (C12+)	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
n-Alkanes (C10+)	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Alkaryl polyethers (C9-C20)	Y	P	2	2G	Open	No			Yes	O	No	A,B		No	15.19.6, 16.2.6
Alkenyl (C11+) amide	X	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkenyl (C16-C20) succinic anhydride	Y	S	3	2G	Cont	No			Yes	C	T	No		E	15.12, 15.17, 15.19
Alkyl acrylate-vinylpyridine copolymer in toluene	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Alkylaryl phosphate mixtures (more than 40% Diphenyl tolyl phosphate, less than 0.02% ortho-isomers)	X	S/P	1	2G	Cont	No	T1	IIA	Yes	C	T	ABC		No	15.12, 15.17, 15.19
Alkylated (C4-C9) hindered phenols	Z	S	3	2G	Open	No	-	-	Yes	O	No	BD		No	15.19.6
Alkylbenzene, alkylindane, alkylindene mixture (each C12-C17)	Y	P	3	2G	Open	No			Yes	O	No	A		No	15.19.6
Alkyl (C3-C4) benzenes	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Alkyl (C5-C8) benzenes	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Alkyl(C9+)benzenes	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkyl (C11-C17) benzene sulphonic acid	Y	S/P	2	2G	Open	No			Yes	O	No	A		No	16.2.7, 16.2.8
Alkylbenzene sulphonic acid, sodium salt solution	Y	P	2	2G	Open	No			NF	O	No	No		No	16.2.7 to 16.2.9
Alkyl (C12+) dimethylamine	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	BCD		E	15.12, 15.17, 15.19
Alkyl dithiocarbamate (C19-C35)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkyldithiothiadiazole (C6-C24)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Alkyl ester copolymer (C4-C20)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkyl (C8-C10)/(C12-C14):(40% or less/60% or more) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No		No	15.19.6, 16.2.6, 16.2.9
Alkyl (C8-C10)/(C12-C14):(60% or more/40% or less) polyglucoside solution(55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No		No	16.2.7, 16.2.9
Alkyl (C7-C9) nitrates	Y	S/P	2	2G	Open	No			Yes	O	No	A,B		No	15.19.6, 15.20, 16.6.1 to 16.6.3
Alkyl(C7-C11)phenol poly(4-12) ethoxylate	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9
Alkyl (C8-C40) phenol sulphide	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkyl (C8-C9) phenylamine in aromatic solvents	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Alkyl (C9-C15) phenyl propoxylate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Alkyl (C8-C10)/(C12-C14):(50%/50%) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No		No	16.2.7, 16.2.9
Alkyl (C12-C14) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No		No	15.19.6, 16.2.6, 16.2.9
Alkyl (C8-C10) polyglucoside solution (65% or less).	Y	P	3	2G	Open	No			Yes	O	No	No		No	16.2.7, 16.2.9
Alkyl(C10-C20, saturated and unsaturated) phosphite	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Alkyl sulphonic acid ester of phenol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Allyl alcohol	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	F-T	A		E	15.12, 15.17, 15.19
Allyl chloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A		E	15.12, 15.17, 15.19
Aluminium chloride (30% or less)/Hydrochloric acid (20% or less) solution	Y	S	2	1G	Cont	No			NF	R	T	No		E(f)	15.11
Aluminium sulphate solution	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
2-(2-Aminoethoxy) ethanol	Z	S	3	2G	Open	No			Yes	O	No	A,D	N2	No	15.19.6
Aminoethyldiethanolamine/Aminoethylethanolamine solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Aminoethyl ethanolamine	Z	S	3	2G	Open	No	T2	IIA	Yes	O	No	A	N1	No	
N-Aminoethylpiperazine	Z	S	3	2G	Cont	No			Yes	R	T	A	N2	No	15.19.6
2-Amino-2-hydroxymethyl-1,3-propanediol solution (40% or less)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
2-Amino-2-methyl-1-propanol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ammonia aqueous (28% or less)	Y	S/P	2	2G	Cont	No			NF	R	T	A,B,C	N4	E(a)	

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Ammonium hydrogen phosphate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ammonium nitrate solution (93% or less)	Z	S	2	1G	Open	No			NF	O	No	No	Y4	No	15.2, 15.11.4, 15.11.6, 15.18, 15.19.6
Ammonium polyphosphate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ammonium sulphate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ammonium sulphide solution (45% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A	N1	E	15.12, 15.16.1, 15.17, 15.19, 16.6.1 to 16.6.3
Ammonium thiocyanate (25% or less)/Ammonium thiosulphate (20% or less) solution	Z	P	3	2G	Open	No			NF	O	No	No		No	
Ammonium thiosulphate solution (60% or less)	Z	P	3	2G	Open	No			NF	O	No	No		No	16.2.9
Amyl acetate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
n-Amyl alcohol	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Amyl alcohol, primary	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
sec-Amyl alcohol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
tert-Amyl alcohol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
tert-Amyl methyl ether	X	P	2	2G	Cont	No	T3		No	R	F	A		No	15.19.6
Aniline	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A		No	15.12, 15.17, 15.19
Aryl polyolefins (C11-C50)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Aviation alkylates (C8 paraffins and iso-paraffins BPT 95 - 120°C) (bb)	Y	P	2	2G	Cont	No			No	R	F	B		No	15.19.6
Barium long chain (C11-C50) alkaryl sulphonate	Y	S/P	2	2G	Open	No			Yes	O	No	AD		No	15.12.3, 15.19, 16.2.6
Benzene and mixtures having 10% benzene or more*	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	F-T	A,B		No	15.12.1, 15.17, 15.19.6, 16.2.9
Benzene sulphonyl chloride	Z	S	3	2G	Cont	No			Yes	R	T	A,D	N1	No	15.19.6
Benzenetricarboxylic acid, trioctyl ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Benzyl acetate	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Benzyl alcohol	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Benzyl chloride	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A,B		E	15.12, 15.13, 15.17, 15.19
Bromochloromethane	Z	S	3	2G	Cont	No			NF	R	T	No	N3	No	
Butyl acetate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Butyl acrylate (all isomers)	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	F-T	A		No	15.13, 15.19.6, 16.6.1, 16.6.2
tert-Butyl alcohol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Butylamine (all isomers)	Y	S/P	2	2G	Cont	No			No	R	F-T	A	N1	E	15.12, 15.17, 15.19.6
Butylbenzene (all isomers)	X	P	2	2G	Cont	No			No	R	F	A			15.19.6
Butyl benzyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Butyl butyrate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Butyl/Decyl/Cetyl/Eicosyl methacrylate mixture	Y	S	2	2G	Cont	No			Yes	R	No	A,D		No	15.13, 16.6.1, 16.6.2
Butylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
1,2-Butylene oxide	Y	S/P	3	2G	Cont	Inert	T2	IIB	No	R	F	A,C	Z	No	15.8.1 to 15.8.7, 15.12, 15.13, 15.16 to 15.19, 15.21, 15.25, 15.27, 15.29, 15.19.6
n-Butyl ether	Y	S/P	3	2G	Cont	Inert	T4	IIB	No	R	F-T	A		No	15.4.6, 15.12, 15.19.6
Butyl methacrylate	Y	S	2	2G	Cont	No		IIB	No	R	F-T	A,D		No	15.13, 15.19.6, 16.6.1, 16.6.2
n-Butyl propionate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Butyl stearate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Butyraldehyde (all isomers)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F-T	A		No	15.16.1, 15.19.6
Butyric acid	Y	S	3	2G	Cont	No			Yes	R	No	A	Y1	No	15.11.2 to 15.11.4, 15.11.6 to 15.11.8
gamma-Butyrolactone	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Calcium carbonate slurry	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Calcium hydroxide slurry	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Calcium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No			NF	R	No	No	N5	No	15.16.1
Calcium hypochlorite solution (more than 15%)	X	S/P	1	2G	Cont	No			NF	R	No	No	N5	No	15.16.1, 15.19.6
Calcium lignosulphonate solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Calcium long-chain alkaryl sulphonate (C11-C50)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Calcium long-chain alkyl(C5-C10) phenate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Calcium long-chain alkyl(C11-C40) phenate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Calcium long-chain alkyl phenate sulphide (C8-C40)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Calcium nitrate/Magnesium nitrate/Potassium chloride solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
epsilon-Caprolactam (molten or aqueous solutions)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Carbolic oil	Y	S/P	2	2G	Cont	No			Yes	C	F-T	A		No	15.12, 15.19
Carbon disulphide	Y	S/P	2	1G	Cont	Pad+inert	T6	IIC	No	C	F-T	C		E	15.3, 15.12, 15.19
Carbon tetrachloride	Y	S/P	2	2G	Cont	No			NF	C	T	No	Z	E	15.12, 15.17, 15.19.6
Cashew nut shell oil (untreated)]* to be considered at MEPC 52	NED	S	NED	2G	Cont	No			Yes	R	T	A,B		No	
Cetyl/Eicosyl methacrylate mixture	Y	S	2	2G	Open	No			Yes	O	No	A,D		No	15.13, 16.6.1, 16.6.2
Chlorinated paraffins (C10-C13)	X	P	1	2G	Open	No			Yes	O	No	A		No	15.19
Chloroacetic acid (80% or less)	Y	S/P	2	2G	Cont	No			NF	C	No	No	Y5	No	15.11.2, 15.11.4, 15.11.6 to 15.11.8, 15.12.3, 15.19, 16.2.9

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Chlorobenzene	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	F-T	A,B		No	15.19.6
Chloroform	Y	S/P	3	2G	Cont	No			NF	R	T	No		E	15.12, 15.19.6
Chlorohydrins (crude)	Y	S	2	2G	Cont	No		IIA	No	C	F-T	A		No	15.12, 15.19
4-Chloro-2-methylphenoxyacetic acid, dimethylamine salt solution	Y	P	3	2G	Open	No			NF	O	No	No	N1	No	
o-Chloronitrobenzene	Y	S/P	2	2G	Cont	No			Yes	C	T	A,B,D		No	15.12, 15.17 to 15.19, 16.2.6, 16.2.9, 16A.2.2
1-(4-Chlorophenyl)-4,4- dimethyl-pentan-3-one	Y	P	2	2G	Open	No			Yes	O	No	ABD		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
2- or 3-Chloropropionic acid	Z	S/P	3	2G	Open	No			Yes	O	No	A	Y1	No	15.11.2 to 15.11.4, 15.11.6 to 15.11.8, 16.2.7 to 16.2.9
Chlorosulphonic acid	Y	S/P	1	2G	Cont	No			NF	C	T	No		E	15.11.2 to 15.11.8, 15.12, 15.16.2, 15.19
m-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A,B		No	15.19.6
o-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A,B		No	15.19.6
p-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A,B		No	15.19.6, 16.2.9
Chlorotoluenes (mixed isomers)	Y	S/P	2	2G	Cont	No			No	R	F-T	A,B		No	15.19.6
Choline chloride solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Citric acid (70% or less)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Coconut oil fatty acid	Y	P	3	2G	Open	No			Yes	O	No	A		No	16.2.7 to 16.2.9
Coconut oil fatty acid methyl ester	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Creosote (coal tar)	X	S/P	1	2G	Open	No	T2	IIA	Yes	O	No	A,D		No	15.19.6
Cresols (all isomers)	Y	S/P	2	2G	Open	No	T1	IIA	Yes	O	No	A,B		No	15.19.6
Cresylic acid, dephenolized	Y	S/P	2	2G	Open	No			Yes	O	No	A,B		No	15.19.6
Crotonaldehyde	Y	S/P	2	2G	Cont	No	T3	IIB	No	R	F-T	A		E	15.12, 15.16.1, 15.17, 15.19.6
1,5,9-Cyclododecatriene	X	S/P	1	2G	Cont	No			Yes	R	T	A	N2	No	15.13, 15.19, 16.6.1, 16.6.2
Cycloheptane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Cyclohexane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.9
Cyclohexanol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Cyclohexanone	Y	S	3	2G	Cont	No	T2	IIA	No	R	F-T	A	N5	No	15.19.6
Cyclohexanone, Cyclohexanol mixture	Y	S	3	2G	Cont	No			Yes	R	F-T	A	N5	No	
Cyclohexyl acetate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Cyclohexylamine	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F-T	A,C	N1	No	15.19.6
1,3-Cyclopentadiene dimer (molten)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Cyclopentane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Cyclopentene	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
p-Cymene (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Decahydronaphthalene	Y	P	2	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Decanoic acid	X	P	2	2G	Open	No			Yes	O	No	A		No	16.2.7 to 16.2.9
Decyl acrylate	X	S/P	1	2G	Open	No	T3	IIA	Yes	O	No	A,C,D	N2	No	15.13, 15.19.6, 16.6.1, 16.6.2
Decyl alcohol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.9(s)
Decyloxytetrahydrothiophene dioxide	X	S/P	2	2G	Cont	No			Yes	R	T	A		No	15.19.6
Diacetone alcohol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Dialkyl (C8-C9) diphenylamines	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Dialkyl (C7-C13) phthalates	X	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Dibromomethane	Y	S/P	2	2G	Cont	No			NF	R	T	No	N3	No	15.12.3, 15.19
Dibutylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A,C,D	N4	No	15.19.6
Dibutyl hydrogen phosphonate	Y	P	3	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
2,6-Di-tert-butylphenol	X	P	2	2G	Open	No	-	-	Yes	O	No	ABC D		No	15.19
Dibutyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Dichlorobenzene (all isomers)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	R	T	A,B,D	N5	No	15.19.6, 16.2.6(x), 16.2.9(y), 16A.2.2(z)
3,4-Dichloro-1-butene	Y	S/P	2	2G	Cont	No			No	C	F-T	ABC		E	15.12.3, 15.17, 15.19.6
1,1-Dichloroethane	Z	S	3	2G	Cont	No	T2	IIA	No	R	F-T	A		E	15.19.6
Dichloroethyl ether	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	N5	No	15.19.6
1,6-Dichlorohexane	Y	S/P	2	2G	Cont	No			No	R	T	A,B		No	15.19.6
2,2'-Dichloroisopropyl ether	Y	S/P	2	2G	Cont	No			Yes	R	T	A,C,D	N5	No	15.12, 15.17, 15.19
Dichloromethane	Y	S	3	2G	Cont	No	T1	IIA	Yes	R	T	No		No	
2,4-Dichlorophenol	Y	S/P	2	2G	Cont	Dry			Yes	R	T	A	N1	No	15.19.6
2,4-Dichlorophenoxyacetic acid, diethanolamine salt solution	Y	S/P	3	2G	Open	No			NF	O	No	No	N1	No	15.19.6
2,4-Dichlorophenoxyacetic acid, dimethylamine salt solution (70% or less)	Y	S/P	3	2G	Open	No			NF	O	No	No	N1	No	15.19.6
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt solution	Y	S/P	3	2G	Open	No			NF	O	No	No	N1	No	15.19.6
1,1-Dichloropropane	Y	S/P	2	2G	Cont	No			No	R	F-T	A,B	Z	No	15.12, 15.19.6
1,2-Dichloropropane	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	F-T	A,B	Z	No	15.12, 15.19.6
1,3-Dichloropropane	Y	S	2	2G	Cont	No	T1	IIA	No	R	F-T	A,B		No	15.12, 15.19.6
1,3-Dichloropropene	X	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A,B		E	15.12, 15.17 to 15.19

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Dichloropropene/Dichloropropane mixtures	X	S/P	2	2G	Cont	No			No	C	F-T	A,B,D		E	15.12, 15.17 to 15.19
2,2-Dichloropropionic acid	Y	S	3	2G	Cont	Dry			Yes	R	No	A	Y5	No	15.11.2, 15.11.4, 15.11.6 to 15.11.8
Diethanolamine	Y	S	3	2G	Open	No	T1	IIA	Yes	O	No	A	N2	No	
Diethylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A	N1	E	15.12, 15.19.6
Diethylaminoethanol	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A,C	N1	No	15.19.6
2,6-Diethylaniline	Y	S/P	3	2G	Open	No			Yes	O	No	B,C,D	N4	No	15.19.6, 16.2.9
Diethylbenzene	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Diethylene glycol dibutyl ether	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Diethylene glycol diethyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Diethylenetriamine	Y	S	3	2G	Open	No	T2	IIA	Yes	O	No	A	N2	No	
Diethylenetriaminepentaacetic acid, pentasodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Diethyl ether	Z	S	2	1G	Cont	Inert	T4	IIB	No	C	F-T	A	N7	E	15.4, 15.14, 15.19
Di-(2-ethylhexyl) adipate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Di-(2-ethylhexyl) phosphoric acid	Y	S/P	2	2G	Open	No			Yes	O	No	A,D	N2	No	
Diethyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Diethyl sulphate	Y	S/P	2	2G	Cont	No			Yes	C	T	A	N3	No	15.19.6
Diglycidyl ether of bisphenol A	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
Diglycidyl ether of bisphenol F	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
Diheptyl phthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Di-n-hexyl adipate	X	P	1	2G	Open	No			Yes	O	No	A		No	15.19.6
Dihexyl phthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
1,4-Dihydro-9,10-dihydroxyanthracene, disodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Diisobutylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A,C,D	N1	No	15.12.3, 15.19.6
Diisobutylene	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Diisobutyl ketone	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Diisobutyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
Diisononyl adipate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Diisooctyl phthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Diisopropanolamine	Y	S/P	3	2G	Open	No	T2	IIA	Yes	O	No	A	N2	No	16.2.7 to 16.2.9
Diisopropylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A	N2	E	15.12, 15.19
Diisopropylbenzene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6

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Diisopropylnaphthalene	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
N,N-Dimethylacetamide	Z	S	3	2G	Cont	No	-	-	Yes	C	T	ACD		No	15.12, 15.17
N,N-Dimethylacetamide solution (40% or less)	Z	S	3	2G	Cont	No			Yes	R	T	B	N4	No	15.12.1, 15.17
Dimethyl adipate	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.9
Dimethylamine solution (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A,C,D	N1	No	15.12, 15.19.6
Dimethylamine solution (greater than 45% but not greater than 55%)	Y	S/P	2	2G	Cont	No			No	C	F-T	A,C,D	N1	E	15.12, 15.17, 15.19
Dimethylamine solution (greater than 55% but not greater than 65%)	Y	S/P	2	2G	Cont	No			No	C	F-T	A,C,D	N1	E	15.12, 15.14, 15.17, 15.19
N,N-Dimethylcyclohexylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A,C	N1	No	15.12, 15.17, 15.19.6
N,N-Dimethyldodecylamine	X	S/P	1	2G	Open	No			Yes	O	No	B	N4	No	15.19
Dimethylethanolamine	Y	S	3	2G	Cont	No	T3	IIA	No	R	F-T	A,D	N2	No	15.19.6
Dimethylformamide	Y	S	3	2G	Cont	No	T2	IIA	No	R	F-T	A,D		No	15.19.6
Dimethyl glutarate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Dimethyl hydrogen phosphite	Y	S/P	3	2G	Cont	No			Yes	R	T	A,D		No	15.12.1
Dimethyl phthalate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Dimethylpolysiloxane	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
2,2-Dimethylpropane-1,3-diol (molten or solution)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Dimethyl succinate	Y	P	3	2G	Open	No			Yes	O	No	A		No	16.2.9
Dinitrotoluene (molten)	X	S/P	2	2G	Cont	No			Yes	C	T	A		No	15.12, 15.17, 15.19, 15.21
1,4-Dioxane	Y	S	2	2G	Cont	No	T2	IIB	No	C	F-T	A		No	15.12, 15.19
Dipentene	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Diphenyl	X	P	2	2G	Open	No			Yes	O	No	B		No	15.19
Diphenylamine (molten)	Y	P	2	2G	Open	No			Yes	O	No	B,D	N4	No	15.19.6, 16.2.9, 16A.2.2
Diphenylamines, alkylated	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Diphenyl/Diphenyl ether mixtures	X	P	2	2G	Open	No			Yes	O	No	B		No	15.19
Diphenyl ether	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Diphenyl ether/Diphenyl phenyl ether mixture	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Diphenylmethane diisocyanate	Y	S	2	2G	Cont	Dry			Yes	C	T(b)	A,B,C (c),D	N5	No	15.12, 15.16.2, 15.17, 15.19.6, 16.2.6, 16.2.9, 16A.2.2
Diphenylol propane-epichlorohydrin resins	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6
Di-n-propylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A	N2	No	15.12.3, 15.19.6
Dipropylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Dithiocarbamate ester (C7-C35)	X	P	2	2G	Open	No			Yes	O	No	AD		No	15.19.6

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Diundecyl phthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Dodecane (all isomers)	Y	P	2	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
tert-Dodecanethiol	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	ABD		E	15.12, 15.17, 15.19
Dodecene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Dodecyl alcohol	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Dodecylamine/Tetradecylamine mixture	X	S/P	2	2G	Cont	No			Yes	R	T	A,D	N2	No	15.19.6
Dodecylbenzene	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Dodecyl diphenyl ether disulphonate solution	X	S/P	2	2G	Open	No			NF	O	No	No		No	15.19.6
Dodecyl hydroxypropyl sulphide	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19
Dodecyl methacrylate	Y	S	3	2G	Open	No			Yes	O	No	A		No	15.13
Dodecyl/Octadecyl methacrylate (mixture)	Z	S	3	2G	Open	No			Yes	R	No	A,D	N4	No	15.13, 16.6.1, 16.6.2
Dodecyl/Pentadecyl methacrylate mixture	Y	S	2	2G	Open	No			Yes	O	No	A,D		No	15.13, 16.6.1, 16.6.2
Dodecyl phenol	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19
Dodecyl Xylene	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Drilling brines (containing Zinc salts)	X	P	2	2G	Open	No			Yes	O	No	No		No	15.19.6
Drilling brines, including:	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Epichlorohydrin	Y	S/P	2	2G	Cont	No		IIB	No	C	F-T	A		E	15.12, 15.17, 15.19
Ethanolamine	Y	S	3	2G	Open	No	T2	IIA	Yes	O	F-T	A	N2	No	
2-Ethoxyethyl acetate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Ethoxylated long chain (C16+) alkyloxyalkylamine	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethyl acetate	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Ethyl acetoacetate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ethyl acrylate	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	F-T	A		E	15.13, 15.19.6, 16.6.1, 16.6.2
Ethylamine	Y	S/P	2	1G	Cont	No	T2	IIA	No	C	F-T	C,D	N2	E	15.12, 15.14, 15.19.6
Ethylamine solutions (72% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A,C	N1	E	15.12, 15.14, 15.17, 15.19
Ethyl amyl ketone	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Ethylbenzene	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Ethyl tert-butyl ether	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Ethyl butyrate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Ethylcyclohexane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
N-Ethylcyclohexylamine	Y	S	2	2G	Cont	No			No	R	F-T	A	N1	No	15.19.6

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
S-Ethyl dipropylthiocarbamate	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Ethylene chlorohydrin	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A,D		E	15.12, 15.17, 15.19
Ethylene cyanohydrin	Y	S	3	2G	Open	No		IIB	Yes	O	No	A		No	
Ethylenediamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	N2	No	15.19.6, 16.2.9
Ethylenediaminetetraacetic acid, tetrasodium salt solution	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethylene dibromide	Y	S/P	2	2G	Cont	No			NF	C	T	No		E	15.12, 15.19.6, 16.2.9
Ethylene dichloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A,B	N4	No	15.19
Ethylene glycol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethylene glycol acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethylene glycol butyl ether acetate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Ethylene glycol diacetate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Ethylene glycol methyl butyl ether	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Ethylene glycol methyl ether acetate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Ethylene glycol monoalkyl ethers	Y	S	3	2G	Cont	No			No	R	F	A		No	15.19.6
Ethylene glycol phenyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ethylene glycol phenyl ether/Diethylene glycol phenyl ether mixture	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Ethylene oxide/Propylene oxide mixture with an Ethylene oxide content of not more than 30% in weight	Y	S/P	2	1G	Cont	Inert	T2	IIB	No	C	F-T	A,C		No	15.8, 15.12, 15.14, 15.19
Ethylene-Vinyl acetate copolymer (emulsion)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethyl-3-ethoxypropionate	Y	P	3	2G	Cont	No			No	R	No	A		No	15.19.6
2-Ethylhexanoic acid	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
2-Ethylhexyl acrylate	Y	S/P	3	2G	Open	No	T3	IIB	Yes	O	No	A		No	15.13, 15.19.6, 16.6.1, 16.6.2
2-Ethylhexylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A	N2	No	15.12, 15.19.6
2-Ethyl-2-(hydroxymethyl) propane-1,3-diol, C8-C10 ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ethylidene norbornene	Y	S/P	2	2G	Cont	No			No	R	F-T	A,D	N4	No	15.12.1, 15.16.1, 15.19.6
Ethyl methacrylate	Y	S	3	2G	Cont	No	T2	IIA	No	R	F-T	A,D		No	15.13, 15.19.6, 16.6.1, 16.6.2
N-Ethylmethylallylamine	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	F	AC	N1	E	15.12.3, 15.17, 15.19
o-Ethylphenol	Y	S/P	2	2G	Open	No	T1	IIA	Yes	O	No	B		No	15.19.6
Ethyl propionate	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
2-Ethyl-3-propylacrolein	Y	S/P	3	2G	Cont	No		IIA	No	R	F-T	A		No	15.19.6
para-Ethyl Toluene	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Fatty acid (saturated C13+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Fatty acids, essentially linear,C6-C18, 2-ethylhexyl ester.	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Ferric chloride solutions	Y	S/P	3	2G	Open	No			NF	O	No	No		No	15.11, 15.19.6, 16.2.9
Ferric nitrate/Nitric acid solution	Y	S/P	2	2G	Cont	No			NF	R	T	No		E	15.11, 15.19
Formaldehyde solutions (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A		E(e)	15.16.1, 15.19.6, 16.2.9
Formamide	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Formic acid	Y	S	3	2G	Cont	No	T1	IIA	No	R	T(v)	A	Y2, Y3	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8, 15.19.6
Fumaric adduct of rosin, water dispersion	Y	P	3	2G	Open	No			Yes	O	No	No		No	15.19.6, 16.2.6
Furfural	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A		No	15.16.1, 15.19.6
Furfuryl alcohol	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Glutaraldehyde solutions (50% or less)	Y	S	3	2G	Open	No			NF	O	No	No		No	15.16.1
Glycerol monooleate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Glyceryl triacetate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Glycidyl ester of C10 trialkylacetic acid	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Glycine, sodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Glycolic acid solution (70% or less)	Z	S	3	2G	Open	No	-	-	NF	O	No	No		No	15.19.6
Glyoxal solution (40% or less)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Glyoxylic acid solution (50 % or less)	Y	S	3	2G	Open	No			Yes	O	No	ACD	Y5	No	15.11.2-15.11.4, 15.11.6-15.11.8, 15.16.1, 16.6.1 to 16.6.3
Glyphosate solution (not containing surfactant)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Heptane (all isomers) (bb)	Y	P	3	2G	Cont	No			No	R	F	A			15.19.6
Heptanol (all isomers) (q)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Heptene (all isomers) (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Heptyl acetate	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
1-Hexadecylnaphthalene / 1,4-bis(hexadecyl)naphthalene mixture	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Hexamethylenediamine (molten)	Y	S/P	2	2G	Cont	No			Yes	C	T	C	N1	E	15.12, 15.17, 15.18, 15.19.6, 16.2.7, 16.2.9
Hexamethylenediamine adipate (50% in water)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Hexamethylenediamine solution	Y	S/P	3	2G	Cont	No			Yes	R	T	A	N2	No	15.19.6, 16.2.9
Hexamethylene diisocyanate	Y	S/P	2	1G	Cont	Dry	T1	IIB	Yes	C	T	A, C(c), D	Y4	E	15.12, 15.17, 15.16.2, 15.18, 15.19
Hexamethylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Hexamethyleneimine	Y	S/P	2	2G	Cont	No			No	R	F-T	A,C	N1	No	15.19.6

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<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I'''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Hexane (all isomers) (bb)	Y	P	2	2G	Cont	No			No	R	F	A			15.19.6
1,6-Hexanediol, distillation overheads	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC D		No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Hexanoic acid	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Hexanol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Hexene (all isomers) (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Hexyl acetate	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Hydrochloric acid	Z	S	3	1G	Cont	No			NF	R	T	No		E(f)	15.11
Hydrogen peroxide solutions (over 60% but not over 70%)	Y	S/P	2	2G	Cont	No			NF	C	No	No		No	15.5.1 to 15.5.13, 15.19.6
2-Hydroxyethyl acrylate	Y	S/P	2	2G	Cont	No			Yes	C	T	A		No	15.12, 15.13, 15.19.6, 16.6.1, 16.6.2
N-(Hydroxyethyl)ethylenediaminetriacetic acid, trisodium salt solution	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
2-Hydroxy-4-(methylthio)butanoic acid	Z	P	3	2G	Open	No			Yes	O	No	A		No	16.2.7, 16.2.8
Isoamyl alcohol	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Isobutyl alcohol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Isobutyl formate	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Isobutyl methacrylate	Z	S	3	2G	Cont	No		IIA	No	C	F-T	BD		E	15.12, 15.13, 15.17, 15.19, 16.6.1, 16.6.2
Isophorone	Y	S/P	3	2G	Cont	No			Yes	R	No	A		No	
Isophoronediamine	Y	S	3	2G	Cont	No			Yes	R	T	A	N2	No	
Isophorone diisocyanate	X	S/P	2	2G	Cont	Dry			Yes	C	T	A,B,D	N5	No	15.12, 15.16.2, 15.17, 15.19.6
Isoprene	Y	S/P	3	2G	Cont	No	T3	IIB	No	R	F	B		No	15.13, 15.14, 15.19.6, 16.6.1, 16.6.2
Isopropanolamine	Y	S/P	3	2G	Open	No	T2	IIA	Yes	O	F-T	A	N2	No	16.2.8, 16.2.9
Isopropyl acetate	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Isopropylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	C,D	N2	E	15.12, 15.14, 15.19
Isopropylcyclohexane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.7, 16.2.8
Isopropyl ether	Y	S	3	2G	Cont	Inert			No	R	F	A		No	15.4.6, 15.13.3, 15.19.6
Lactic acid	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Lactonitrile solution (80% or less)	Y	S/P	2	1G	Cont	No			Yes	C	T	A,C,D	Y1	E	15.1, 15.12, 15.17 to 15.19, 16.2.6, 16.6.1 to 16.6.3
Lard	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Latex, ammonia(1% or less)-inhibited	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Latex: Carboxylated styrene-Butadiene copolymer; Styrene-Butadiene rubber	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Lauric acid	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Long-chain alkaryl polyether (C11-C20)	Y	P	2	2G	Open	No			Yes	O	No	A,B		No	16.2.7, 16.2.8
L-Lysine solution (60% or less)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Magnesium chloride solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Maleic anhydride	Y	S	3	2G	Cont	No			Yes	R	No	A, C(g)		No	
Mercaptobenzothiazol, sodium salt solution	X	S/P	2	2G	Open	No			NF	O	No	No	N1	No	15.19.6, 16.2.9
Mesityl oxide	Z	S	3	2G	Cont	No	T2	IIB	No	R	F-T	A		No	15.19.6
Metam sodium solution	X	S/P	1	2G	Open	No			NF	O	No	No	N1	No	15.19.6
Methacrylic acid	Y	S	3	2G	Cont	No			Yes	R	T	A	Y1	No	15.13, 16.6.1
Methacrylic resin in Ethylene dichloride	Y	S	2	2G	Cont	No	T2	IIA	No	R	F-T	A,B	N4	No	15.19, 16.2.6
Methacrylonitrile	Y	S	2	2G	Cont	No			No	C	F-T	A	N4,Z	E	15.12, 15.13, 15.17, 15.19
3-Methoxy-1-butanol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
3-Methoxybutyl acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
N-(2-Methoxy-1-methyl ethyl)-2-ethyl-6-methyl chloroacetanilide	X	P	1	2G	Open	No			Yes	O	No	A		No	15.19.6
Methyl acetate	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Methyl acetoacetate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Methyl acrylate	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	F-T	A		E	15.13, 15.19.6, 16.6.1, 16.6.2
Methyl alcohol	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Methylamine solutions (42% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A,C,D	N1	E	15.12, 15.17, 15.19
Methylamyl acetate	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Methylamyl alcohol	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Methyl amyl ketone	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Methylbutenol	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Methyl tert-butyl ether	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Methyl butyl ketone	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Methylbutynol	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Methyl butyrate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Methylcyclohexane (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Methylcyclopentadiene dimer	Y	P	2	2G	Cont	No			No	R	F	B		No	15.19.6
Methylcyclopentadienyl manganese tricarbonyl	X	S/P	1	1G	Cont	No	-	-	Yes	C	T	ABC D		E	15.12, 15.18, 15.19

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Methyl diethanolamine	Y	S	3	2G	Open	No			Yes	O	No	A	N2	No	
2-Methyl-6-ethyl aniline	Y	S/P	3	2G	Open	No			Yes	O	No	A,D		No	
Methyl ethyl ketone	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
2-Methyl-5-ethyl pyridine	Y	S/P	3	2G	Open	No		IIA	Yes	O	No	A,D	N4	No	15.19.6
Methyl formate	Z	S	2	2G	Cont	No			No	R	F-T	A		E	15.12, 15.14, 15.19
Methyl heptyl ketone	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
2-Methyl-2-hydroxy-3-butyne	Z	S	3	2G	Cont	No		IIA	No	R	F-T	A,B,D	N6		15.19.6
Methyl isobutyl ketone	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Methyl methacrylate	Y	S	2	2G	Cont	No	T2	IIA	No	R	F-T	A		No	15.13, 15.19.6, 16.6.1, 16.6.2
3-Methyl-3-methoxybutanol	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
3-Methyl-3-methoxybutyl acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Methyl naphthalene (molten)	X	S/P	2	2G	Cont	No			Yes	R	No	A,D		No	15.19.6
2-Methyl-1,3-propanediol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Methyl propyl ketone	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
2-Methylpyridine	Z	S	2	2G	Cont	No			No	C	F	A	N4	No	15.12.3, 15.19.6
3-Methylpyridine	Z	S/P	2	2G	Cont	No			No	C	F	A,C	N4	No	15.12.3, 15.19
4-Methylpyridine	Z	S	2	2G	Cont	No			No	C	F-T	A	N4	No	15.12.3, 15.19, 16.2.9
N-Methyl-2-pyrrolidone	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Methyl salicylate	Y	P	3	2G	Open	No			Yes	O	No	A		No	15.19.6
alpha-Methylstyrene	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	F-T	A,D*		No	15.13, 15.19.6, 16.6.1, 16.6.2
3-(methylthio)propionaldehyde	Y	S/P	2	2G	Cont	No	T3	IIA	Yes	C	T	BC	Y5	E	15.12, 15.17, 15.19
Morpholine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	A	N2,Z	No	15.19.6
Motor fuel anti-knock compounds (containing lead alkyls)	X	S/P	1	1G	Cont	No	T4	IIA	No	C	F-T	A,C		E	15.6, 15.12, 15.18, 15.19
Myrcene	X	P	2	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Naphthalene (molten)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	R	No	A,D		No	15.19.6
Naphthalenesulphonic acid-Formaldehyde copolymer, sodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Neodecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A		No	16.2.8
Nitrating acid (mixture of sulphuric and nitric acids)	Y	S/P	2	2G	Cont	No			NF	C	T	No		E	15.11, 15.16.2, 15.17, 15.19
Nitric acid (70% and over)	Y	S/P	2	2G	Cont	No			NF	C	T	No		E	15.11, 15.19
Nitric acid (less than 70%)	Y	S/P	2	2G	Cont	No			NF	R	T	No		E	15.11, 15.19
Nitrilotriacetic acid, trisodium salt solution	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Nitrobenzene	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A,D		No	15.12, 15.17 to 15.19, 16.2.9
Nitroethane	Y	S	3	2G	Cont	No		IIB	No	R	F-T	A(u)	N4	No	15.16.1, 15.19.6, 16.6.1, 16.6.2, 16.6.4
Nitroethane(80%)/ Nitropropane(20%)	Y	S	3	2G	Cont	No		IIB	No	R	F-T	A(u)	N4	No	15.16.1, 15.19.6, 16.6.1 to 16.6.3
o-Nitrophenol (molten)	Y	S/P	2	2G	Cont	No			Yes	C	T	A,D		No	15.12, 15.19.6, 16.2.6, 16.2.9, 16A.2.2
1- or 2-Nitropropane	Y	S	3	2G	Cont	No	T2	IIB	No	R	F-T	A		No	15.19.6
Nitropropane (60%)/Nitroethane (40%) mixture	Y	S	3	2G	Cont	No			No	R	F-T	A(u)	N4	No	15.19.6
o- or p-Nitrotoluenes	Y	S/P	2	2G	Cont	No		IIB	Yes	C	T	A,B		No	15.12, 15.17, 15.19, 16.2.9
Nonane (all isomers) (bb)	Y	P	2	2G	Cont	No			No	R	F	B,C			15.19.6
Nonanoic acid (all isomers)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Nonene (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Nonyl alcohol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Nonyl methacrylate monomer	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Nonylphenol	X	P	1	2G	Open	No			Yes	O	No	A		No	15.19.6
Nonylphenol poly(4+)ethoxylate	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2(aa)
Nonylphenol poly(4-12)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2(aa)
Octane (all isomers) (bb)	X	P	2	2G	Cont	No			No	R	F	A			15.19.6
Octanoic acid (all isomers)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Octanol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Octene (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
n-Octyl acetate	Y	P	3	2G	Open	No			Yes	O	No	A		No	
Octyl aldehydes	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.9
Octyl decyl adipate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Olefin-Alkyl ester copolymer (molecular weight 2000+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Olefins (C13+, all isomers)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Oleic acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Oleum	Y	S/P	2	2G	Cont	No			NF	C	T	No		E	15.11.2 to 15.11.8, 15.12.1, 15.16.2, 15.17, 15.19, 16.2.7, 16.2.8
Palm stearin	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Paraffin wax	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

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Paraldehyde	Z	S/P	3	2G	Cont	No	T3	IIB	No	R	F	A		No	15.19.6, 16.2.9
Paraldehyde-ammonia reaction product	Y	S/P	2	2G	Cont	No			No	C	F-T	A	N1	No	15.12.3, 15.19
Pentachloroethane	Y	S/P	2	2G	Cont	No			NF	R	T	No		No	15.12, 15.17, 15.19.6
1,3-Pentadiene	Y	S/P	3	2G	Cont	No			No	R	F-T	A,B		No	15.13, 15.19.6, 16.6.1 to 16.6.3
Pentane (all isomers) (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.14, 15.19.6
Pentanoic acid	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
n-Pentanoic acid (64%)/2-Methyl butyric acid (36%) mixture	Y	S	2	2G	Open	No	T2		Yes	C	No	A,D	Y1	No	15.11.2, to 15.11.4, 15.11.6 to 15.11.8, 15.12.3, 15.19
Pentene (all isomers) (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.14, 15.19.6
n-Pentyl propionate	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Perchloroethylene	Y	S/P	2	2G	Cont	No			NF	R	T	No		No	15.12.1, 15.12.2, 15.19.6
Petrolatum	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Phenol	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A		No	15.12, 15.19, 16.2.7, 16.2.8, 16.2.9
1-Phenyl-1-xylyl ethane (bb)	Y	P	3	2G	Open	No			Yes	O	No	A,B		No	
Phosphoric acid	Z	S	3	2G	Open	No			NF	O	No	No		No	15.11.1 to 15.11.4, 15.11.6 to 15.11.8
Phosphorous, yellow or white	X	S/P	1	1G	Cont	Pad+(vent or inert)			No(k)	C	No	C		E	15.7, 15.19
Phthalic anhydride (molten)	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	R	No	A,D		No	16.2.7 to 16.2.9
alpha-Pinene	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
beta-Pinene	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Pine oil	X	P	2	2G	Open	No			Yes	O	No	A		No	16.2.7, 16.2.8
Polyalkyl (C18-C22) acrylate in Xylene	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.7, 16.2.8
Polyalkyl (C10-C20) methacrylate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyalkyl (C10-C18) methacrylate/ethylene-propylene copolymer mixture	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Poly(2+)cyclic aromatics	X	P	1	2G	Cont	No			Yes	R	No	A,D		No	15.19.6
Polyethylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Polyethylene glycol dimethyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Polyferric sulphate solution	Y	S/P	3	2G	Open	No			NF	O	No	No	Y4	No	
Polyisobutenamine in aliphatic (C10-C14) solvent	Y	P	3	2G	Open	No	T3	IIA	Yes	O	No	A		No	16.2.8
Polyisobutenyl anhydride adduct	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Poly(4+)isobutylene	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

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Polyolefin amide alkeneamine (C17+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyolefin amide alkeneamine borate (C28-C250)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyolefin amide alkeneamine polyol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Polyolefinamine (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Polyolefinamine in alkyl (C2-C4) benzenes	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.7, 16.2.8
Polyolefinamine in aromatic solvent	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.7, 16.2.8
Polyolefin anhydride	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyolefin ester (C28-C250)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyolefin phenolic amine (C28-C250)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polyolefin phosphorusulphide, barium derivative (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A,B		No	16.2.7, 16.2.8
Poly(20)oxyethylene sorbitan monooleate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Polypropylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Polysiloxane	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
Poly(tetramethylene ether) glycol (mw 600-3000)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC D		No	16.2.6, 16.2.8, 16.2.9, 16A.2.2
Potassium hydroxide solution	Y	S/P	3	2G	Open	No			NF	O	No	No	N8	No	16.2.9
Potassium oleate	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Potassium thiosulphate (50% or less)	Y	P	3	2G	Open	No			NF	O	No	No		No	
n-Propanolamine	Y	S/P	3	2G	Open	No			Yes	O	No	A,D	N2	No	16.2.9
beta-Propiolactone	Y	S	2	2G	Cont	No		IIA	Yes	R	T	A		No	
Propionaldehyde	Y	S/P	3	2G	Cont	No			No	R	F-T	A		E	15.16.1, 15.17, 15.19.6
Propionic acid	Y	S	3	2G	Cont	No	T1	IIA	No	R	F	A	Y1	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8, 15.19.6
Propionic anhydride	Y	S/P	3	2G	Cont	No	T2	IIA	Yes	R	T	A	Y1	No	
Propionitrile	Y	S/P	2	1G	Cont	No	T1	IIB	No	C	F-T	A,D		E	15.12, 15.17 to 15.19
n-Propyl acetate	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
n-propyl alcohol	Y	P	3	2G	Cont	No	-	-	No	R	F	A		No	15.19.6
n-Propylamine	Z	S/P	2	2G	Cont	Inert	T2	IIA	No	C	F-T	A,D	N2	E	15.12, 15.19
Propylbenzene (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
n-Propyl chloride	Y	S	3	2G	Cont	No			No	R	F	A,B		No	15.19.6
Propylene dimer (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Propylene glycol methyl ether acetate	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	

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Propylene glycol monoalkyl ether	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Propylene glycol phenyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Propylene oxide	Y	S/P	2	2G	Cont	Inert	T2	IIB	No	C	F-T	A,C	Z	No	15.8, 15.12.1, 15.14, 15.19
Propylene tetramer	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Propylene trimer	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Pyridine	Y	S	2	2G	Cont	No	T1	IIA	No	R	F	A	N4	No	15.19.6
Pyrolysis gasoline	X	S/P	2	2G	Cont	No	T3	IIA	No	C	F-T	A,B		No	15.12, 15.17, 15.19.6
Rape seed oil fatty acid methyl esters	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Rosin	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Rosin soap (disproportionated) solution	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Sodium aluminosilicate slurry	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Sodium benzoate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Sodium borohydride (15% or less)/Sodium hydroxide solution	Y	S	3	2G	Open	No			NF	O	No	No	N1	No	16.2.7
Sodium carbonate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Sodium chlorate solution (50% or less)	Z	S	3	2G	Open	No			NF	O	No	No		No	15.9, 15.16.1, 15.19.6
Sodium dichromate solution (70% or less)	Y	S/P	2	2G	Open	No			NF	C	No	No	N2	No	15.12.3, 15.19
Sodium hydrogen sulphide (6% or less)/Sodium carbonate (3% or less) solution	Z	P	3	2G	Open	No			NF	O	No	No		No	15.19.6
Sodium hydrogen sulphite solution (45% or less)	Z	S	3	2G	Open	No			NF	O	No	No		No	
Sodium hydrosulphide/Ammonium sulphide solution	Y	S/P	2	2G	Cont	No			No	C	F-T	A	N1	E	15.12, 15.14, 15.16.1, 15.17, 15.19, 16.6.1 to 16.6.3
Sodium hydrosulphide solution (45% or less)	Z	S/P	3	2G	Cont	Vent or pad (gas)			NF	R	T	No		No	15.16.1, 15.19.6, 16.2.9
Sodium hydroxide solution	Y	S	3	2G	Open	No			NF	O	No	No	N8	No	
Sodium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No	-	-	-	R	No	No	N5	No	15.16.1
Sodium nitrite solution	Y	S/P	2	2G	Open	No			NF	O	No	No		No	15.12.3.1, 15.12.3.2, 15.16.1, 15.19
Sodium silicate solution	Y	P	3	2G	Open	No			NF	O	No	No		No	
Sodium sulphide solution (15% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	N5	No	15.16.1, 15.19.6, 16.2.9
Sodium sulphite solution (25% or less)	Y	P	3	2G	Open	No			NF	O	No	No		No	15.16.1, 15.19.6, 16.2.9
Sodium tartrates/Sodium succinates solution	Z	S	3	2G	Open	No			Yes	O	No	A,B	Y5	No	
Sodium thiocyanate solution (56% or less)	Y	P	3	2G	Open	No			Yes	O	No	No		No	15.19.6
Styrene monomer	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	F	A,B	N4,Z	No	15.13, 15.19.6, 16.6.1, 16.6.2
Sulpholane	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

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Sulphonated polyacrylate solution	Z	P	3	2G	Cont	No	-	-	No	R	F	A		No	
Sulphur (molten)	Z	S	3	1G	Open	Vent or pad (gas)	T3		Yes(I)	O	F-T	No		No	15.10
Sulphuric acid	Y	S/P	3	2G	Open	No			NF	O	No	No		No	15.11, 15.16.2, 16.2.8, 16.2.9
Sulphuric acid, spent	Y	S/P	3	2G	Open	No			NF	O	No	No		No	15.11, 15.16.2, 16.2.8, 16.2.9
Sulphurized fat (C14-C20)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Tall oil (crude and distilled)	Y	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.6, 16.2.9, 16A.2.2
Tall oil fatty acid (resin acids less than 20%)	Y	P	2	2G	Open	No			Yes	O	No	A		No	16.2.7 to 16.2.9
Tallow	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Tetrachloroethane	Y	S/P	2	2G	Cont	No			NF	R	T	No		No	15.12, 15.17, 15.19.6
Tetraethylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Tetraethylene pentamine	Y	S	2	2G	Open	No			Yes	O	No	A	N1	No	
Tetrahydrofuran	Z	S	3	2G	Cont	No	T3	IIB	No	R	F-T	A		No	15.19.6
Tetrahydronaphthalene (bb)	Y	P	2	2G	Open	No			Yes	O	No	A		No	
Tetramethylbenzene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A		No	16.2.9, 16A.2.2
Titanium dioxide slurry	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Toluene (bb)	Y	P	3	2G	Cont	No			No	R	F	A		No	15.19.6
Toluenediamine	Y	S/P	2	2G	Cont	No			Yes	C	T	A,D	N1	E	15.12, 15.17, 15.19, 16.2.7, 16.2.9
Toluene diisocyanate	Y	S/P	2	2G	Cont	Dry	T1	IIA	Yes	C	F-T	A, C(c), D	N4	E	15.12, 15.16.2, 15.17, 15.19, 16.2.9
o-Toluidine	Y	S/P	2	2G	Cont	No			Yes	C	T	A		No	15.12, 15.17, 15.19
Tributyl phosphate	Y	P	3	2G	Open	No			Yes	O	No	A		No	15.19.6
1,2,3-Trichlorobenzene (molten)	X	S/P	1	2G	Cont	No			Yes	C	T	A, C, D		E	15.12.1, 15.17, 15.19, 16.2.9
1,2,4-Trichlorobenzene	X	S/P	1	2G	Cont	No			Yes	R	T	A,B		No	15.19.6, 16.2.9, 16A.2.2
1,1,1-Trichloroethane	Y	P	3	2G	Open	No			Yes	O	No	A		No	
1,1,2-Trichloroethane	Y	S/P	3	2G	Cont	No			NF	R	T	No		No	15.12.1, 15.19.6
Trichloroethylene	Y	S/P	2	2G	Cont	No	T2	IIA	Yes	R	T	No		No	15.12, 15.16.1, 15.17, 15.19.6
1,2,3-Trichloropropane	Y	S/P	2	2G	Cont	No			Yes	C	T	A,B,D		No	15.12, 15.17, 15.19
1,1,2-Trichloro-1,2,2-Trifluoroethane	Y	P	2	2G	Open	No			NF	O	No	No		No	
Tricresyl phosphate (containing 1% or more ortho-isomer)	Y	S/P	1	2G	Cont	No	T2	IIA	Yes	C	No	A,B		No	15.12.3, 15.19
Tridecane	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6

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Tridecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A			15.19.6, 16.2.6, 16.2.9, 16A.2.2
Tridecyl acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Triethanolamine	Z	S	3	2G	Open	No		IIA	Yes	O	No	A	N1	No	
Triethylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A,C	N2	E	15.12, 15.19.6
Triethylbenzene	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Triethylenetetramine	Y	S	2	2G	Open	No	T2	IIA	Yes	O	No	A	N1	No	
Triethyl phosphate	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Triethylphosphite	Y	S/P	3	2G	Cont	No			No	R	F-T	A,B		No	15.12.1, 15.19.6
Triisopropanolamine	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Triisopropylated phenyl phosphates (containing less than 1% ortho-isomer)	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Trimethylacetic acid	Y	S	3	2G	Cont	No			Yes	R	No	A	Y1	No	15.11.2 to 15.11.8
Trimethylamine solution (30% or less)	Z	S/P	2	2G	Cont	No			No	C	F-T	A,C	N1	E	15.12, 15.14, 15.19, 16.2.9
Trimethylbenzene (all isomers)	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Trimethylhexamethylene diisocyanate (2,2,4- and 2,4,4-isomers)	Y	S/P	2	2G	Cont	Dry			Yes	C	T	A, C(c)		No	15.12, 15.16.2, 15.17, 15.19.6
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
2,2,4-Trimethyl-1,3-pentanediol-1-isobutyrate	Y	P	2	2G	Open	No			Yes	O	No	A		No	
1,3,5-Trioxane	Y	S	3	2G	Cont	No			No	R	F	A,D		No	15.19.6
Tripropylene glycol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Trixylyl phosphate	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19
Turpentine	X	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Undecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A		No	16.2.6, 16.2.9
1-Undecene	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6
Undecyl alcohol	X	P	2	2G	Open	No			Yes	O	No	A		No	15.19.6, 16.2.9, 16A.2.2(r)
Urea/Ammonium mono- and di-hydrogen phosphate/Potassium chloride solution	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Urea/Ammonium nitrate solution	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Urea/Ammonium nitrate solution (containing aqua ammonia)	Y	S/P	2	2G	Cont	No			NF	R	T	A	N4	No	
Urea/Ammonium phosphate solution	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Urea solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	
Valeraldehyde (all isomers)	Y	S/P	3	2G	Cont	Inert	T3	IIB	No	R	F-T	A		No	15.4.6, 15.16.1, 15.19.6
Vegetable acid oils and distillates, n.o.s., including:	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Vegetable protein solution (hydrolysed)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A		No	

<u>Substance</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>I'</u>	<u>I''</u>	<u>J</u>	<u>K</u>	<u>L</u>	<u>M</u>	<u>N</u>	<u>O</u>
Vinyl acetate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	A		No	15.13, 15.19.6, 16.6.1, 16.6.2
Vinyl ethyl ether	Z	S/P	2	1G	Cont	Inert	T3	IIB	No	C	F-T	A	N6	E	15.4, 15.13, 15.14, 15.19, 16.6.1, 16.6.2
Vinylidene chloride	Y	S	2	2G	Cont	Inert	T2	IIA	No	R	F-T	B	N5	E	15.13, 15.14, 15.19.6, 16.6.1, 16.6.2
Vinyl neodecanoate	Y	S/P	2	2G	Open	No			Yes	O	No	A,B		No	15.13, 15.16.1, 15.19.6, 16.6.1, 16.6.2
Vinyltoluene	Y	S/P	2	2G	Cont	No		IIA	No	R	F	A,B	N1	No	15.13, 15.19.6, 16.6.1, 16.6.2
Waxes (Should be Petrolatum, purified)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Xylenes (bb)	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6, 16.2.9(w)
Xylenes/ethylbenzene (10% or more) mixture	Y	P	2	2G	Cont	No			No	R	F	A		No	15.19.6
Xylenol	Y	S/P	3	2G	Open	No		IIA	Yes	O	No	A,B		No	15.19.6, 16.2.9, 16A.2.2
Zinc alkaryl dithiophosphate (C7-C16)	Y	P	2	2G	Open	No			Yes	O	No	A,B		No	16.2.7, 16.2.8
Zinc alkenyl carboxamide	Y	P	2	2G	Open	No	-	-	Yes	O	No	A		No	15.19.6
Zinc alkyl dithiophosphate (C3-C14)	Y	P	2	2G	Open	No			Yes	O	No	A,B		No	15.19.6, 16.2.6

- a Applies to ammonia aqueous (28% or less), but not below 10%.

Ammonia aqueous (28% or less)

- b If the product to be carried contains flammable solvents such that the flashpoint does not exceed 60°C, then special electrical systems and a flammable-vapour detector shall be provided.

Diphenylmethane diisocyanate
Polymethylene polyphenyl isocyanate

- c Although water is suitable for extinguishing open-air fires involving chemicals to which this footnote applies, water shall not be allowed to contaminate closed tanks containing these chemicals because of the risk of hazardous gas generation.

Diphenylmethane diisocyanate
Toluene diisocyanate
Trimethylhexamethylene diisocyanate (2,2,4- and 2,4,4-isomers)

- d Deleted

- e Applies to formaldehyde solutions (45% or less), but not below 5%.

Formaldehyde solutions (45% or less)

- f Applies to hydrochloric acid not below 10%.

Aluminium chloride (30% or less)/Hydrochloric acid (20% or less) solution
Hydrochloric acid

- g Dry chemical cannot be used because of the possibility of an explosion.

Maleic anhydride

- h Deleted

- i Deleted

- j Deleted

- k Phosphorus, yellow or white is carried above its autoignition temperature and therefore flashpoint is not appropriate. Electrical equipment requirements may be similar to those for substances with a flashpoint above 60°C.

Phosphorus, yellow or white

- l Deleted

- m Deleted

n Deleted

o Deleted

p Deleted

q Requirements are based on those isomers having a flashpoint of 60°C c.c., or less; some isomers have a flashpoint greater than 60°C c.c., and therefore the requirements based on flammability would not apply to such isomers.

Heptanol (all isomers)

r Deleted

s Applies to n-decyl alcohol only.

Decyl alcohol (all isomers)

t Deleted

u Dry chemical shall not be used as fire-extinguishing media.

Nitropropane (60%)/Nitroethane (40%) mixture

v Confined spaces shall be tested for both formic acid vapours and carbon monoxide gas, a decomposition product.

Formic acid

w Applies to p-xylene only.

Xylenes

x Applies to p-isomer and mixtures containing p-isomer the viscosity of which is ≤ 23 mPa.s at 20°C.

Dichlorobenzene (all isomers)

y Applies to p-isomer and mixtures containing p-isomer the melting point of which is 0°C and above

Dichlorobenzene (all isomers)

z Deleted

aa Deleted

Chapter 18

List of liquid substances to which the Code does not apply

1 The following are liquid substances, which have been reviewed for their safety and pollution hazards and determined not to present hazards to such an extent as to warrant application of the Code.

2 Although the liquid substances listed in this chapter fall outside the scope of the Code, the attention of Administrations is drawn to the fact that some safety precautions may be needed for their safe transportation. Accordingly, Administrations shall prescribe appropriate safety requirements.

3 Some liquid substances are identified as falling into Pollution Category Z and, therefore, subject to certain operational requirements of Annex II of MARPOL 73/78.

4 Liquid mixtures which are provisionally assessed under regulation 6.3 of Annex II of MARPOL 73/78 as falling into pollution category OS, and which do not present safety hazards, may be carried under the entry for “Non-Noxious Liquid Substances, not otherwise specified (n.o.s)” in this Chapter.

EXPLANATORY NOTES

Product name (column a)	In some cases, the product names are not identical with the names given in previous issues of the Code
UN Number (column b)	Deleted
Pollution category (column c)	The letter Z means the Pollution Category assigned to each product under Annex II of MARPOL 73/78. OS means the product was evaluated and found to fall outside the categories X, Y, or Z.

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Substance	Pollution Category	UN No.
Acetone	Z	
Alcoholic beverages, n.o.s.	Z	
Animal and fish oils, n.o.s., including:]* to be considered at MEPC 52	NED	
Apple juice	Z	
Butyl alcohol (all isomers)	Z	
n-Butyl alcohol	Z	
sec-Butyl alcohol	Z	
Calcium nitrate solutions (50% or less)	Z	1454
Clay slurry	Z	
Coal slurry	Z	
Diethylene glycol	Z	
Ethyl alcohol	Z	
Ethylene carbonate	Z	
Glucose solution	Z	
Glycerine	Z	
Hexamethylenetetramine solutions	Z	
Hexylene glycol	Z	
Isopropyl alcohol	Z	
Kaolin slurry	Z	
Magnesium hydroxide slurry	Z	
N-Methylglucamine solution (70% or less)	Z	
Molasses	Z	
Polyaluminium chloride solution	Z	
Potassium formate solutions	Z	
Propylene carbonate	Z	
Propylene glycol	Z	
Sodium acetate solutions	Z	

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Substance	Pollution Category	UN No.
Sodium sulphate solutions	Z	
Tetraethyl silicate monomer/oligomer (20% in ethanol)	Z	
Triethylene glycol	Z	
[Vegetable oils, n.o.s., including:]* to be considered at MEPC 52	NED	
Water	Z	

Chapter 19

Index of Dangerous Products Carried in Bulk

1 *Column 1* of the index gives the names of products listed in Chapters 17 and 18 of the Code.

- .1 Products listed in these Chapters as well as abbreviations are shown in capitals. Alternative names are shown in lower case letters with an initial capital. If the product in *column 1* is listed in Chapter 17 or Chapter 18 the relevant reference is indicated in *column 2*. Where no reference to an appropriate Chapter is given in *column 2*, the name of the basic product is given and the Chapter references and conditions of carriage for that chemical are applicable. An asterisk (*) alongside a chemical name signifies that the name conforms with the system of nomenclature of the International Union of Pure and Applied Chemistry (IUPAC).
- .2 Prefixes forming an integral part of the name are shown in ordinary (roman) type and are taken into account in determining the alphabetical order of entries. These include such prefixes as:

Mono Di Tri Tetra Penta Iso Bis Neo Ortho

- .3 Prefixes that are disregarded for purposes of alphabetical order are in italics and include the following:

n-	(normal-)
sec-	(secondary-)
tert-	(tertiary-)
o-	(ortho-)
m-	(meta-)
p-	(para-)
N-	
O-	
sym-	(symmetrical)
uns-	(unsymmetrical)
dl-	
cis-	
trans-	
(E)-	
(Z)-	
alpha-	(α)
beta-	β
gamma-	γ
epsilon-	ϵ

2 *Column 3* of the index gives those UN numbers of products, which were available up to February 2001*

* The reason for this decision is given in paragraph 7.10 of BLG 6/16

Index of chemicals

to be compiled and added by the Secretariat.

Chapter 20

Transport of liquid chemical wastes

20.1 Preamble

20.1.1 Maritime transport of liquid chemical wastes could present a threat to human health and to the environment.

20.1.2 Liquid chemical wastes shall, therefore, be transported in accordance with relevant international conventions and recommendations and, in particular, where it concerns maritime transport in bulk, with the requirements of this Code.

20.2 Definitions

For the purpose of this Chapter:

20.2.1 *Liquid chemical wastes* are substances, solutions or mixtures, offered for shipment, containing or contaminated with one or more constituents which are subject to the requirements of this Code and for which no direct use is envisaged but which are carried for dumping, incineration or other methods of disposal other than at sea.

20.2.2 *Transboundary movement* means maritime transport of wastes from an area under the national jurisdiction of one country to or through an area under the national jurisdiction of another country, or to or through an area not under the national jurisdiction of any country, provided at least two countries are concerned by the movement.

20.3 Applicability

20.3.1 The requirements of this Chapter are applicable to the transboundary movement of liquid chemical wastes in bulk by seagoing ships and shall be considered in conjunction with all other requirements of this Code.

20.3.2 The requirements of this Chapter do not apply to:

- .1 wastes derived from shipboard operations which are covered by the requirements of MARPOL 73/78; and
- .2 substances, solutions or mixtures containing or contaminated with radioactive materials which are subject to the applicable requirements for radioactive materials.

20.4 Permitted shipments

20.4.1 Transboundary movement of wastes is permitted to commence only when:

- .1 notification has been sent by the competent authority of the country of origin, or by the generator or exporter through the channel of the competent authority of the country of origin, to the country of final destination; and

- .2 the competent authority of the country of origin, having received the written consent of the country of final destination stating that the wastes will be safely incinerated or treated by other methods of disposal, has given authorization to the movement.

20.5 Documentation

20.5.1 In addition to the documentation specified in 16.2 of this Code, ships engaged in transboundary movement of liquid chemical wastes shall carry on board a waste movement document issued by the competent authority of the country of origin.

20.6 Classification of liquid chemical wastes

20.6.1 For the purpose of the protection of the marine environment, all liquid chemical wastes transported in bulk shall be treated as Category X Noxious Liquid Substances, irrespective of the actual evaluated category.

20.7 Carriage and handling of liquid chemical wastes

20.7.1 Liquid chemical wastes shall be carried in ships and cargo tanks in accordance with the minimum requirements for liquid chemical wastes specified in Chapter 17, unless there are clear grounds indicating that the hazards of the wastes would warrant:

- .1 carriage in accordance with the ship type 1 requirements; or
- .2 any additional requirements of this Code applicable to the substance or, in case the of a mixture, its constituent presenting the predominant hazard.

Chapter 21

Criteria for assigning Carriage Requirements for products subject to the IBC Code

21.1 Introduction

21.1.1 The following criteria are guidelines for the determination of Pollution Classification and assignment of appropriate carriage requirements for bulk liquid cargoes being considered as candidates for entry into the IBC Code or annexes 1, 3 or 4 of MEPC.2/Circs.

21.1.2 In developing such criteria, every effort has been made to follow the criteria and cut off points developed under the Global Harmonized System (GHS).

21.1.3 Although the criteria are intended to be closely defined in order to establish a uniform approach, it must be emphasized that these are guidelines only and, where human experience or other factors indicates the need for alternative arrangements, these shall always be taken into account. Where deviations from the criteria have been recognized, they shall be properly recorded with justifications.

21.2 Contents

21.2.1 This annex contains the following sections and appendices:

- .1 minimum safety and pollution criteria for bulk liquid cargoes subject to Chapter 17 of the IBC Code;
- .2 criteria used to assign the minimum carriage requirements for products, which meet the safety or pollution criteria to make them subject to Chapter 17 of the IBC Code;
- .3 special requirements in Chapter 15 of the IBC Code to be included in *column o* of Chapter 17 of the IBC Code;
- .4 special requirements in Chapter 16 of the IBC Code to be included in *column o* of Chapter 17 of the IBC Code; and
- .5 definitions of properties used within this annex.

21.3 Minimum safety and pollution criteria for bulk liquid cargoes subject to Chapter 17 of the IBC Code

21.3.1 Bulk liquid cargoes are deemed to be hazardous and subject to Chapter 17 of the IBC Code if they meet one or more of the following criteria:

- .1 inhalation $LC_{50} \leq 20$ mg/l/4hr (see definitions in paragraph 21.7.1.1);
- .2 dermal $LD_{50} \leq 2000$ mg/kg (see definitions in paragraph 21.7.1.2);
- .3 oral $LD_{50} \leq 2000$ mg/kg (see definitions in paragraph 21.7.1.3);

- .4 toxic to mammals by prolonged exposure (see definitions in paragraph 21.7.2);
- .5 cause skin sensitization (see definitions in paragraph 21.7.3);
- .6 cause respiratory sensitization (see definitions in paragraph 21.7.4);
- .7 corrosive to skin (see definitions in paragraph 21.7.5);
- .8 have a Water Reactive Index (WRI) of ≥ 1 (see definitions in paragraph 21.7.6);
- .9 require inertion, inhibition, stabilization, temperature control or tank environmental control in order to prevent a hazardous reaction (see definitions in paragraph 21.7.10);
- .10.1 flash point $< 23^{\circ}\text{C}$; and have an explosive/flammability range (expressed as a percentage by volume in air) of $\geq 20\%$;
- .11 autoignition temperature of $\leq 200^{\circ}\text{C}$; and
- .12 classified as Pollution Category X or Y or meeting the criteria for rules 11 to 13 under paragraph 21.4.5.1.

21.4 Criteria used to assign the Minimum Carriage Requirements for products, which meet the minimum safety or pollution criteria to make them subject to Chapter 17 of the IBC Code.

21.4.1 *Column a* - Product Name

21.4.1.1 The IUPAC name shall be used as far as possible but, where this is unnecessarily complex, then a technically correct and unambiguous alternative chemical name may be used.

21.4.2 *Column b* –Deleted

21.4.3 *Column c* - Pollution Category

21.4.3.1 *Column c* identifies the pollution category assigned to each product under MARPOL Annex II.

21.4.4 *Column d* - Hazards

21.4.4.1 An *S* is assigned to *column d* if any of the safety criteria described in paragraphs 21.3.1.1 to 21.3.1.11 are met.

21.4.4.2 A *P* is assigned to *column d* if the product is classified as pollution category X or Y, as referred to in paragraph 21.3.1.12.

21.4.5 Column e - Ship Type

21.4.5.1 The basic criteria for assigning Ship Types based on the GESAMP Hazard Profile are shown in the table below. An explanation of the details in the columns is provided in appendix 1 of Annex II to MARPOL 73/78. Selected rules, identified in this table, are specified in section 21.4.5.2 for assigning specific Ship Types.

Rule Number	A1	A2	B1	B2	D3	E2	Ship Type
1			≥ 5				1
2	≥ 4	NR	4		CMRTNI		
3	≥ 4	NR			CMRTNI		2
4			4				
5	≥ 4		3				
6		NR	3				
7				≥ 1			
8						Fp	
9					CMRTNI	F	
10			≥ 2			S	
11	≥ 4						3
12		NR					
13			≥ 1				
14	All other Category Y Substances						
15	All other Category Z Substances All “Other Substances” (OS)						NA

21.4.5.2 The ship type is assigned according to the following criteria:

Ship Type 1:

Inhalation $LC_{50} \leq 0.5$ mg/l/4h; and/or
 Dermal $LD_{50} \leq 50$ mg/kg; and/or
 Oral $LD_{50} \leq 5$ mg/kg; and/or
 Autoignition temperature $\leq 65^{\circ}\text{C}$; and/or
 Explosive range $\geq 50\%$ v/v in air and the flash point $< 23^{\circ}\text{C}$; and/or
 Rules 1 or 2 of the table shown in 21.4.5.1

Ship Type 2:

Inhalation $LC_{50} > 0.5$ mg/l/4h - ≤ 2 mg/l/4h; and/or
 Dermal $LD_{50} > 50$ mg/kg - ≤ 1000 mg/kg; and/or
 Oral $LD_{50} > 5$ mg/kg - ≤ 300 mg/kg; and/or
 WRI=2;
 Autoignition temperature $\leq 200^{\circ}\text{C}$; and/or
 Explosive range $\geq 40\%$ v/v in air and the flash point $< 23^{\circ}\text{C}$; and/or
 Any of the rules 3 to 10 of the table shown in 21.4.5.1

Ship Type 3:

Any of the minimum safety or pollution criteria for bulk liquid cargoes subject to Chapter 17 of the IBC Code not meeting the requirements for ship types 1 or 2 and not meeting rule 15 of the table shown in 21.4.5.1.

21.4.6 Column f - Tank type

21.4.6.1 The tank type is assigned according to the following criteria:

Tank type 1G: Inhalation $LC_{50} \leq 0.5$ mg/l/4h; and/or
Dermal $LD_{50} \leq 200$ mg/kg; and/or
Autoignition temperature $\leq 65^{\circ}\text{C}$; and/or
Explosive range $\geq 40\%$ v/v in air and the flash point $< 23^{\circ}\text{C}$; and/or
WRI=2

Tank type 2G: Any of the minimum safety or pollution criteria for bulk liquid cargoes subject to Chapter 17 or the IBC Code not meeting the requirements for tank type 1G.

21.4.7 Column g - Tank vents

21.4.7.1 The tank venting arrangements are assigned according to the following criteria:

Controlled: Inhalation $LC_{50} \leq 10$ mg/l/4h; and/or
Toxic to mammals by prolonged exposure; and/or
Respiratory sensitizer; and/or
Special carriage control needed; and/or
Flash point $\leq 60^{\circ}\text{C}$
Corrosive to skin (≤ 4 h exposure)

Open: Any of the minimum safety or pollution criteria for bulk liquid cargoes subject to Chapter 17 or the IBC Code not meeting the requirements for controlled tank vents.

21.4.8 Column h - Tank environmental control

21.4.8.1 The Tank environmental control conditions are assigned according to the following criteria:

Inert: Autoignition temperature $\leq 200^{\circ}\text{C}$; and/or
Reacts with air to cause a hazard; and/or
Explosive range $\geq 40\%$ and the flash point $< 23^{\circ}\text{C}$.

Dry: WRI ≥ 1

Pad: Only applies to specific products identified on a case by case basis.

Vent: Only applies to specific products identified on a case by case basis.

21.4.9 Column i - Electrical equipment

21.4.9.1 If the flash point of the product is $\leq 60^{\circ}\text{C}$ or the product is heated to within 15°C of its flash point then the electrical equipment required are assigned according to the following criteria, else '-' is assigned:

.1 Column i' - Temperature class:

T1	Autoignition temperature $\geq 450^{\circ}\text{C}$
T2	Autoignition temperature $\geq 300^{\circ}\text{C}$ but $< 450^{\circ}\text{C}$
T3	Autoignition temperature $\geq 200^{\circ}\text{C}$ but $< 300^{\circ}\text{C}$
T4	Autoignition temperature $\geq 135^{\circ}\text{C}$ but $< 200^{\circ}\text{C}$
T5	Autoignition temperature $\geq 100^{\circ}\text{C}$ but $< 135^{\circ}\text{C}$
T6	Autoignition temperature $\geq 85^{\circ}\text{C}$ but $< 100^{\circ}\text{C}$

.2 Column i'' - Apparatus group:

Apparatus group	MESG at 20°C (mm)	MIC ratio product/methane
IIA	≥ 0.9	> 0.8
IIB	> 0.5 to < 0.9	≥ 0.45 to ≤ 0.8
IIC	≤ 0.5	< 0.45

.2.1 The tests shall be carried out in accordance with the procedures described in IEC 79-1A and IEC 79-3.

.2.2 For gases and vapours it is sufficient to make only one determination of either MESG or MIC provided that:

for Group IIA: the MESG > 0.9 mm or the MIC ratio > 0.9 .
 for Group IIB: the MESG is ≥ 0.55 mm and ≤ 0.9 mm; or the MIC ratio is ≥ 0.5 and ≤ 0.8 .
 for Group IIC: the MESG is < 0.5 mm or the MIC ratio is < 0.45 .

.2.3 It is necessary to determine both the MESG and the MIC ratio when:

- .1 The MIC ratio determination only has been made, and the ratio is between 0.8 and 0.9, when an MESG determination will be required;
- .2 The MIC ratio determination only has been made, and the ratio is between 0.45 and 0.5, when an MESG determination will be required; or
- .3 The MESG only has been found, and is between 0.5 mm and 0.55 mm, when an MIC ratio determination will be required.

.3 Column i''' Flash point: $> 60^{\circ}\text{C}$:Yes
 $\leq 60^{\circ}\text{C}$:No
 Non-flammable :NF

21.4.10 Column j - Gauging

21.4.10.1 The type of gauging equipment permitted is assigned according to the following criteria:

Closed	Inhalation $LC_{50} \leq 2 \text{ mg/l/4hr}$; and/or Dermal $LD_{50} \leq 1000 \text{ mg/kg}$; and/or Toxic to mammals by prolonged exposure; and/or Respiratory sensitizer; and/or Corrosive to skin ($\leq 3 \text{ min}$ exposure).
Restricted	Inhalation $LC_{50} > 2 - \leq 10 \text{ mg/l/4h}$; and/or Special carriage control indicates Inerting required; and/or Corrosive to skin ($> 3 \text{ min} - \leq 1 \text{ h}$ exposure); and/or Flash point $\leq 60^\circ\text{C}$.
Open	Any of the minimum safety or pollution criteria for bulk liquid cargoes subject to Chapter 17 or the IBC Code not meeting the requirements for closed or restricted gauging.

21.4.11 Column k - Vapour detection

21.4.11.1 The type of vapour detection equipment required is determined by the following criteria:

Toxic(T) : Inhalation $LC_{50} \leq 10 \text{ mg/l/4 h}$, and/or
Respiratory sensitizer; and/or
Toxic by prolonged exposure.

Flammable(F) : Flash point $\leq 60^\circ\text{C}$

21.4.12 Column l - Fire protection equipment

21.4.12.1 The appropriate fire fighting media are defined as being appropriate according to the following criteria related to the properties of the product:

Solubility $> 10\%$ ($> 100000 \text{ mg/l}$)	:	A	Alcohol-resistant foam.
Solubility $< 10\%$ ($< 100000 \text{ mg/l}$)	:	A	Alcohol-resistant foam; and/or
	:	B	Regular foam.
WRI = 0	:	C	Water spray (generally used as a coolant and can be used under .1 and .2 providing that the WRI=0).
WRI ≥ 1	:	D	Dry powder

Note: all appropriate media will be listed

21.4.13 Column m - Deleted

21.4.14 *Column n* - Personnel safety equipment for emergencies

21.4.14.1 The requirement to have personnel safety equipment for emergencies on board is identified by 'Yes' in *column o* according to the following criteria:

Inhalation $LC_{50} \leq 2$ mg/l/4 h; and/or
Respiratory sensitizer; and/or
Corrosive to skin (≤ 3 min exposure); and/or
WRI=2

21.5 Special requirements in Chapter 15 to be included in *column o*

21.5.1 The assignment of special requirements in *column o* shall normally follow clear criteria based on the data supplied in the reporting form. Where it is considered appropriate to deviate from such criteria, this shall be clearly documented in such a way that it can easily be retrieved on demand.

21.5.2 The criteria for making reference to the special requirements identified in Chapters 15 and 16 are defined below with comments where relevant.

21.5.3 Paragraphs 15.2 to 15.10

21.5.3.1 Paragraphs 15.2 to 15.10 identify specific products by name with special carriage requirements that cannot be easily accommodated in any other way.

21.5.4 Paragraph 15.11 - Acids

21.5.4.1 Paragraph 15.11 applies to ALL acids unless they:

are organic acids - when only paragraphs 15.11.2 - 15.11.4 and paragraphs 15.11.6 - 15.11.8 apply; or
do not evolve hydrogen - when paragraph 15.11.5 need not apply

21.5.5 Paragraph 15.12 - Toxic products

21.5.5.1 All of paragraph 15.12 is added to *column o* according to the following criteria:

Inhalation $LC_{50} \leq 2$ mg/l/4 hr; and/or
the product is a Respiratory Sensitizer; and/or
the product is Toxic to mammals by prolonged exposure.

21.5.5.2 Paragraph 15.12.3 is added to *column o* according to the following criteria:

Inhalation $LC_{50} > 2 - \leq 10$ mg/l/4 hr; and/or
Dermal $LD_{50} \leq 1000$ mg/kg; and/or
Oral $LD_{50} \leq 300$ mg/kg.

21.5.5.3 Paragraph 15.12.4 is added to *column o* according to the following criterion:

inhalation $LC_{50} > 2 - \leq 10$ mg/l/4 h.

21.5.6 Paragraph 15.13 - Cargoes protected by additives

21.5.6.1 The requirement to assign paragraph 15.13 to *column o* is based on the information related to the products tendency to polymerise, decompose, oxidise or undergo other chemical changes which may cause a hazard under normal carriage conditions and which would be prevented by the addition of appropriate additives.

21.5.7 Paragraph 15.14 - Cargoes with a vapour pressure greater than atmospheric at 37.8°C

21.5.7.1 The requirement to assign paragraph 15.14 to *column o* is based on the following criterion:

Boiling point $\leq 37.8^\circ\text{C}$

21.5.8 Paragraph 15.16 - Prevention of cargo contamination

21.5.8.1 Paragraph 15.16.1 is deleted.

21.5.8.2 Paragraph 15.16.2 is added to *column o* according to the following criterion:

$WRI \geq 1$

21.5.9 Paragraph 15.17 - Increased ventilation requirements

21.5.9.1 Paragraph 15.17 shall be added to *column o* according to the following criteria:

Inhalation $LC_{50} > 0.5 - \leq 2$ mg/l/4 hrs; and/or
Respiratory sensitizer; and/or
Toxic to mammals by prolonged exposure; and/or
Corrosive to skin (≤ 1 h exposure time).

21.5.10 Paragraph 15.18 - Special cargo pumproom requirements

21.5.10.1 Paragraph 15.18 shall be added to *column o* according to the following criterion:

Inhalation $LC_{50} \leq 0.5$ mg/l/4 h

21.5.11 Paragraph 15.19 - Overflow control

21.5.11.1 Paragraph 15.19 shall be added to *column o* according to the following criteria:

Inhalation $LC_{50} \leq 2$ mg/l/4 h; and/or
Dermal $LD_{50} \leq 1000$ mg/kg; and/or
Oral $LD_{50} \leq 300$ mg/kg; and/or
Respiratory sensitizer; and/or

Corrosive to skin (≤ 3 min exposure); and/or
Autoignition temperature $\leq 200^{\circ}\text{C}$; and/or
Explosive range $\geq 40\%$ v/v in air and flash point $< 23^{\circ}\text{C}$; and/or
Classified as Ship Type 1 on pollution grounds.

21.5.11.2 Only paragraph 15.19.6 shall apply if the product has any of the following properties:

Inhalation $\text{LC}_{50} > 2 \text{ mg/l/4h} - \leq 10 \text{ mg/l/4 h}$; and/or
Dermal $\text{LD}_{50} > 1000 \text{ mg/kg} - \leq 2000 \text{ mg/kg}$; and/or
Oral $\text{LD}_{50} > 300 \text{ mg/kg} - \leq 2000 \text{ mg/kg}$; and/or
Skin sensitizer; and/or
Corrosive to skin ($> 3 \text{ min} - \leq 1 \text{ hr}$ exposure); and/or
Flash point $\leq 60^{\circ}\text{C}$; and/or
Classified as Ship Type 2 on pollution grounds; and/or
Pollution Category X or Y.

21.5.12 Paragraph 15.21

21.5.12.1 Paragraph 15.21 is added to *column o* according to the heat sensitivity of the product. This requirement is related to pumps in cargo pump rooms only.

21.6 Special requirements in Chapters 16 to be included in *column o*

21.6.1 Paragraphs 16.1 to 16.2.5 and 16.3 to 16.5

21.6.1.1 These apply to all cargoes and so are not referenced specifically in *column o*.

21.6.2 Paragraph 16.2.6

21.6.2.1 Paragraph 16.2.6 is added to *column o* for products, which meet the following criteria:

Pollution Category Y and viscosity $\geq 50 \text{ mPa.s}$ at 20°C

21.6.3 Paragraph 16.2.9

21.6.3.1 Paragraph 16.2.9 is added to *column o* for products, which meet the following criterion:

Melting point $\geq 0^{\circ}\text{C}$.

21.6.4 Paragraph 16.6

Paragraphs 16.6.2 to 16.6.4 are added to *column o* for products, which are identified as requiring temperature control during carriage.

21.7 Definitions

21.7.1 Acute mammalian toxicity

21.7.1.1 Acutely toxic by inhalation

Inhalation toxicity (LC ₅₀)	
Hazard level	mg/l/4 h
High	≤0.5
Moderately high	>0.5 - ≤2
Moderate	>2 - ≤10
Slight	>10 - ≤20
Negligible	>20

Note: All inhalation toxicity data are assumed to be associated with vapours and not mists or sprays, unless indicated otherwise.

21.7.1.2 Acutely toxic in contact with skin

Dermal toxicity (LD ₅₀)	
Hazard Level	mg/kg
High	≤50
Moderately high	>50 - ≤200
Moderate	>200 - ≤1000
Slight	>1000 - ≤2000
Negligible	>2000

21.7.1.3 Acutely toxic if swallowed

Oral toxicity (LD ₅₀)	
Hazard Level	mg/kg
High	≤5
Moderately High	>5 - ≤50
Moderate	>50 - ≤300
Slight	>300 - ≤2000
Negligible	>2000

21.7.2 Toxic to mammals by prolonged exposure

21.7.2.1 A product is classified as *toxic by prolonged exposure* if it meets any of the following criteria: it is known to be, or suspected of being a carcinogen, mutagen, reprotoxic, neurotoxic, immunotoxic or exposure below the lethal dose is known to cause specific organ oriented systemic toxicity (TOST) or other related effects.

21.7.2.2 Such effects may be identified from the GESAMP Hazard Profile of the product or other recognized sources of such information.

21.7.3 Skin sensitization

21.7.3.1 A product is classified as a *skin sensitizer*:

if there is evidence in humans that the substance can induce sensitization by skin contact in a substantial number of persons; or

where there are positive results from an appropriate animal test.

21.7.3.2 When an adjuvant type test method for skin sensitization is used, a response of at least 30% of the animals is considered as positive. For a non-adjuvant test method a response of at least 15% of the animals is considered positive.

21.7.3.3 When a positive result is obtained from the Mouse Ear Swelling Test (MEST) or the Local Lymph Node Assay (LLNA), this may be sufficient to classify the product as a skin sensitizer.

21.7.4 Respiratory sensitization

21.7.4.1 A product is classified as a *respiratory sensitizer*:

if there is evidence in humans that the substance can induce specific respiratory hypersensitivity; and/or

where there are positive results from an appropriate animal test; and/or

where the product is identified as a skin sensitizer and there is no evidence to show that it is not a respiratory sensitizer.

21.7.5 Corrosive to skin

Hazard Level	Exposure time to cause full thickness necrosis of skin	Observation time
Severely corrosive to skin	≤ 3 min	≤ 1 h
Highly corrosive to skin	> 3 min - ≤ 1 h	≤ 14 days
Moderately corrosive to skin	> 1 h - ≤ 4 h	≤ 14 days

Note: Products that are corrosive to skin are, for the purpose of assigning relevant carriage requirements, deemed to be corrosive by inhalation.

21.7.6 Water reactive substances

21.7.6.1 These are classified into three groups as follows:

Water reactive index (WRI)	Definition
2	Any chemical which, in contact with water, may produce a toxic, flammable or corrosive gas or aerosol
1	Any chemical which, in contact with water, may generate heat or produce a non-toxic, non-flammable or non corrosive gas.
0	Any chemical which, in contact with water, would not undergo a reaction to justify a value of 1 or 2.

21.7.7 Air reactive substances

21.7.7.1 Air reactive substances are products which react with air to cause a potentially hazardous situation, e.g. the formation of peroxides which may cause an explosive reaction.

21.7.8 Electrical apparatus - Temperature Class (for products which either have a flashpoint of $\leq 60^{\circ}\text{C}$ or are heated to within 15°C of their flashpoint)

21.7.8.1 The Temperature Class is defined by the International Electrotechnical Commission (IEC) as:

The highest temperature attained under practical conditions of operation within the rating of the apparatus (and recognized overloads, if any, associated therewith) by any part of any surface, the exposure of which to an explosive atmosphere may involve a risk.

21.7.8.2 The Temperature Class of the electrical apparatus is assigned by selecting the Maximum Surface Temperature which is closest to, but less than, the product's autoignition temperature (see paragraph 21.4.9.1.1).

21.7.9 Electrical apparatus - Apparatus group (for products with a flashpoint of $\leq 60^{\circ}\text{C}$)

21.7.9.1 This refers to intrinsically safe and associated electrical apparatus for explosive gas atmospheres which the IEC divide into the following groups:

- Group I: for mines susceptible to firedamp (not used by IMO); and
- Group II: for applications in other industries - further sub-divided according to its Maximum Experimental Safe Gap (MESG) and/or the Minimum Igniting Current (MIC) of the gas/vapour into groups IIA, IIB and IIC.

21.7.9.2 This property cannot be determined from other data associated with the product; it has to be either measured or assigned by assimilation with related products in an homologous series (see paragraph 21.4.9.2.2).

21.7.10 Special carriage control conditions

21.7.10.1 Special carriage control conditions refer to specific measures that need to be taken in order to either prevent a hazardous reaction. They include:

Inhibition: the addition of a compound (usually organic) that retards or stops an undesired chemical reaction such as corrosion, oxidation or polymerisation;

Stabilization: the addition of a substance (stabilizer) that tends to keep a compound, mixture or solution from changing its form or chemical nature. Such stabilizers may retard a reaction rate, preserve a chemical equilibrium, act as antioxidants, keep pigments and other components in emulsion form or prevent the particles in colloidal suspension from precipitating;

Inertion: the addition of a gas (usually nitrogen) in the ullage space of a tank that prevents the formation of a flammable cargo/air mixture;

Temperature control: the maintenance of a specific temperature range for the cargo in order to prevent a hazardous reaction or to keep the viscosity low enough to allow the product to be pumped; and

Padding and venting: only applies to specific products identified on a case by case basis.

21.7.11 Flammable cargoes

21.7.11.1 A cargo is defined as flammable according to the following criteria:

IBC Code descriptor	Flash point (degrees Centigrade)
Highly flammable	< 23
Flammable	≤ 60 but ≥ 23

21.7.11.2 Note: The flash point of mixtures and aqueous solution needs to be measured unless all of the components are non-flammable.

21.7.11.3 Note: The carriage of bulk liquid cargoes which have a flash point of $\leq 60^{\circ}\text{C}$ are subject to the other regulations in SOLAS.

Appendix

Model form of International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk

INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

(Official seal)

Issued under the provisions of the

INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS
CARRYING DANGEROUS CHEMICALS IN BULK
(resolutions MSC....(...) and MEPC....())

under the authority of the Government of

.....
(full official designation of country)

by.....
(full designation of the competent person or organization recognized by the Administration)

Particulars of ship¹

Name of ship

Distinctive number or letters

Port of registry

Gross tonnage

Ship type (Code paragraph 2.1.2)

IMO Number²

Date on which keel was laid or on which the ship
was at a similar stage of construction or
(in the case of a converted ship) date on which
conversion to chemical tanker was commenced

The ship also complies fully with the following amendments to the Code:

.....
.....

¹ Alternatively, the particulars of the ship may be placed horizontally in boxes.

² In accordance with IMO ship identification number scheme adopted by the Organization by resolution A.600(15).

The ship is exempted from compliance with the following provisions of the Code:

.....

THIS IS TO CERTIFY:

- 1 That the ship has been surveyed in accordance with the provisions of section 1.5 of the Code;
- 2 That the survey showed that the construction and equipment of the ship and the condition thereof are in all respects satisfactory and that the ship complies with the relevant provisions of the Code;
- 3 That the ship has been provided with a manual in accordance with Appendix 4 of Annex II as called for by regulation 14 of Annex II of MARPOL 73/78, and that the arrangements and equipment of the ship prescribed in the Manual are in all respects satisfactory;
- 4 That the ship meets the requirements for the carriage in bulk of the following products, provided that all relevant operational provisions of the Code and Annex II of MARPOL 73/78 are observed:

Product	Conditions of carriage (tank numbers etc.)	Pollution Category
Continued on attachment 1, additional signed and dated sheets ³ Tank numbers referred to in this list are identified on attachment 2, signed and dated tank plan.		

- 5 That, in accordance with 1.4 / 2.8.2³, the provisions of the Code are modified in respect of the ship in the following manner:

.....

- 6 That the ship must be loaded:

.1 in accordance with the loading conditions provided in the approved loading manual, stamped and dated and signed by a responsible officer of the Administration, or of an organization recognized by the Administration³;

.2 in accordance with the loading limitations appended to this Certificate³.

³ Delete as appropriate.

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions should be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition⁴.

This Certificate is valid until⁵
subject to surveys in accordance with 1.5 of the Code.

Completion date of the survey on which this certificate is based: dd/mm/yyyy

Issued at
(Place of issue of certificate)

.....
(Date of issue)

.....
(Signature of authorized official
issuing the certificate)

(Seal or stamp of the authority, as appropriate)

Notes on completion of Certificate:

- 1 The Certificate can be issued only to ships entitled to fly the flags of States which are both a Contracting Government to the 1974 SOLAS Convention and a Party to MARPOL 73/78.
- 2 Ship Type: Any entry under this column must relate to all relevant recommendations, e.g. an entry "Type 2" should mean Type 2 in all respects prescribed by the Code.
- 3 Products: products listed in chapter 17 of the Code, or which have been evaluated by the Administration in accordance with 1.1.6 of the Code, should be listed. In respect of the latter "new" products, any special requirements provisionally prescribed should be noted.
- 4 Products: The list of products the ship is suitable to carry should include the noxious liquid substances of Category Z which are not covered by the Code and should be identified as "chapter 18 Category Z".

⁴ Instead of being incorporated in the Certificate, this text may be appended to the Certificate if signed and stamped.

⁵ Insert the date of expiry as specified by the Administration in accordance with 1.5.6.1 of the Code. The day and the month of this day correspond to the anniversary date as defined in 1.3.3 of the Code, unless amended in accordance with 1.5.6.8 of the Code.

ENDORSEMENT FOR ANNUAL AND INTERMEDIATE SURVEYS

THIS IS TO CERTIFY that at a survey required by 1.5.2 of the Code the ship was found to comply with the relevant provisions of the Code.

Annual survey: Signed
(Signature of duly authorized official)
Place
Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

Annual/Intermediate³ survey: Signed
(Signature of duly authorized official)
Place
Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

Annual/Intermediate³ survey: Signed
(Signature of duly authorized official)
Place
Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

Annual survey: Signed
(Signature of duly authorized official)
Place
Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

³ Delete as appropriate.

ANNUAL/INTERMEDIATE SURVEY IN ACCORDANCE WITH PARAGRAPH 1.5.6.8.3

THIS IS TO CERTIFY that, at an annual/intermediate³ survey in accordance with paragraph 1.5.8.6.3 of the Code, the ship was found to comply with the relevant provisions of the Convention:

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

**ENDORSEMENT TO EXTEND THE CERTIFICATE IF VALID
FOR LESS THAN 5 YEARS WHERE PARAGRAPH 1.5.6.3 APPLIES**

The ship complies with the relevant provisions of the Convention, and this Certificate shall, in accordance with paragraph 1.5.6.3 of the Code, be accepted as valid until

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

**ENDORSEMENT WHERE THE RENEWAL SURVEY HAS BEEN
COMPLETED AND PARAGRAPH 1.5.6.4 APPLIES**

The ship complies with the relevant provisions of the Convention, and this Certificate shall, in accordance with paragraph 1.5.6.4 of the Code, be accepted as valid until

Annual survey:

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

³ Delete as appropriate.

**ENDORSEMENT TO EXTEND THE VALIDITY OF THE CERTIFICATE
UNTIL REACHING THE PORT OF SURVEY OR FOR A PERIOD
OF GRACE WHERE PARAGRAPH 1.5.6.5 OR 1.5.6.6 APPLIES**

This Certificate shall, in accordance with paragraph 1.5.6.5/1.5.6.6³ of the Code, be accepted as valid until

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

**ENDORSEMENT FOR ADVANCEMENT OF ANNIVERSARY DATE WHERE
PARAGRAPH 1.5.6.8 APPLIES**

In accordance with paragraph 1.5.6.8 of the Code, the new anniversary date is

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

In accordance with paragraph 1.5.6.8, the new anniversary date is

Signed
(Signature of duly authorized official)

Place

Date (dd/mm/yyyy)

(Seal or stamp of the Authority, as appropriate)

³ Delete as appropriate.

**ATTACHMENT 1
TO THE
INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF
DANGEROUS CHEMICALS IN BULK**

Continued list of products to those specified in section 3, and their conditions of carriage.

[illegible]

Date _____
(as for Certificate)

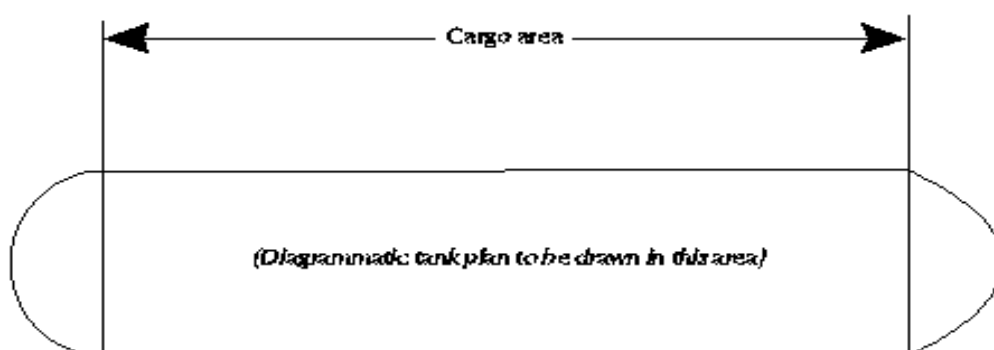
(Signature of official issuing the Certificate
and/or seal of issuing authority)

**ATTACHMENT 2
TO THE
INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF
DANGEROUS CHEMICALS IN BULK**

TANK PLAN (specimen)

Name of ship:

Distinctive number or letters:



Date
(as for Certificate)

.....
(Signature of official issuing the Certificate
and/or seal of issuing authority)
