Treaty Series No. 13 (1998)

1983 Amendments

to the

International Convention for the Safety of Life at Sea, 1974 (MSC.4(48)) Volume 2

International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code)

Adopted at London, 17 June 1983

[The Amendments entered into force on 1 July 1986]

Presented to Parliament
by the Secretary of State for Foreign and Commonwealth Affairs
by Command of Her Majesty
April 1998

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Cm 3926

RESOLUTION MSC. 4 (48)
(Adopted on 17 June 1983)

ADOPTION OF THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (IBC CODE)

THE MARITIME SAFETY COMMITTEE.

RECALLING resolution A.490(XII) by which the Assembly authorized it to adopt the revised Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk when harmonized with the Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk as adopted by resolution A.328(IX).

NOTING resolution MSC.6(48) by which it adopts, *inter alia,* amendments to chapter VII of the International Convention for the Safety of Life at Sea, 1974 [1] (1974 SOLAS Convention), to make the provisions of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) mandatory under that Convention.

HAVING CONSIDERED the text of the proposed IBC Code:

1 ADOPTS the IBC Code, the text of which is given in the Annex to the present resolution;

2 NOTES that under part B of chapter VII of the 1974 SOLAS Convention as amended by resolution MSC.6(48)[2] amendments to the IBC Code shall be adopted, brought into force and take effect in accordance with the provisions of article VIII of that Convention;

3 FURTHER NOTES that the IBC Code will require amendments to cover pollution prevention aspects prior to the entry into force of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973 [3], as modified by the Protocol of 19784 relating thereto;

4 REQUESTS the Secretary-General to circulate to all Governments concerned amendments to the IBC Code adopted as above which comprise the inclusion in chapter 17 of new products, recommending that, pending the entry into force of those amendments, these new products should be carried by chemical tankers in compliance with the provisions of the amendments;

5 FURTHER REQUESTS the Secretary-General to transmit a copy of the present resolution together with the text of the IBC Code to all Members of the Organization and to all Contracting Governments to the 1974 SOLAS Convention which are not Members of the Organization.

Note by the Secretariat

1. At its forty-eighth session held in June 1983, the Maritime Safety Committee adopted amendments to the International Convention for the Safety of Life at Sea, 1974 (SOLAS). Thirty-three Contracting Governments to the Convention were present at the session and all the texts of the amendments were adopted in accordance with the procedure specified in Article VIII(b)(iv).

2. The amendments adopted at the session consist of complete replacement texts of Chapters III and VII and amendments to Chapters II-1, 11-2 and IV.

3. The decimal numbering system has been used in Chapters II-1, 11-2, III and VII. Metric and Imperial units have been replaced with those of the Systême International (SI Units), except where conventionally accepted nautical units were considered more appropriate.

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[1]Treaty Series No. 46 (1980) Cmnd 7874.
[2]Treaty Series No. (1997) Cm.
[3]Miscellaneous Series No. 26 (1974) Cmnd 5748.
[4]Miscellaneous Series No. 27 (1978) Cmnd 7347.

4. Cross references are given in a concise form, e.g. Regulation 11-2/10.4 meaning paragraph 4 of Regulation 10 of Chapter 11-2.

5. Footnotes given throughout the Convention, as well as amendments thereto, refer to the relevant recommendations annexed to the Convention and other internationally accepted standards. The Maritime Safety Committee has emphasized that these footnotes do not form part of the Convention and are only inserted for ease of reference. The footnotes are to be altered to reflect any changes which may be made to the resolutions, recommendations or documents on which they are based. References to draft resolutions to be considered by the Assembly at its thirteenth regular session are to be replaced by the definitive numbers of the resolutions as adopted by the Assembly.

ANNEX

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

TABLE OF CONTENTS

Preamble

1 The purpose of this Code is to provide an international standard for the safe carriage by sea in bulk of dangerous liquid chemicals 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 should carry so as to minimise the risk to the ship, to its crew and to the environment, having regard to the nature of the products involved.

2 The basic philosophy is one of ship types related to the hazards of the products covered by the Code. Each of the products may have one or more hazard properties which include flammability, toxicity, corrosivity and reactivity.

3 Throughout the development of the Code it was recognised 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 should not remain static. Therefore the Organisation will periodically review the Code taking into account both experience and technical development.

4 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 of the Organisation, prior to the entry into force of the appropriate amendments, under the terms of article VIII of the International Convention for the Safety of Life at Sea, 1974.

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 Organisation.

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-eigth session. Gas carriers may also carry in bulk liquid chemicals covered by this Code as dealt with in the IGC Code.

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 liquid chemical 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.

The Code is at present limited to the liquids shown in the summary of minimum requirements in chapter 17. Products that have been reviewed and determined not to come within the scope of the Code are found in chapter 18.

1.1.2 Liquids covered by the Code are those having a vapour pressure not exceeding 2.8 bar at a temperature of 37.8°C.

1.1.3 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 should prescribe the preliminary suitable conditions for the carriage, having regard to the criteria for hazard evaluation of bulk chemicals. The Organization should be notified of the conditions for consideration for inclusion of the product in the Code.

1.1.4 Unless expressly provided otherwise the Code applies to ships the keels of which are laid or which are at a stage at which:

.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 structured material, whichever is less;

on or after 1 July 1986.

1.1.5 A ship, irrespective of the date of construction, which is converted to a chemical tanker on or after 1 July 1986, should be treated as a chemical tanker constructed on the date on which such conversion commences.

'Treaty Series No. (1997) Cm.

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

1.2 **Hazards**

Hazards of products covered by the Code include:

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

1.2.2 Health hazard defined by:

.1 irritant or toxic effect on the skin or on the mucous membranes of the eyes, nose, throat and lungs in the gas or vapour state combined with vapour pressure; or

.2 irritational effects on the skin in the liquid state; or

.3 toxic effect, taking into account values of

LD 50 oral: a dose which is lethal to 50% of the test subjects when administered orally;

LD 50 skin: a dose which is lethal to 50% of the test subjects when administered to the skin;

LC 50: the concentration which is lethal by inhalation to 50% of the test subjects.

1.2.3 Water pollution hazard defined by human toxicity, water solubility, volatility, odour or taste, and relative density.

1.2.4 Air pollution hazard defined by:

.1 emergency exposure limit (E.E.L.) or LC 50;

.2 vapour pressure;

.3 solubility in water;

.4 relative density of liquid;

.5 vapour density.

1.2.5 Reactivity hazard defined by reactivity with:

.1 other products; or

.2 water; or

.3 the product itself (including polymerization).

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.

1.3.2.1 *Administration* means the Government of the State whose flag the ship is entitled to fly.

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

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

1.3.4 *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) should be measured in metres.

1.3.5 *Cargo area* is that part of the ship that contains cargo tanks, slop tanks, cargo pump rooms including pump rooms, cofferdams, ballast or void spaces adjacent to cargo 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 forwardmost hold space are excluded from the cargo area.

1.3.6 *Cargo pump room* is a space containing pumps and their accessories for the handling of products covered by the Code.

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

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

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

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

1.3.11 *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.

1.3.12 *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.

1.3.13 *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 "closed cup test" determined by an approved flashpoint apparatus.

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

1.3.15 *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.

1.3.16 *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 should be parallel to the designed waterline. The length (L) should be measured in metres.

1.3.17 *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.

1.3.18 *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 stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.

1.3.19 *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 pressure of more than 1.8 bar gauge.

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

1.3.21 *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.

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

1.3.23 *Relative density* of liquid is the ratio of the mass of a volume of a product to the mass of an equal volume of fresh water. For a product of limited solubility, the relative density indicates whether it floats on water or sinks.

1.3.24 *Separate* means that a cargo piping system or cargo vent system, for example, is not connected to another cargo piping or cargo vent system. This separation may be achieved by the use of design or operation methods. Operational methods should not be used within a cargo tank and should 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.

1.3.25 *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.

1.3.26 *1974 SOLAS Convention* means the International Convention for the Safety of Life at Sea, 1974.

1.3.27 *1983 SOLAS amendments* means the amendments to the 1974 SOLAS Convention adopted by the Maritime Safety Committee of the Organization at its forty-eighth session on 17 June 1983 by resolution MSC.6(48).

1.3.28 *Vapour density* or the relative density of vapour is the ratio of the mass of a volume of vapour or gas (with no air present) to the mass of an equal volume of air at the same pressure and temperature. Vapour density below or above 1 indicates whether the vapour or gas is lighter or heavier than air.

1.3.29 *Vapour pressure* is the equilibrium pressure of the saturated vapour above the liquid expressed in bars absolute at a specified temperature.

1.3.30 *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 pump room, pump room, 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 should be fitted or carried in a ship, or that any particular provision should be made, or any procedure or arrangment should 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 so 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 thereafter, it should 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 the 1974 SOLAS Convention 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, should 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 Adminsitration nominating surveyors or recognizing organizations to conduct surveys should, 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 port State authority) concerned.

The Administration should 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.

1.5.1.3 When a nominated surveyor or recognized organization determines that the condition of the ship or its equipment does not correspond substantially with the particulars of the certificate or is such that the ship is not fit to proceed to sea without danger to the ship, or persons on board, such surveyor or organization should immediately ensure that corrective action is taken and should in due course notify the Administration. If such corrective action is not taken the relevant certificate should be withdrawn and the Administration should be notified immediately; and, if the ship is in a port of another Contracting Government, the port State authority concerned should also be notified immediately.

1.5.1.4 In every case, the Administration should guarantee the completeness and efficiency of the survey, and should 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 Radiotelegraphy Certificate or Cargo Ship Safety Radiotelephony Certificate are issued) of a chemical tanker should 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 should 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 should be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code.

.2 A periodical survey at intervals specified by the Administration, but not exceeding 5 years which should be such as to ensure that the structure, equipment, fittings, arrangements and material comply with the applicable provisions of the Code.

.3 A minimum of one intermediate survey during the period of validity of the International Certificate of Fitness for the Carriage of Dangerous Chemicals

[1]Port State authority has the meaning as presented in chapter 1, regulation 19 of the 1978 protocol to the 1974 SOLAS Convention.

in Bulk. In cases where only one such intermediate survey is carried out in any one certificate validity period, it should be held not before 6 months prior to, nor later than 6 months after, the half-way date of the certificate's period of validity. Intermediate surveys should be such as to ensure that the safety equipment, and other equipment, and associated pump and piping systems comply with the applicable provisions of the Code and are in good working order. Such surveys should be endorsed on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

.4 A mandatory annual survey within 3 months before or after the anniversary date of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk which should include a general examination to ensure that the structure, equipment, fittings, arrangements and materials remain in all respects satisfactory for the service for which the ship is intended. Such a survey should be endorsed in the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

.5 An additional survey, either general or partial according to the circumstances, should 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 should 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.

1.5.3 *Maintenance of conditions after survey*

1.5.3.1 The condition of the ship and its equipment should 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.

1.5.3.2 After any survey of the ship under 1.5.2 has been completed, no change should 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, the master or owner of the ship should report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible for issuing the relevant certificate, who should cause investigations to be initiated to determine whether a survey, as required by 1.5.2.5 is necessary. If the ship is in a port of another Contracting Government, the master or owner should also report immediately to the port State authority concerned and the nominated surveyor or recognized organization should ascertain that such a report has been made.

1.5.4 *Issue of International Certificate of Fitness*

1.5.4.1 A certificate called an International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, the model form of which is set out in the appendix, should be issued after an initial or periodical survey to a chemical tanker which complies with the relevant requirements of the Code.

1.5.4.2 The certificate issued under provisions of this section should be available on board for inspection at all times.

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

1.5.5.1 A Contracting Government may, at the request of the Government of another State, cause a ship entitled to fly the flag of the other State to be surveyed and, if satisfied that the requirements of the Code are complied with, issue or authorize the issue of the certificate 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 should 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 the International Certificate of Fitness*

1.5.6.1 An International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be issued for a period specified by the Administration which should not exceed 5 years from the date of the initial survey or the periodical survey.

1.5.6.2 No extension of the 5 year period of the certificate should be permitted.

1.5.6.3 The certificate should cease to be valid:

.1 if the surveys are not carried out within the period specified by 1.5.2;

.2 upon transfer of the ship to the flag of another State. A new certificate should 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. Where a transfer occurs between Contracting Governments, the Government of the State whose flag the ship was formerly entitled to fly should, if requested within 12 months after the transfer has taken place, as soon as possible transmit to the Administration copies of the certificates carried by the ship before the transfer and, if available, copies of the relevant survey reports.

CHAPTER 2—SHIP SURVIVAL CAPABILITY[1] AND LOCATION OF CARGO TANKS

2.1 General

2.1.1 Ships subject to the Code should 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 should 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 damage to be assumed and the proximity of the cargo tanks to the ship's shell should be dependent upon the degree of hazard presented by the products to be carried.

2.1.2 Ships subject to the Code should 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 should survive the most severe standard of damage and its cargo tanks should 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 "c" 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 should 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.

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[1]Reference is made to the Guidelines for the Uniform Application of the Survival Requirements of the Bulk Chemical Code and the Gas Carrier Code.

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 should not be greater than the maximum draught otherwise permitted by this Code.

2.2.2 The stability of the ship in all seagoing conditions should 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 should 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 should be those where the effect of free surfaces is the greatest. The free surface effect in undamaged compartments should be calculated by a method acceptable to the Administration.

2.2.4 Solid ballast should 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 should 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 should be supplied with a Loading and Stability Information booklet. This booklet should 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 should contain sufficient information to enable the master to load and operate the ship in a safe and seaworthy manner.

2.3 Shipside 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 superstructures and deckhouses on the freeboard deck fitted with weathertight doors should comply with the requirements of the relevant regulation of the International Convention on Load Lines in force, except that the choice of valves should 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 0.01 L, 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 waterline" 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 should be of a type acceptable to the Administration and should 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.

2.4 **Conditions of loading**

Damage survival capability should 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 should be:

.1 Side damage

.1.1 Longitudinal extent: $1/3L^{2/3}$ or 14.5m, whichever is less

.1.2 Transverse extent: measured inboard from the ship's side at right anges to the centreline at the level of the summer load line	B/5 or 11.5m, whichever is less	
.1.3 Vertical extent: from the moulded line of the bottom shell plating at centreline	upwards without limit	
.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 14.5m, whichever is less	$1/3L^{2/3}$ or 5m, whichever is less
.2.2 Transverse extent:	B/6 or 10m, whichever is less	B/6 or 5m, whichever is less
.2.3 Vertical extent:	B/15 or 6m, whichever is less measured from the moulded line of the bottom shell plating at centreline (see 2.6.2).	B/15 or 6m, whichever is less measured from the moulded line of the bottom shell plating at centreline (see 2.6.2).

2.5.2 Other damage:

.1 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 should be considered.

.2 For type 1 and type 2 ships, local side damage anywhere in the cargo area extending inboard 760 mm measured normal to the hull shell should be considered and transverse bulkheads should be additionally assumed damaged when also required by the applicable subparagraphs of 2.8.1

2.6 **Location of cargo tanks**

2.6.1 Cargo tanks should 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.

.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.

.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 than 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 should 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 should 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 should 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 0.951
Intended for other liquids	0 to 0.951

2.7.3 Wherever damage penetrates a tank containing liquids it should be assumed that the contents are completely lost from that compartment and replaced by salt water up 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 should 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 should be assumed to be penetrated.

2.7.5 The ship should 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, should 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 should 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 should be such that progressive flooding cannot thereby extend to compartment 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 should be disregarded. The unflooded parts of superstructure 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 should 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 should be assumed to sustain damage anywhere in its length;

.2 A type 2 ship of more than 150 m in length should be assumed to sustain damage anywhere in its length;

.3 A type 2 ship of 150 m in length or less should be assumed at 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 should be assumed to sustain damage anywhere in its length;

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[1]**The permeability of partially filled compartments should be consistent with the amount of liquid carried in the compartment.**

.5 A type 3 ship of 125 m in length or more but not exceeding 225 m in length should 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 should 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 should 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 dispensations 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 should be approved and clearly stated and be available to the port Administration. Any such dispensation should 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 should 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 should satisfy the following criteria.

2.9.2 In any stage of flooding:

.1 the waterline, taking into account sinkage, heel and trim, should be below the lower edge of any opening through which progressive flooding or downflooding may take place. Such openings should 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 should not exceed 25°, except that this angle may be increased up to 30° if no deck immersion occurs;

.3 the residual stability during intermediate stages of flooding should be to the satisfaction of the Administration. However, it should never be significantly less than that required by 2.9.3.

2.9.3 At final equilibrium after flooding;

.1 the righting lever curve should 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 should not be less than 0.0175 m/rad. Unprotected openings should 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 should 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 should 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 pump room, pump room, empty tank, oil fuel tank or other similar space.

3.1.2 Cargoes which react in a hazardous manner with other cargoes should:

.1 be segregated from such other cargoes by means of a cofferdam, void space, cargo pump room, pump room, empty tank, or tank containing a mutually compatible cargo;

.2 have separate pumping and piping systems which should not pass through other cargo tanks containing such cargoes, unless encased in a tunnel; and

.3 have separate tank venting systems.

3.1.3 Cargo piping should not pass through any accommodation, service or machinery space other than cargo pump rooms or pump rooms.

3.1.4 Cargoes subject to the Code should 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 should be located within the cargo area except over a cargo pump room recess or pump room recess that complies with regulation 11-2/56 of the 1983 SOLAS amendments and no cargo or slop tank should be aft of the forward end of any accommodation.

3.2.2 In order to guard against the danger of hazardous vapours, due consideration should 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 should not face the cargo area. They should be located on the end bulkhead not facing the cargo area and/or on the outboard side of the superstructure or deckhouse 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 deckhouse facing the cargo area. This distance, however, need not exceed 5 m. No doors should 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 permitted by the Administration. Where such doors are fitted, the boundaries of the space should 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 deckhouses within the limits specified above should be of the fixed (non-opening) type. Such sidescuttles in the first tier on the main deck should be fitted with inside covers of steel or equivalent material.

3.3 **Cargo pump rooms**

3.3.1 Cargo pump rooms should 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 should be made for hoisting an injured person with a rescue line while avoiding any projecting obstacles.

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

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

3.3.5 Means should be provided to deal with drainage and any possible leakage from cargo pumps and valves in cargo pump rooms. The bilge system serving the cargo pump room should be operable from outside the cargo pump room. One or more slop tanks for

'Reference is made to the Recommendation on Safe Access to and Working in Large Tanks (resolution A.272(VIII)) as amended by resolution A.330(IX).

storage of contaminated bilge water or tank washings should be provided. A shore connection with a standard coupling or other facilities should be provided for transferring contaminated liquids to on-shore reception facilities.

3.3.6 Pump discharge pressure gauges should be provided outside the cargo pump room.

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 should 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 should be direct from the open deck and such as to ensure their complete inspection. Access to double bottom spaces may be through a cargo pump room, pump room, deep cofferdam, pipe tunnel or similar compartments, subject to consideration of ventilation aspects.

3.4.2 For access through horizontal openings, hatches or manholes, the dimensions should 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 should 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 should 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 should 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 should 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 pump rooms, pump rooms void spaces, slop tanks, double bottom tanks and similar spaces should 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 a double bulkhead.

3.6 Pump and pipeline identification

3.6.1 Provisions should 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 Subject to the approval of the Administration, cargo piping may be fitted to permit bow or stern loading and unloading. Portable arrangements should not be permitted.

3.7.2 Bow or stern loading and unloading lines should not be used for the transfer of products required to be carried in type 1 ships. Bow and stern loading and unloading lines should 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 should be fitted at least 760 mm inboard on the open deck. Such piping should 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 should also be capable of being separated by means of a removable spool piece and blank flanges when not in use.

.2 The shore connection should be fitted with a shutoff valve and a blank flange.

.3 The piping should be full penetration butt welded, and fully radio-graphed. Flange connections in the piping should only be permitted within the cargo area and at the shore connection.

.4 Spray shields should be provided at the connections specified in .1 as well as collecting trays of sufficient capacity with means for the disposal of drainage.

.5 The piping should 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 should 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 should be located in the cargo area. The relevant connections to the piping should 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 should not face the cargo shore connection location of bow or stern loading and unloading arrangements. They should be located on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship but not less than 3 m from the end of the house facing the cargo shore connection location of the bow or stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore connection location and on the sides of the superstructure or deckhouse within the distance mentioned above should be of the fixed (non-opening) type. In addition, during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deckhouse side should 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 shoud be shielded from any spray which may come from a burst hose or connection.

3.7.6 Escape routes should 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 should 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 should be in accordance with the requirements of chapter 10.

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

3.7.10 Means of communication between the cargo control station and the cargo shore connection location should be provided and certified safe, if necessary. Provision should 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 0.7 bar gauge at the top of the tank. A gravity tank may be independent or integral. A gravity tank should be constructed and tested according to the standards of the Administration 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 0.7 bar gauge. A pressure tank should be an independent tank and should be of a configuration permitting the application of pressure vessel design criteria according to the standards of the Administration.

4.2 Tank type requirements for individual products

Requirements for both installation and design of tank types for individual products are shown in column "d" in the table of chapter 17.

CHAPTER 5—CARGO TRANSFER

5.1 Piping scantlingst

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

$$t = \frac{to + b + c}{\quad} \text{ (mm)}$$

where:

to = theoretical thickness

$$to = PD/(20\,Ke + P) \text{ (mm)}$$

with

P = design pressure (bar) referred to in 5.1.2

D = outside diameter (mm)

K = allowable stress (N/mm^2) 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 manufacturers approved for making welded pipes which are considered by the Administration as equivalent to seamless pipes. In other cases the e value is to be determined by the Administration depending on the manufacturing process and testing procedure.

b =allowance for bending (mm). The value of b should 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 should be not less than:

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

with

r = mean radius of the bend (mm).

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

a =negative manufacturing tolerance for thickness (%).

'Reference is also made to the published Rules of the Members and Associate Members of the International Association of Classification Societies (IACS).

5.1.2 The design pressure P in the formula for to 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, should 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 should not be less than 10 bar gauge except for open-ended lines where it should be not less than 5 bar gauge.

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

$$\frac{Rm}{A} \text{ or } \frac{Re}{B}$$

where:

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

Re = specified minimum yield stress at ambient temperature (N/mm^2). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.

A and B should have values of at least

A = 2.7 and B = 1.8

5.1.6.1 The minimum wall thickness should 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 should be increased over that required by 5.1.1 or, if this is impracticable or would cause excessive local stresses, these loads should be reduced, protected against or eliminated by other design methods.

5.1.6.3 Flanges, valves and other fittings should be to a standard acceptable to the Administration, taking into account the design pressure defined under 5.1.2

5.1.6.4 For flanges not complying with a standard the dimensions of flanges and associated bolts should 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, the Administration may accept relaxations from these requirements for open-ended piping and for piping inside carge tanks except for cargo piping serving other cargo tanks.

5.2.2 Cargo piping should 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.

'Recognized Standards for the purpose of this chapter are standards laid down and maintained by a classification society recognized by the Administration.

.2 Slip-on welded joints with sleeves and related welding having dimensions satisfactory to the Administration should only be used for pipes with an external diameter of 50 mm or less. This type of joint should not be used when crevice corrosion is expected to occur.

.3 Screwed connections acceptable to the Administration should only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.

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

.1 Bellows may be specially considered by the Administration in each case.

.2 Slip joints should not be used.

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

5.3 **Flange connections**

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

5.3.2 Flanges should comply with standards acceptable to the Administration 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, the Administration may accept relaxations from these requirements for piping inside cargo tanks and open-ended piping.

5.4.2 After assembly, each cargo piping system should 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 should be hydrostatically tested to at least 1.5 times the design pressure.

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

5.5 **Piping arrangements**

5.5.1 Cargo piping should not be installed under deck between the outboard 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, pump rooms or cargo pump rooms 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 pump room, the stop valve operable from the weather deck may be situated on the tank bulkhead on the cargo pump side. As an exception, where a cargo tank is adjacent to a cargo pump room, the stop valve operable from the weather deck may be situated on the tank bulkhead on the carge pump room side, provided an additional valve is fitted between the bulkhead valve and the cargo pump. The Administration may, however, accept a totally enclosed hydraulically operated valve located outside the cargo tank, 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 pump room where a pump serves more than one tank, a stop valve should be fitted in the line to each tank.

5.5.4 Cargo piping installed in pipe tunnels should also comply with the requirements of 5.5.1 and 5.5.2. Pipe tunnels should satisfy all tank requirements for construction, location and ventilation and electrical hazard requirements. Cargo compatibility should be assured in the event of a piping failure. The tunnel should not have any other openings except to the weather deck and cargo pump room or pump room.

5.5.5 Cargo piping passing through bulkheads should be so arranged as to preclude excessive stresses at the bulkhead and should 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 should 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 pump rooms which have been dealt with elsewhere in the Code should not be located below the weather deck.

5.6.3 For certain products additional cargo transfer control requirements are shown in column "m" in the table of chapter 17.

5.7 **Ship's cargo hoses**

5.7.1 Liquid and vapour hoses used for cargo transfer should 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 should 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 Each new type of cargo hose, complete with end fittings, should be prototype tested to a pressure not less than 5 times its specified maximum working pressure. The hose temperature during this prototype test should be the intended extreme service temperature. Hoses used for prototype testing should not be used for cargo service. Thereafter, before being placed in service, each new length of cargo hose produced should 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 should be stencilled or otherwise marked with its specified maximum working pressure and, if used in other than ambient temperature services, its maximum and minimum service temperature as applicable. The specified maximum working pressure should not be less than 10 bar gauge.

CHAPTER 6—MATERIALS OF CONSTRUCTION

6.1 General

6.1.1 Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, should be suitable at the temperature and pressure for the cargo to be carried to the satisfaction of the Administration. Steel is assumed to be the normal material of construction.

6.1.2 Where applicable the following should 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.

6.2 Special requirements for materials

6.2.1 For certain products special requirements apply in respect of materials indicated by symbols in column "k" in the table of chapter 17, as stipulated in 6.2.2, 6.2.3 and 6.2.4.

6.2.2 The following materials of construction should not be used for tanks, pipelines, valves, fittings and other equipment, which may come into contact with the products or their vapour where referred to in column "k" in the table of chapter 17:

N1 Aluminium, copper, copper alloys, zinc, galvanized steel and mercury.

N2 Copper, copper alloys, zinc and galvanized steel.

N3 Aluminium, magnesium, zinc, galvanized steel and lithium.

N4 Copper and copper-bearing alloys.

N5 Aluminium, copper and alloys of either.

N6 Copper, silver, mercury, magnesium and other acetylide-forming metals and their alloys.

N7 Copper and copper-bearing alloys with greater than 1% copper.

N8 Aluminium, zinc, galvanized steel and mercury.

6.2.3 Materials normally used in electrical apparatus, such as copper, aluminium and insulation, should as far as practicable be protected, e.g. by encapsulation, to prevent contact with vapours of products where referred to by Z in column "k" in the table of chapter 17.

6.2.4 The following materials of construction which may come into contact with certain products or their vapour should be used for tanks, pipelines, valves, fittings and other equipment, where referred to in column "k" in the table of chapter 17 as follows:

Y1 Steel covered with a suitable protective lining or coating, aluminium or stainless steel.

Y2 Aluminium or stainless steel for product concentrations of 98% or more.

Y3 Special acid-resistant stainless steel for product concentrations of less than 98%.

Y4 Solid austenitic stainless steel.

Y5 Steel covered with suitable protective lining or coating or stainless steel.

6.2.5 Materials of construction having a melting point below 925°C, e.g. aluminium and its alloys, should not be used for external piping involved in cargo handling operations on ships intended for the carriage of products with flashpoints not exceeding 60°C (closed cup test) unless so specified in column "k" in the table of chapter 17. Short lengths of external pipes connected to cargo tanks may be permitted by the Administration if they are provided with fire-resistant insulation.

CHAPTER 7—CARGO TEMPERATURE CONTROL

7.1 General

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

7.1.2 Heating or cooling media should be of a type approved for use with the specific cargo. Consideration should 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 should 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 should 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 should be provided for measuring the cargo temperature.

.1 The means for measuring the cargo temperature should be of restricted or closed type, respectively, when a restricted or closed gauging device is required for individual substances as shown in column "h" 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 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 should 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 "m" in the table of chapter 17 are being heated or cooled, the heating or cooling medium should 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 should 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 should 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 "m" in the table of chapter 17.

CHAPTER 8—CARGO TANK VENT SYSTEMS

8.1 General

8.1.1 All cargo tanks should be provided with a venting system appropriate to the cargo being carried. Tank vent systems should 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, any spaces containing sources of ignition. They should also be designed to minimize possible spraying on to the decks. Vent outlets should be arranged to prevent entrance of water into the cargo tanks and, at the same time, should direct the vapour discharge upwards in the form of unimpeded jets.

8.1.2 Provision should be made to ensure that the liquid head in any tank does not exceed the test head of that 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 should comply with the appropriate provisions of 15.19.

8.1.3 For a tank equipped with closed or restricted gauging, the vent system should be sized, allowing for flame screens if fitted, to permit loading at the design rate without overpressurizing the tank. Specifically, under conditions in which a saturated cargo vapour is discharged through the venting system at the maximum anticipated loading rate, the pressure differential between the cargo tank vapour space and the atmosphere should not exceed 0.2 bar or, for independent tanks, the maximum working pressure of the tank.

8.1.4 Any flame screens fitted to the discharge openings of vent systems should be easily accessible and removable for cleaning.

8.1.5 Suitable provision should be made for drainage of vent lines.

8.1.6 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, should be similarly lined or coated, or constructed of corrosion-resistant material.

8.2 Types of tank vent systems'

8.2.1 Open tank venting system means a system which offers no restriction except for friction losses and flame screens if fitted, to the free flow of cargo vapours to and from the cargo tanks during normal operations and should only be used for those cargoes having a flashpoint above 60°C (closed cup test) and not offering a significant inhalation health hazard. 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. However, in no case should shutoff valves be fitted either to the individual vents or to the header.

8.2.2 Controlled tank venting system means a system in which pressure/vacuum relief valves are fitted to each tank to limit the pressure or vacuum in the tank to be used for cargoes other than those for which open venting is permitted. 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 should shutoff valves be fitted either above or below pressure/vacuum relief valves but provision may be made for bypassing the pressure/vacuum relief valves under certain operating conditions.

.1 The heights of vent outlets should not be less than 4 m above the weather deck or above the fore and aft gangway if fitted within 4 m of the gangway.

.2 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 a type approved by the Administration directing the vapour-air mixture upwards in the unimpeded jet with an exit velocity of at least 30 rn/s are fitted.

.3 The vent outlets should also be arranged at a distance of at least 10 m from the nearest air intake or openings to accommodation, service and machinery spaces and ignition sources. Flammable vapour outlets should be provided with readily renewable and effective flame screens or safety heads of an approved type. Due attention should be paid in the design of pressure/vacuum valves, flame screens and vent heads to the possibility of the blockage of these devices by the freezing of cargo vapour or by icing up in adverse weather conditions.

8.2.3 Reference in 8.2.1 and 8.2.2 to the use of shutoff valves in the vent lines should be interpreted to extend to all other means of stoppage, including spectacle blanks and blank flanges.

'Attention is drawn to regulation 11-2/59 of the 1983 amendments to the 1974 SOLAS Convention.

8.3 Venting requirements for individual products

Venting requirements for individual products are shown in column "e" and additional requirements in column "m" in the table of chapter 17.

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 should be carried or should be manufactured on board unless a shore supply is available. In addition, sufficient inert gas should be available on the ship to compensate for normal losses during transportation.

.2 The inert gas system on board the ship should be able to maintain a pressure of at least 0.07 bar gauge within the containment system at all times. In addition, the inert gas system should 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 should be made as required for inert gas in .1 and .2.

.4 Means should 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, should 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 should 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 should 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 "f' 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 should be applied in conjunction with applicable electrical requirements of part D, chapter II-1 of the 1983 SOLAS amendments.

10.1.2.1 Electrical installations should be such as to minimize the risk of fire and explosion from flammable products. Electrical installations complying with this chapter should not be considered a source of ignition for the purposes of 8.2.2.3, 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 should be given to the particular characteristics of the materials chosen for conductors, insulation, metal parts, etc. as far as necessary, these components should be protected to prevent contact with gases or vapours liable to be encountered.

10.1.3 The Administration should 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 should 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 should 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 "g" in the table of chapter 17.

10.1.6 Absence of information on temperature class and apparatus group in column "g" in the table of chapter 17 means that data are not currently available, and this should 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 (closed cup test). 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.

10.2.2 Cargoes with a flashpoint exceeding 60°C (closed cup test):

.1 Cargo tanks and cargo piping are the only hazardous locations for such cargoes which have no qualification in column "m" in the table of chaper 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 should 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 should be indicated by an alarm at the cargo control station.

.2 Where electrical equipment is located in a cargo pump room, due consideration should 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 pump room should 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 pump rooms. Electrical equipment installed within these locations should be of a certified safe type.

.4 Where the cargo is heated above its flashpoint value, the requirements of 10.2.3 are applicable.

'Reference is made to the Recommendations published by the International Electrotechnical Commission and in particular to Publication 92.502.

10.2.3 For cargoes with a flashpoint not exceeding 60°C (closed cup test) without qualification in column "m" in the table of chapter 17, the hazardous locations are given below. In addition to intrinsically safe sytems and circuits, the only electrical installations permitted in hazardous locations are the following:

.1 Cargo tanks and cargo piping:

No additional electrical equipment is permitted.

.2 Void spaces adjacent to, above or below integral tanks:

.2.1 Through runs of cables. Such cables should be installed in heavy gauge steel pipes with gastight joints. Expansion bends should 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 should be housed in gastight enclosures; associated cables should be protected as referred to in 10.2.3.2.1.

.3 Hold spaces containing independent cargo tanks:

.3.1 Through runs of cables without any additional protection.

.3.2 Lighting fittings with pressurized enclosure or of the flameproof type. The lighting system should be divided between at least two branch circuits. All switches and protective devices should interrupt all poles or phases and should 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 should be housed in gastight enclosures.

.4 Cargo pump rooms and pump rooms in the cargo area:

.4.1 Lighting fittings with pressurized enclosures or of the flameproof type. The lighting system should be divided between at least two branch circuits. All switches and all protective devices should interrupt all poles or phases and should be located in a non-hazardous location.

.4.2 Electrical motors for driving cargo pumps and any associated auxiliary pumps should be separated from these spaces by a gastight bulkhead or deck. Flexible couplings, or other means of maintaining alignment, should be fitted to the shafts between the driven equipment and its motors, and in addition, glands should be provided to the satisfaction of the Administration where the shafts pass through the bulkhead or deck. Such electrical motors should 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 pump rooms; cargo area on open deck over all cargo tanks and cargo tank holds, including all ballast tank and cofferdams within the cargo area, 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 pump rooms 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 should be divided between at least two branch circuits. All switches and protective devices should interrupt all poles or phases and should 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 should have electrical installations complying with the requirements for the space or zone into which the opening leads.

10.3 Bonding

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

10.4 Electrical requirements for individual products

Electrical requirements for individual products are shown in column "g" 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 11-2 of the 1983 SOLAS amendments should 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 should 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 should apply as they would apply to tankers of 2,000 tons gross tonnage and over;

.4 the provisions of 11.3 should apply in lieu of regulation 61; and

.5 the provisions of 11.2 should apply in lieu of regulation 63.

11.1.2 Notwithstanding the provisions of 11.1.1, ships engaged solely in the carriage of caustic potash solution, phosphoric acid or sodium hydroxide solution need not comply with part D of chapter 11-2 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.

11.2 Cargo pump rooms

11.2.1 The cargo pump room of any ship should be provided with a fixed fire-extinguishing system as follows:

.1 a carbon dioxide system as specified in regulation 11-2/5.1 and .2 of the 1983 SOLAS amendments. A notice should 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 11-2/5.1.6 of the 1983 SOLAS amendments should be safe for use in a flammable cargo vapour-air mixture. For the purpose of this requirement, an extinguishing system should be provided which would be suitable for machinery spaces. However, the amount of gas carried should be sufficient to provide a quantity of free gas equal to 45% of the gross volume of the cargo pump room in all cases; or

.2 a halogenated hydrocarbon system as specified in regulation 11-2/5.1 and .3 of the 1983 SOLAS amendments. A notice should 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 11-2/5.1.6 of the 1983 SOLAS amendments should be safe for use in a flammable cargo vapour-air mixture. For the purpose of this requirement, an extinguishing system should be provided which would be suitable for machinery spaces but utilizing the following minimum design quantities based on the gross volume of the cargo pump room:

halon 1301	7%
halon 1211	5.5%
halon 2402	0.3 kg/m3

11.2.2 Cargo pump rooms of ships which are dedicated to the carriage of a restricted number of cargoes should 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 pump room if it can be demonstrated to the Administration that cargoes will be carried which are not suited to extinguishment by carbon dioxide or halogenated hydrocarbons. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should reflect this conditional requirement.

11.3 **Cargo areal**

11.3.1 Every ship should 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 should be supplied, and it should 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 should be provided. Basic protein foams should not be used.

11.3.3 The arrangements for providing foam should 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 should be capable of simple and rapid operation. The main control station for the system should 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 should be not less than the greatest of the following:

.1 21/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 //min per square metre of the horizontal sectional area of the single tank having the largest such area;

.3 10 //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 //min. For ships of less than 4,000 tonnes deadweight, the minimum capacity of the monitor should be to the satisfaction of the Administration.

11.3.6 Sufficient foam concentrate should be supplied to ensure at least 30 min 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.

'Reference is made to MSC/Circ. 314 which provides guidance for calculating the capacity of foam systems for chemical tankers and may be used in applying the requirements for extinguishing media of the Code.

11.3.7 Foam from the fixed foam system should 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 should be delivered from each monitor. The capacity of any monitor should be at least 10 1/min of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of the monitor. Such capacity should be not less than 1,250 //min. For ships of less than 4,000 tonnes deadweight, the minimum capacity of the monitor should 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 should 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 should be situated both port and starboard at the poop front or accommodation spaces facing the cargo area.

11.3.10 Applicators should be provided for flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator should be not less than 400 //min and the applicator throw in still air conditions should be not less than 15 m. The number of foam applicators provided should be not less than four. The number and disposition of foam main outlets should 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 should 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 should 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 should 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 should be provided and kept in good operating order.

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

11.3.16 Ships fitted with bow or stern loading and unloading arrangements should 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 should 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 should be protected by the above-mentioned applicator.

11.4 Special requirements

Fire-extinguishing media considered to be suitable for certain products are listed for information in column "j" 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 11-2/59.3 of the 1983 SOLAS amendments.

12.1 Spaces normally entered during cargo handling operations

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

12.1.2 Provision should 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 should be placed outside the compartment.

12.1.3 Mechanical ventilation inlets and outlets should 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 should 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 pump rooms are prescribed in 15.17.

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

12.1.5 Ventilation exhaust ducts from spaces within the cargo area should 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 should be so arranged as to minimize the possibility of recycling hazardous vapours from any ventilation discharge opening.

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

12.1.8 Electric motors driving fans should 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 should be of non-sparking construction defined as:

.1 impellers and 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 magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and should not be used in these places.

12.1.9 Sufficient spare parts should 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 should be fitted in outside openings of ventilation ducts.

12.2 Pump rooms and other enclosed spaces normally entered

Pump rooms and other enclosed spaces normally entered, which are not covered by 12.1.1, should 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 should not be less than 20 changes of air per hour, based upon the total volume of the space. Provision should be made to ventilate such spaces prior to entering.

12.3 Spaces not normally entered

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

for portable systems the capacity of 16 air changes per hour. Fans or blowers should be clear of personnel access openings, and should comply with 12.1.8.

CHAPTER 13—INSTRUMENTATION

13.1 Gauging

13.1.1 Cargo tanks should 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 should 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 should be independent of the equipment required under 15.19.

13.1.3 Open gauging and restricted gauging should 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 "h" in the table of chapter 17.

13.2 Vapour detection

13.2.1 Ships carrying toxic or flammable products or both should 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 should be provided.

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

13.2.3 When toxic detection equipment is not available for some products which require such detection, as indicated in column "i" 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 should recognize the necessity for additional breathing air supply and an entry should be made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk drawing attenting 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 "i" 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 should 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 should cover all skin so that no part of the body is unprotected.

14.1.2 Work clothes and protective equipment should be kept in easily accessible places and in special lockers. Such equipment should 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 Administraction may, however, approve storage rooms for such equipment within accommodation spaces if adequately segregated from living speces such as cabins, passageways, dining rooms, bathrooms, etc.

14.1.3 Protective equipment should 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 "m" in the table of chapter 17 should 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 should be in addition to that required by regulation 11-2/17 of the 1983 SOLAS amendments.

14.2.2 One complete set of safety equipment should 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 should carry the following, either:

.1 one set of fully charged spare air bottles for each breathing apparatus;

.2 a special air compressor suitable for the supply of high-pressure air of the required purity;

.3 a charging manifold capable of dealing with sufficient spare breathing apparatus air bottles for the breathing apparatus; or

.4 fully charged spare air bottles with a total free air capacity of at least 6,000 / for each breathing apparatus on board in excess of the requirements of regulation 11-2/17 of the 1983 SOLAS amendments.

14.2.4 A cargo pump room of ships carrying cargoes which are subject to the requirements of 15.18 or cargoes for which the column "i" in the table of chapter 17 toxic vapour detection equipment is required but is not available should 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 should 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 should be provided for recharging the fixed air bottles and breathing apparatus air bottles from a special air compressor suitable for the supply of high-pressure air of the required purity; or

.2 an equivalent quantity of spare bottled air in lieu of the low-pressure air line.

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

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

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

14.2.8 Ships intended for the carriage of certain cargoes should 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 should be accepted only when one filter is suitable for all designated cargoes that the ship is certified to carry;

.2 self-contained breathing apparatus should have normally at least a duration of service of 15 min;

.3 emergency escape respiratory protection should not be used for firefighting or cargo handling purposes and should be marked to that effect.

Individual cargoes to which the provisions of this paragraph apply are indicated in column "1" in the table of chapter 17.

14.2.9 The ship should have on board medical first-aid equipment including oxygen resuscitation equipment and antidotes for cargoes carried.

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

CHAPTER 15—SPECIAL REQUIREMENTS

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

15.1 Acetone cyanohydrin

Acetone cyanohydrin should be stabilized with an inorganic acid to prevent decomposition. A certificate of stabilization should be provided by the manufacturer, and kept on board, specifying:

.1 name and amount of stabilizer added;

.2 date stabilizer was added and duration of effectiveness;

.3 any temperature limitations qualifying the stabilizer's effective lifetime;

.4 the action to be taken should the length of voyage exceed the effective lifetime of the stabilizer.

15.2 Ammonium nitrate solution, 93% or less

15.2.1 The ammonium nitrate solution should 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 should be between 5.0 and 7.0. The solution should not contain more than 10 ppm chloride ions, 10 ppm ferric ions, and should be free of other contaminants.

15.2.2 Tanks and equipment for ammonium nitrate solution should 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, should not be used. **Tanks** should not be used for seawater ballast.

15.2.3 Except where expressly approved by the Administration, ammonium nitrate solutions should 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 should not exceed 160°C. The heating system should 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 should be provided. Where the temperature of the heat exchanging medium exceeds 160°C an alarm should also be given. Temperature alarms and controls should be located on the navigating bridge.

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

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

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

15.2.8 Vent piping should be fitted with approved weatherhoods to prevent clogging. Such weatherhoods should 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 should only be done after all traces of ammonium nitrate have been removed, inside as well as outside.

15.3 Carbon disulphide

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

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

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

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

15.3.5 Cargo piping and vent lines should 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 should not present a source of ignition for carbon disulphide and should not employ equipment that may exceed a temperature of 80°C.

15.3.7 If a cargo discharge pump is used, it should be inserted through a cylindrical well extending from the tank top to a point near the tank bottom. A water pad should 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 should 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.

15.4 Diethyl ether

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

15.4.2 Pressure relief valve settings should not be less than 0.2 bar 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 should 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 should be made to maintain the inert gas pad in the cargo tank during lo'ding, unloading and transit.

1 .5 Hydrogen peroxide solutions over 60% but not over 70%

15.5.1 Hydrogen peroxide solutions should be carried in dedicated ships only and no other cargoes should be carried.

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

15.5.3 Pump rooms should not be used for cargo transfer operations.

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

15.5.5 Tanks intended for the carriage of hydrogen peroxide should not be used for seawater ballast.

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

15.5.7 Fixed oxygen monitors (or gas sampling lines) should 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 should also be located on the navigating bridge. The visible and audible alarms should be activated if the oxygen concentration in these void spaces exceeds 30% by volume. Two portable oxygen monitors should also be available as back-up systems.

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

15.5.9 Cargo tank venting systems should 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 should be sized on the basis of tank design pressure, tank size and anticipated decomposition rate.

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

.1 The product should be diluted from the original concentration to 35% by weight within 5 min of the spill.

.2 The rate and estimated size of the spill should 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.

15.5.11 Hydrogen peroxide solutions should be stabilized to prevent decomposition. A certificate of stabilization should be provided by the manufacturer, and kept on board, specifying:

.1 name and amount of stabilizer added;

.2 date stabilizer was added and duration of effectiveness;

.3 any temperature limitations qualifying the stabilizer's effective lifetime;

.4 the action to be taken should the length of voyage exceed the effective lifetime of the stabilizer.

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

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

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

15.6.1 Tanks used for these cargoes should 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 pump room is located on deck level according to 15.18, the ventilation arrangements should 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 should be made for lead content to determine if the atmosphere is satisfactory prior to allowing personnel to enter the cargo pump room or void spaces surrounding the cargo tank.

15.7 Phosphorus, yellow or white

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

15.7.2 Tanks should 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 should 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% should be maintained above the water pad. The ullage space should 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 should be at the top of cargo tanks, and fittings and joints attached thereto should be of materials resistant to phosphorus pentoxide.

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

15.7.7 Tank heating arrangements should 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 should be fitted.

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

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

15.7.10 Loading and discharge of phosphorus should be governed by a central system on the ship which, in addition to incorporating high-level alarms, should 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 should 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 should be of a type approved by the Administration.

15.8 Propylene oxide

15.8.1 Propylene oxide transported under the provisions of this section should be acetylene-free.

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

.1 mineral acids (e.g. suphuric, hydrochloric, nitric);

.2 carboxylic acids and anhydrides (e.g. formic, acetic);

.3 halogenated carboxylic acids (e.g. chloroacetic);

.4 sulphonic acids (e.g. benzene sulphonic);

.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 carrying propylene oxide, tanks should be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate prior cargo has been propylene oxide. Particular care should 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 should 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 propylene oxide.

15.8.5 Tanks should be entered and inspected prior to each initial loading of propylene oxide to ensure freedom from contamination, heavy rust deposits and visible structural defects. When cargo tanks are in continuous propylene oxide service, such inspections should be performed at intervals of not more than 2 years.

15.8.6 Tanks for the carriage of propylene oxide should be of steel or stainless steel construction. Suitable tank coatings may be accepted as such by the Administration and noted on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

15.8.7 Tanks which have contained propylene oxide 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 should be of a type suitable for use with propylene oxide and should be constructed of steel or stainless steel or other material acceptable to the Administration. The chemical composition of all material used should be submitted to the Administration for approval prior to fabrication. Discs or disc faces, seats and other wearing parts of valves should be made of stainless steel containing not less than 11% chromium.

15.8.9 Gaskets should be constructed of materials which do not react with, dissolve in, or lower the autoignition temperature of propylene oxide and which are fire-resistant and possess adequate mechanical behaviour. The surface presented to the cargo should 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 by the Administration.

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

15.8.11 The following materials are generally found unsatisfactory for gaskets, packing and similar uses in propylene oxide containment systems and would require testing before being approved by the Administration:

.1 neoprene or natural rubber, if it comes into contact with propylene oxide;

.2 asbestos, or binders used with asbestos;

.3 materials containing oxides of magnesium, such as mineral wools.

15.8.12 Threaded joints should not be permitted in the cargo liquid and vapour lines.

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

15.8.14 The containment system for a tank containing propylene oxide should have a valved vapour return connection.

15.8.15 Propylene oxide should be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a propylene oxide containment system should be independent of all other containment systems.

15.8.16 During discharging operations, the pressure in the cargo tank should be maintained above 0.07 bar gauge.

15.8.17 Tanks carrying propylene oxide should be vented independently of tanks carrying other products. Facilities should be provided for sampling the tank contents without opening the tank to atmosphere.

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

15.8.19 Cargo hoses used for transfer of propylene oxide should be marked "FOR PROPYLENE OXIDE TRANSFER ONLY".

15.8.20 Cargo tanks, void spaces and other enclosed spaces, adjacent to an integral gravity cargo tank, should 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 should be inerted.

Such inerted spaces and tanks should be monitored for propylene oxide and oxygen. Portable sampling equipment is satisfactory. The oxygen content of these spaces should be maintained below 2%.

15.8.21 In no case should air be allowed to enter the cargo pump or piping system while propylene oxide is contained within the system.

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

15.8.23 Propylene oxide may be carried in pressure tanks or in independent or integral gravity tanks. Tanks should be designed for the maximum pressure expected to be encountered during loading, conveying and discharging cargo.

15.8.24 Cargo tanks with a design pressure less than 0.6 bar gauge should have a cooling system to maintain the propylene oxide below the reference temperature. Reference temperature (R) means, in the case of propylene oxide, the temperature corresponding to the vapour pressure of the propylene oxide at the set pressure of the pressure relief valve.

15.8:25 The refrigeration requirement for tanks with a design pressure less than 0.6 bar gauge may be waived by the Administration if the ship is operating in restricted areas or in voyages of restricted duration, and account may be taken in such cases of any insulation of the tanks. The area and times of year for which such carriage would be permitted should be included in the conditions of carriage on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

15.8.26 Any cooling system should 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 should be provided. Each cooling plant should be complete with the necessary auxiliaries for proper operation. The control system should also be capable of being manually operated. An alarm should be provided to indicate malfunctioning of the temperature controls. The capacity of each cooling system should be sufficient to maintain the temperature of the liquid cargo below the reference temperature (R).

15.8.27 An alternative arrangement may consist of three cooling plants, any two of which should be sufficient to maintain the liquid temperature below the reference temperature (R).

15.8.28 Cooling media which are separated from propylene oxide by a single wall only should be nonreactive with the propylene oxide.

15.8.29 Cooling systems requiring compression of propylene oxide should not be used.

15.8.30 Pressure relief valve settings should not be less than 0.2 bar gauge, or greater than 7.0 bar gauge, for pressure tanks.

15.8.31 The piping system for tanks to be loaded with propylene oxide should be separate (as defined in 1.3.24) 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 **1.3.15),** the required piping separation should be accomplished by the removal of spool pieces, valves, or other pipe sections, and the installation of blank flanges at these locations. The required separation applies to all liquid and vapour piping, liquid and vapour vent lines and any other possible connections such as common inert gas supply lines.

15.8.32 Propylene oxide may be transported only in accordance with cargo handling plans that have been approved by the Administration. Each intended loading arrangement should be shown on a separate cargo handling plan. Cargo handling plans should 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 should be maintained on board the ship. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be endorsed to include reference to the approved cargo handling plans.

15.8.33 Before each loading of propylene oxide, certification verifying that the required piping separation has been achieved should be obtained from a responsible person acceptable to the port Administration and should be carried on board the ship. Each connection between a blank flange and a pipeline flange should be fitted with a wire and seal by the responsible person to ensure that inadvertent removal of the blank flange is impossible.

15.8.34.1 No cargo tanks should be more than 98% liquid full at the reference temperature (R).

15.8.34.2 The maximum volume (VI) of cargo to be loaded in a tank should be:

$$V_L = 0.98\ V\ \frac{PR}{P_L}$$

where V = volume of the tank

PR *relative density of cargo at the reference temperature (R)*

PL = *relative density of cargo at the loading temperature*

R = reference temperature corresponding to the vapour pressure of the cargo at the set pressure relief valve.

15.8.34.3 The maximum allowable tank filling limits for each cargo tank should 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 should be permanently kept on board by the master.

15.8.35 The cargo should be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system should be installed to prevent the tank pressure falling below 0.07 bar gauge in the event of product temperature fall due to ambient conditions or maloperation of refrigeration systems. Sufficient nitrogen should be available on board to satisfy the demand of the automatic pressure control. Nitrogen of commercially pure quality (99.9% by volume) should 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.

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

15.8.37 A water spray system of sufficient capacity should 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 should be such as to give a uniform distribution rate of 10 //min per square metre. The water-spray system should be capable of both local and remote manual operation and the arrangement should ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle, when atmospheric temperatures permit, should be connected ready for immediate use during loading and unloading operations.

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

15.9 Sodium chlorate solution, 50% or less

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 should be thoroughly washed away without delay. To minimise fire risk, spillage should not be allowed to dry out.

15.10 **Sulphur liquid**

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

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

15.10.3 Ventilation systems should 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 should be so designed and fitted as to prevent the entry of water, sulphur or cargo vapour.

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

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

15.11 Acids

15.11.1 The ship's shell plating should 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 should 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 should take into account the corrosivity of the cargo.

15.11.4 Flanges of the loading and discharge manifold connections should be provided with shields, which may be portable, to guard against the danger of the cargo being sprayed; and, in addition, drip trays should 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 should comply with 10.2.3.1, 10.2.3.2, 10.2.3.3, 10.2.3.4, 10.2.3.6 and 10.2.3.7. The certified safe type equipment should be suitable for use in hydrogen-air mixtures. Other sources of ignition should not be permitted in such spaces.

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

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

15.11.8 The cargo pump room bilge pumping and drainage arrangements should be of corrosion-resistant materials.

15.12 **Toxic products**

15.12.1 Exhaust openings of tank vent systems should 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; and

.3 15 m from any opening or air intake to any accommodation and service spaces;

.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 a type approved by the Administration, 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 should be provided with a connection for a vapour return line to the shore installation.

15.12.3 Products should:

.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 should be a minimum of 0.2 bar gauge.

15.13 Cargoes inhibited against self-reaction

15.13.1 Certain cargoes, with a reference in column "m" in the table of chapter 17, by the nature of their chemical make-up tend to polymerize under certain conditions of temperature, exposure to air or contact with a catalyst. Mitigation of this tendency is carried out by introducing small amounts of chemical inhibitors into the liquid cargo or controlling the cargo tank environment.

15.13.2 Ships carrying these cargoes should be designed so 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 should be taken to ensure that these cargoes are sufficiently inhibited to prevent polymerization at all times during the voyage. Ships carrying such cargoes should be provided with a certificate of inhibition from the manufacturer, and kept during the voyage, specifying:

.1 name and amount of inhibitor added;

.2 date inhibitor was added and duration of effectiveness;

.3 any temperature limitations qualifying the inhibitor's effective lifetime;

.4 the action to be taken should the length of voyage exceed the effective lifetime of the inhibitor.

15.13.4 Ships using the exclusion of air as the method of preventing self-reaction of the cargo should comply with 9.1.3.

15.13.5 Venting systems should be of a design that elimates blockage from polymer build-up. Venting equipment should be of a type that can be checked periodically for adequacy of operation.

15.13.6 Crystallization or solidification of cargoes normally carried in the molten state can lead to depletion of inhibitor in parts of the tank contents. Subsequent remelting can thus yield pockets of uninhibited liquid, with the accompanying risk of dangerous polymerization. To prevent this, care should 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 should be such as to ensure that in no part of the tank does cargo become overheated to such an extent that any dangerous polymerization can be initiated. If the temperature from steam coils would induce overheating, an indirect low-temperature heating system should be used.

15.14 **Cargoes** with **a vapour pressure greater than 1.013 bar absolute at 37.8°C**

15.14.1 For a cargo referenced in column "m" in the table of chapter 17 to this section, a mechanical refrigeration system should 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 should 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 should 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, should be included in the conditions of carriage on the International Certificate for the Carriage of Dangerous Chemicals in Bulk.

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

15.14.5 Each tank should 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 should be provided at the top and bottom of each tank.

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

15.14.7.2 The maximum volume ("L) of cargo to be loaded in a tank should be:

$$^{v}L = 0.98V \frac{^{\circ}R}{^{\circ}L}$$

where V = volume of the tank

$^{\circ}R$ = relative density of cargo at the reference temperature (R)

$^{\circ}L$ = relative density of cargo at the loading temperature

R = reference temperature corresponding to the vapour pressure of the cargo at the set pressure of the pressure relief valve.

15.14.7.3 The maximum allowable tank filling limits for each cargo tank should 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 should be permanently kept on board by the master.

15.15 Cargoes with low ignition temperature and wide flammability range

For ships carrying such cargoes, the distance requirements of 10.2.3.5 should be increased to at least 4.5 m.

15.16 **Cargo contamination**

15.16.1 Where column "m" in the table of chapter 17 refers to this section, alkaline or acidic materials, such as caustic soda or sulphuric acid, should not be allowed to contaminate the cargo.

15.16.2 Where column "m" in the table of chapter 17 refers to this section, water should 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 should be situated at least 2 m above the weather deck.

.2 Water or steam should not be used as the heat transfer media in a cargo temperature control system required by chapter 7.

.3 The cargo should not be carried in cargo tanks adjacent to permanent ballast or water tanks unless the tanks are empty and dry.

.4 The cargo should 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 should be separate from similar equipment serving tanks containing the cargo. Pipelines from slop tanks or ballast lines should 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 should 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 should 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 pump room requirements

For certain products, the cargo pump room should be located on the deck level or cargo pumps should be located in the cargo tank. The Administration may give special consideration to cargo pump rooms below deck.

15.19 **Overflow control**

15.19.1 The provisions of this section are applicable where specific reference is made in column "m" 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 should be given to the operators concerned.

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

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

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

15.19.6 Cargo tanks should 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 should:

.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 pumps and valve shutdown, may be dependent on operator's intervention. The use of shipboard automatic closing valves should be permitted only when specific approval has been obtained from the Administration and the port Administration concerned.

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

$$LR = \frac{3600\ U}{t} \quad (m3fh)$$

where U = ullage volume (m^3) 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 should also take into account the pipeline system design pressure.

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 should not exceed 1,250 m^3 in any one tank.

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

16.1.3 Tanks carrying liquids at ambient temperatures should 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, should be on board every ship covered by this Code.

16.2.2 Any cargo offered for bulk shipment should be indicated in the shipping documents by the correct technical name. Where the cargo is a mixture, an analysis indicating the dangerous components contributing significantly to the total hazard of the product should be provided, or a complete analysis if this is available. Such an analysis should be certified by the manufacturer or by an independent expert acceptable to the Administration.

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

.1 a full description of the physical and chemical properties, including reactivity necessary for the safe containment of the cargo;

.2 action to be taken in the event of spills or leaks;

.3 counter-measures 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 in accordance with 15.1, 15.5.11 or 15.13.3, the cargo should 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 availabe, the cargo should be refused.

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

16.3 Personnel training2

16.3.1 All personnel should 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 should be adequately trained in handling procedures.

16.3.3 Officers should be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo, and a sufficient number of them should be instructed and trained in essential first aid for cargoes carried.

'Attention is also drawn to the operation guidelines contained in the ICS Tanker Safety Guide (Chemicals).

[2]Reference is made to the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, and in particular to the "Mandatory minimum requirements for the training and qualifications of master, officers and ratings of chemical tankers"—regulation V/2, chapter V of the Annex to that Convention and to resolution 11 of the International Conference on Training and Certification of Seafarers, 1978.

16.4 Opening of and entry into cargo tanks

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

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

16.5 Stowage of cargo samples

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

16.5.2 The stowage space should 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 should not be stowed close to each other.

16.5.4 Samples should 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 should be loaded and carried adequately segregated from othe 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 should be blanked off or secured by equivalent means.

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

16.7 Additional operational requirements

The code contains additional operational requirements in:

3.1.1	15.3.8	15.8.28
3.1.2.1	15.4.6	15.8.29
3.1.2.2	15.5	15.8.31
3.1.4	15.6.1	15.8.32
3.5.2	15.6.3	15.8.33
3.7.4	15.6.4	15.8.34.1
7.1.2	15.7.1	15.8.34.2
7.1.6.3	15.7.6	15.8.34.3
9.1.4	**15.7.11**	15.8.35
9.2	15.8.1	15.8.36
11.3.2	15.8.2	15.8.37

11.4	15.8.3	15.9
12.1.2	15.8.4	15.10.1
12.2	15.8.5	15.11.4
13.2.1	15.8.7	15.11.6
13.2.2	15.8.15	15.12.3.1
13.2.3	15.8.16	15.13
13.2.4	15.8.17	15.14.7.1
Ch.14	15.8.19	15.14.7.2
15.1	15.8.20	15.14.7.3
15.3.1	15.8.21	15.16
15.3.7	15.8.22	15.19.8

CHAPTER 17—SUMMARY OF MINIMUM REQUIREMENTS

EXPLANATORY NOTES

Product name (column a)
The product names are not always identical with those given in the Bulk Chemical Code, as amended (adopted by resolution A.212(VII)). (For explanation see index of chemicals).

UN number (column b)
The number relating to each product shown in the recommendations proposed by the United Nations Committee of Experts on the Transport of Dangerous Goods. UN numbers, where available, are given for information only.

Ship type (column c)
1 = ship type 1 (2.1.2)
2 = ship type 2 (2.1.2)
3 = ship type 3 (2.1.2)

Tank type (column d)
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 e)
Open: open venting
Cont: controlled venting
SR: safety relief valve

Tank environmental control' (column f)
Inert: inerting (9.1.2.1)
Pad: liquid or gas (9.1.2.2)
Dry: drying (9.1.2.3)
Vent: natural or forced (9.1.2.4)

Electrical equipment (column g)
T1 to T6: temperature classes [2]
IIA, IIB or IIC: apparatus groups2
NF: nonflammable product (10.1.6)
Yes: flashpoint exceeding 60°C (closed cup test) (10.1.6)

Gauging (column h)
0: 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)

Vapour detection' (column i)
F: flammable vapours
T: toxic vapours

""No" indicates nil requirements.

[2]Temperature classes and apparatus groups as defined in International Electrotechnical Commission Publication 79 (Part 1, Appendix D, Parts 4, 8 and 12). A blank indicates that data are currently not available.

Fire protection (column j)	A: alcohol-resistant foam B: regular foam, encompasses all foams that are not of an alcohol-resistant type, including fluoroprotein and aqueous-film-forming foam (AFFF) C: water-spray D: dry chemical No: no special requirements under this Code
Materials of construction (column k)	N: see 6.2.2 Z: see 6.2.3 Y: see 6.2.4 A blank indicates no special guidance given for materials of construction
Respiratory and eye protection' (column 1)	E: see 14.2.8

"No" indicates nil requirements.

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	*i*	*j*	*k*	*l*	m
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flash point > 60°C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory eye protection*	*Special requirements*
Acetic acid	2789	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
Acetic anhydride	1715	2	2G	Cont.	No	T2	IIA	No	R	F-T	A	Y1	E to 15.11.8	15.11.2 to 15.11.4, 15.11.6
Acetone cyanohydrin	1541	2	2G	Cont.	No	T1	ILA	Yes	C	T	A	Y1	E	15.1, 15.12, 15.17, 15.18, 15.19, 16.6
Acetonitrile	1648	2	2G	Cont.	No	T2	IIA	No	R	F-T	A		No	15.12
Acrylamide solution, 50% or less		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	2218	3	2G	Cont.	No	T2	IIA	No	R	F-T	A	Y1	No	15.13. 16.6.1
Acrylonitrile	1093	2	2G	Cont.	No	T1	IIB	No	C	F-T	A	N3, Z	E	15.12, 15.13, 15.17, 15.19
Adiponitrile	2205	3	2G	Cont.	No		IIB	Yes	R	T	A		No	
Alkyl benzene sulphonic acid	2584	3	2G	Open	No			Yes	O	No	B		No	
Allyl alcohol	1098	2	2G	Cont.	No	T2	IIB	No	C	F-T	A		E	15.12, 15.17, 15.19
Allyl chloride	1100	2	2G	Cont.	No	T2	HA	No	C	F-T	A		E	15.12, 15.17, 15.19
2-(2-Aminoethoxy) ethanol		3	2G	Open	No			Yes	O	No	A, C, D	N2	No	15.19.6
Aminoethylethanolamine		3	2G	Open	No	T2	IIA	Yes	O	No	A	NI	No	
N-Aminoethylpiperazine	2815	3	2G	Cont.	No			Yes	R	T	A, C, D	N2	No	15.19.6
Ammonia aqueous, 28% or less	2672	3	2G	Cont.	No	NF			R	T	C	N4	Ea	
Ammonium nitrate solution, 93% or less	2426	2	1G	Open	No	NF			O	No	No	Y4	No	15.2, 15.11.4, 15.11.6, 15.18, 15.19.6
Aniline	1547	2	2G	Cont.	No	T1	IIA	Yes	C	T	A		No	15.12, 15.17, 15.19
Benzene and mixtures having 10°0 benzene content or more	1114	3	2G	Cont.	No	T1	IIA	No	R	F-T	B		No	15.12.1, 15.17
Benzenesulphonyl chloride	2225	3	2G	Cont.	No			Yes	R	T	B, D	NI	No	15.19.6
Benzyl chloride	1738	2	2G	Cont.	No	T1	IIA	Yes	C	T	B		E	15.12, 15.13, 15.17, 15.19
n-Butyl acrylate	2348	2	2G	Cont.	No	T2	IIB	No	R	F-T	A		No	15.13, 16.6.1, 16.6.2
Butylamine (all isomers)	1125 1214	2	2G	Cont.	No			No	R	F-T	A	N1	E	15.12, 15.17, 15.19.6

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	i	*j*	*k*	*I*	*m*
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint* >60°C	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
n-Butyl ether	1149	3	2G	Cont.	Inert	T4	IIB	No	R	F-T	A,D		No	15.4.6,-15.12
Butyl/Decyl/Cetyl-Eicosyl methacrylate mixture		3	2G	Cont.	No				R	No	A,C,D		No	15.13, 16.6.1, 16.6.2
Butyl Methacrylate	2227	3	2G	Cont.	No		HA	No	R	F-T	A,D		No	15.13, 16.6.1, 16.6.2
n-Butyraldehyde	1129	3	2G	Cont.	No	T3	HA	No	o	F-T	A		No	15.16.1
Camphor oil	1130	3	2G	Cont.	No		HA	No	o	F	B		No	
Carbolic oil		2	2G	Cont.	No			Yes	C	F-T	A		No	15.12, 15.19
Carbon disulphide	1131	2	1O	Cont.	Pad + Inert	T5	'IC	No	C	F-T	C		E	15.3, 15.12. 15.15, 15.19
Carbon tetrachloride	1846	3	2G	Cont.	No	NF			C	T	No	Z	E	15.12, 15.17, 15.19.6
Cashew nut shell oil (untreated)		3	2G	Cont.	No			Yes	R	T	B		No	
Caustic potash solution	1814	3	2G	Open	No	NF			o	No	No	N8	No	
Cetyl-Eicosyl methacrylate mixture		3	2G	Open	No			Yes	o	No	A,C,D		No	15.13, 16.6.1, 16.6.2
Chlorobenzene	1134	3	2G	Cont.	No	T1	HA	No	R	F-T	B		No	
Chloroform	1888	3	2G	Cont.	No	NF			R	T	No		E	15.12
Chlorohydrins, crude		2	2G	Cont.	No		HA	No	C	F-T	A		No	15.12, 15.19
2- or 3-Chloropropionic acid	2511	3	2G	Open	No			Yes	o	No	A	Y1	No	15.11.2 to 15.11.4, 15.11.6 to 15.11.8
Chlorosulphonic acid	1754	1	2G	Cont.	No	NF			C	T	No		E	15.11.2, to 15.11.8, 15.12, 15.16.2, 15.19
(o-, *m-, p-)* Chlorotoluenes	2238	3	2G	Cont.	No			No	R	F-T	B,C		No	
Coal tar naphtha	2553	3	2G	Cont.	No	T3	HA	No	R	F-T	A,D		No	
Creosote		3	2G	Open	No	T2	IIA	Yes	O	No	B, D		No	15.19.6
Cresols, mixed isomers	2076	3	2G	Open	No	T1	HA	Yes	O	No	B		No	
Crotonaldehyde	1143	2	2G	Cont.	No	T3	IIB	No	R	F-T	A		E	15.12, 15.16.1, 15.17
Cyclohexanone	1915	3	2G	Cont.	No	T2	HA	No	R	F-T	A	N5	No	

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	*i*	*j*	*k*	*l*	*m*
Product name	*UN number*	*ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint > 60°C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
Cyclohexylamine	2357	3	2G	Cont.	No	T3	IIA	No	R	F-T	A,D	N1	No	
Decyl acrylate		3	2G	Open	No	T3	IIA	Yes	0	No	A,C,D	N2	No	15.13, 16.6.1, 16.6.2
Dibutylamine	2248	3	2G	Cont.	No	T2	IIA	No	R	F-T	**B,D**	N4	No	
o-Dichlorobenzene	1591	3	2G	Cont.	No	T1	IIA	Yes	R	T	B,D	N5	No	
1,1-Dichloroethane	2362	3	2G	Cont.	No	T2	IIA	No	R	F-T	B		E	
Dichloroethyl ether	1916	2	2G	Cont.	No	T2	IIA	No	R	F-T	A	N5	No	
2,2-Dichloroisopropyl ether	2490	2	2G	Cont.	No			Yes	R	T	B,C,D	N5	No	15.12, 15.17, 15.19
2,4-Dichlorophenol	2021	3	2G	Cont.	Dry			Yes	R	T	B,C,D	NI	No	15.19.6
1,2-Dichloropropane	1279	2	2G	Cont.	No	T1	IIA	No	R	F-T	B	Z	No	15.12
1,3-Dichloropropane		2	2G	Cont.	No	T1	IIA	No	R	F-T	B		No	15.12
Dichloropropene/Dichloro-propane mixtures		2	2G	Cont.	No			No	C	F-T	B,C,D		E	15.12, 15.17, 15.18, 15.19
1,3-Dichloropropene	2047	2	20	Cont.	No	T2	IIA	No	C	F-T	B		E	15.12, 15.17, 15.18, 15.19
2,2-Dichloropropionic acid		3	2G	Cont.	Dry			Yes	R	No	A	Y5	No	15.11.2, 15.11.4, 15.11.6, 15.11.8
Diethanolamine		3	2G	Open	No	T1	IIA	Yes	0	No	A	N2	No	
Diethylamine	1154	3	2G	Cont.	No	T2	IIA	No	R	F-T	A	NI	E	15.12
Diethylenetriamine	2079	3	2G	Open	No	T2	IIA	Yes	0	No	A	N2	No	
Diethylethanolamine	2686	3	2G	Cont.	No	T2	IIA	No	R	F-T	A,D	NI	No	
Diethyl ether	1155	2	1G	Cont.	Inert	T4	IIB	No	C	F-T	A	N7	E	15.4, 15.14, 15.15, 15.19
Di-(2-ethylhexyl) phosphoric acid	1902	3	2G	Open	No			Yes	0	No	B,C,D	N2	No	
Diethyl sulphate	1594	2	2G	Cont.	No			Yes	C	T	A,D	N3	No	15.19.6
Diisobutylamine	2361	2	2G	Cont.	No			No	R	F-T	B,D	NI	No	15.12.3, 15.19.6
Diisopropanolamine		3	2G	Open	No	T2	IIA	Yes	0	No	A	N2	No	

a	b	c	d	e	f	g			h	i	j	k	l	m
						Electrical equipment								
Product name	UN number	Ship type	Tank type	Tank vents	Tank environmental control	Class	Group	Flashpoint >60°C	Gauging –dipping	Vapour detection	Fire protection	Materials of construction	Respiratory and eye protection	Special requirements
Diisopropylamine	**1158**	2	2G	Cont.	No	T2	IIA	No	C	F-T	A	N2	E	15.12, 15.19
Dimethylamine aqueous, 45% or less	1160	3	2G	Cont.	No	T2	HA	No	R	F-T	C, D	NI	E	15.12
Dimethylamine aqueous greater than 45% but not greater than 55%	1160	2	2G	Cont.	No			No	C	**F-T**	A, C, D	NI	E	15.12, **15.17,** 15.19
Dimethylamine aqueous greater than 55% but not greater than 65%	1160	2	2G	Cont.	No			No	C	F-T	A, C, D	NI	E	15.12, 15.14, 15.17, 15.19
N, N-Dimethylcyclohexyl-amine	2264	2	2G	Cont.	No			No	R	**F-T**	A, C	NI	No	15.12, 15.17, 15.19.6
Dimethylethanolamine	2051	3	2G	Cont.	No	T3	IIA	No	R	F-T	A, D	N2	No	
Dimethylformamide	2265	3	2G	Cont.	No	T2	IIA	No	R	F-T	A, D		No	
1,4-Dioxane	1165	2	2G	Cont.	No	T4	IIB	No	C	F-T	A		No	15.12, 15.19
Diphenylmethane diisocyanate	2489	2	2G	Cont.	Dry			Nob	C	Tb	Cc, D	N5	No	15.12, 15.16.2, 15.17, 15.19.6
Di-n-propylamine	2383	3	2G	Cont.	No			No	R	F-T	A	N2	No	15.12.3, 15.19.6
Dodecyl diphenyl oxide disulphonate solution		3	2G	Open	No	NF			O	No	No		No	
Dodecyl methacrylate		3	2G	Open	No			Yes	O	No	A, C		No	15.13
Dodecyl-Pentadecyl methacrylate mixture		3	2G	Open	No			Yes	O	No	A, C, D		No	15.13, 16.6.1, 16.6.2
Epichlorohydrin	2023	2	2G	Cont.	No		IIB	No	C	F-T	A		E	15.12, 15.17, 15.19
Ethyl acrylate	1917	2	2G	Cont.	No	T2	IIB	No	R	F-T	A		E	15.13, 16.6.1, 16.6.2
N-Ethylbutylamine		3	2G	Cont.	No			No	R	F-T	A	NI	No	15.12.3, 15.19.6
N-Ethylcyclohexylamine		3	2G	Cont.	No			No	R	F-T	A, C	NI	No	15.19.6
Ethylene chlorohydrin	1135	2	2G	Cont.	No	T2	IIA	No	C	F-T	D		E	15.12, 15.17, 15.19
Ethylene cyanohydrin		3	2G	Open	No		IIB	Yes	O	No	A		No	
Ethylenediamine	1604	2	2G	Cont.	No	T2	ILA	No	R	F-T	A	N2	No	
Ethylene dibromide	1605	2	2G	Cont.	No	NF			C	T	No		E	15.12, 15.19.6
Ethylene dichloride	1184	2	2G	Cont.	No	T2	ILA I	No	R	F-T	B	N4	No	15.19

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	i	*j*	*k*	*I*	*m*
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint >60°C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
2-Ethylhexyl acrylate		3	2G	Open	No	T3	IIB	Yes	O	No	A		No	15.13, 16.6.1, 16.6.2
2-Ethylhexylamine	2276	2	2G	Cont.	No			No	R	F-T	A	N2	No	15.12
Ethylidene norbornene		3	2G	Cont.	No			No	R	F-T	B, C, D	N4	No	15.12.1, 15.16.1, 15.19.6
Ethyl Methacrylate	2277	3	2G	Cont.	No		IIA	No	R	F-T	B, D		No	15.13, 16.6.1, 16.6.2
2-Ethyl-3-propylacrolein		3	2G	Cont.	No		IIA	No	R	F-T	A		No	
Formaldehyde solutions, 45% or less	1198[d]	3	2G	Cont.	No	T2	IIB	No	R	F-T	A		Et	15.16.1
Formic acid	1779	3	2G	Cont.	No	T1	IIA	No	R	T	A	Y2/Y3	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8
Furfural	1199	3	2G	Cont.	No	T2	IIB	No	R	F-T	A		No	15.16.1
Glutaraldehyde solutions, 50% or less		3	2G	Open	No	NF			O	No	No		No	15.16.1
Hexamethylenediamine solutions	1783	3	2G	Cont.	No			Yes	R	T	A	N2	No	15.19.6
Hexamethyleneimine	2493	2	2G	Cont.	No			No	R	F-T	A, C	NI	No	
Hydrochloric acid	1789	3	1G	Cont.	No	NF			R	T	No		5	15.11
Hydrogen peroxide solutions, over 60% but not over 70%		2	2G	Cont.	No	NF			C	No	No		No	15.5, 15.19.6
2 acrylate		2	2G	Cont.	No			Yes	C	T	A		No	15.12, 15.13, 15.19.6, 16.6.1, 16.6.2
Isobutyl acrylate	2527	2	2G	Cont.	No	T2	IIB	No	R	F-T	A		No	15.13, 16.6.1, 16.6.2
Isobutyraldehyde	2045	3	2G	Cont.	No	T3	IIA	No	O	F-T	A		No	15.16.1
Isophorone diamine	2289	3	2G	Cont.	No			Yes	R	T	A	N2	No	
Isophorone diisocyanate	2290	3	2G	Cont.	Dry			Yes	C	T	Ce, D	N5	No	15.12, 15.16.2, 15.17, 15.19.6
Isoprene	1218	3	2G	Cont.	No	T3	IIB	No	R	F	B		No	15.13, 15.14, 16.6.1, 16.6.2
Isopropylamine	1221	2	2G	Cont.	No	T2	IIA	No	C	F-T	C, D	N2	E	15.12, 15.14, 15.19
Isopropyl ether	1159	3	2G	Cont.	Inert			No	R	F	A		No	15.4.6, 15.13.3, 15.19.6
Isovaleraldehyde	2058	3	2G	Cont.	Inert	T3	JIB	No	R	F-T	A		No	15.4.6, 15.16.1

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	i	*j*	*k*	*l*	*m*
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint >60°C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
Maleic anhydride	2215	3	2G	Cont.	No			Yes	R	No	M, C		No	
Mesityl oxide	1229	3	2G	Cont.	No	T2	IIB	No	R	F-T	A		No	15.19.6
Methacrylic acid	2531	3	2G	Cont.	No			Yes	R	T	A	Y1	No	15.13, 16.6.1
Methyl acrylate	1919	2	2G	Cont.	No	T1	JIB	No	R	F-T	B		E	15.13, 16.6.1, 16.6.2
Methylamine solutions, 42% or less	1235	2	2G	Cont.	No				C	F-T	A, C, D	NI	E	15.12, 15.17, 15.19
2-Methyl-6-ethyl aniline		3	2G	Open	No			Yes	O	No	B, C, D		No	
Methylene chloride	1593	3	2G	Cont.	No	T1	HA	Yes	R	T	No		No	
2-Methyl-5-ethylpyridine	2300	3	2G	Open.	No		IIA	Yes	O	No	D	N4	No	
Methyl formate	1243	2	2G	Cont.	No			No	R	F-T	A		E	15.12, 15.14, 15.19
2-Methyl-2-hydroxy-3-butyne		3	2G	Cont.	No			No	R	F-T	A, C, D	N6	No	15.19.6
Methyl methacrylate	1247	2	2G	Cont.	No	T2	IIA	No	R	F-T	B		No	15.13, 16.6.1, 16.6.2
2-Methylpyridine	2313	2	2G	Cont.	No			No	C	F	A, C	N4	No	15.12.3, 15.19.6
a-Methylstyrene	2303	3	2G	Cont.	No	T1	IIB	No	R	F-T	D		No	15.13, 16.6.1, 16.6.2
Monoethanolamine	2491	3	2G	Open	No	T2	IIA	Yes	O	F-T	A	N2	No	
Monoethylamine		2	1O	Cont.	No	T2	IIA	No	C	F-T	C, D	N2	E	15.12, 15.14
Monoethylamine solutions, 72% or less	2270	2	2G	Cont.	No			No	C	F-T	A, C	NI	E	15.12 15.14, 15.17, 15.19
Monoisopropanolamine		3	2G	Open	No	T2	HA	Yes	O	F-T	A	N2	No	
Mononitrobenzene	1662	2	2G	Cont.	No	TI	IIA	Yes	C	T	D		No	15.12, 15.17, 15.18, 15.19
Morpholine	2054	3	2G	Cont.	No	T2	IIA	No	R	F	A	N2, Z	No	
Motor fuel anti-knock compounds	1649	2	1G	Cont.	No	T4	IIA	No	C	F-T	B, C		E	15.6, 15.12, 15.18, 15.19
Naphthalene, molten	2304	3	2G	Cont.	No	T1	IIA	Yes	R	No	A, D		No	
Nitric acid, 70% and over	2031 2032h	2	2G	Cont.	No	NF			C	T	No		E	15.11, 15.19

a	*b*	*c*	*d*	*e*	*f*	*g* Electrical equipment			*h*	*i*	*j*	*k*	*l*	*m*
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint >60°C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
Nitric acid, less than 70%	2031	2	2G	Cont.	No	NF			R	T	No		E	15.11, 15.19
o-Nitrochlorobenzene	1578	2	2G	Cont.	No			Yes	C	T	B, C, D		No	15.12, 15.17, 15.18, 15.19
o-Nitrophenol, molten	1663	2	2G	Cont.	No			Yes	C	T	A, C, D		No	15.12, 15.19.6
1- or 2-Nitropropane	2608	3	2G	Cont.	No	T2	JIB	No	R	F-T	A		No	
(o- and *p-)* Nitrotoluene	1664	2	2G	Cont.	No		IIB	Yes	C	T	B		No	15.12, 15.17, 15.19
Oleum	1831	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
Paraldehyde	1264	3	2G	Cont.	No	T3	IIB	No	R	F	A		No	
Pentachloroethane	1669	3	2G	Cont.	No	NF			R	T	No		No	15.12, 15.17
1,3-Pentadiene		3	2G	Cont.	No			No	R	F-T	B		No	15.13, 16.6
Phenol	2312	2	2G	Cont.	No	T1	IIA	Yes	C	T	A		No	15.12, 15.19
Phosphoric acid	1805	3	2G	Open	No	NF			O	No	No		No	15.11.1 to 15.11.4, 15.11.6 to 15.11.8
Phosphorus, yellow or white	2447	1	1G	Cont.	Pad + (vent or Inert)			Nok	C	No	C		E	15.7, 15.19
Phthalic anhydride	2214	3	2G	Cont.	No	T1	IIA	Yes	R	No	D		No	
Polyethylene polyamines	2734' 2735	3	2G	Open	No			Yes	O	No	A	N2	No	
Polymethylene polyphenyl isocyanate	2206' 2207	2	2G	Cont.	Dry			Nob	C	Tb	C", D	N5	No	15.12, 15.16.2, 15.19.6
n-Propanolamine		3	2G	Open	No			Yes	O	No	A, D	N2	No	
B-Propiolactone		2	2G	Cont.	No		IIA	Yes	R	T	A		No	
Propionaldehyde	1275	3	2G	Cont.	No			No	R	F-T	A		E	15.16.1, **15.17**
Propionic acid	1848	3	2G	Cont.	No.	TI	IIA	No	R	F	A	Y1	E	15.11.2 to 15.11.4, 15.11.6 to 15.11.8
Propionic anhydride	2496	3	2G	Cont.	No	T2	IIA	Yes	R	T	A	Y1	No	
Propionitrile	2404	2	1G	Cont.	No	T1	IIB	No	C	F-T	A, D		E	15.12, 15.17, 15.18, 15.19

a	b	c	d	e	f	g			h	i	j	k	l	m
						Electrical equipment								
Product name	UN number	Ship type	Tank type	Tank vents	Tank environmental control	Class	Group	Flashpoint >60°C	Gauging	Vapour detection	Fire protection	Materials of construction	Respiratory and eye protection	Special requirements
n-Propylamine	1277	2	2G	Cont.	Inert	T2	IIA	No	C	F-T	C,D	N2	E	15.12, 15.19
Propylene oxide	1280	2	2G	Cont.	Inert	T2	IIB	No	C	F-T	A,C	Z	No	15.8, 15.12.1, 15.14, 15.15, 15.19
Pyridine	1282	3	2G	Cont.	No.	T1	IIA	No	R	F	A	N4	No	
Sodium borohydride, 15% or less/Sodium hydroxide solution		3	2G	Open	No	NF			O	No	No	N1	No	
Sodium chlorate solutions, 50% or less		3	2G	Open	No	NF			O	No	No		No	15.9, 15.16.1, 15.19.6
Sodium dichromate solution, 70% or less		2	2G	Open	No	NF			C	No	No	N2	No	15.12.3, 15.19
Sodium hydrosulphide solution, 45% or less		3	2G	Cont.	Vent or pad (gas)	NF			R	T	No		No	15.16.1
Sodium hydroxide solution	1824	3	2G	Open	No	NF			O	No	No	N8	No	
Sodium hypochlorite solution. 15% or less		3	2G	Cont.	No	NF			R	No	No	N5	No	15.16.1
Sodium-2-mercaptobenzothiazol solution		3	2G	Open	No	NF			O	No	No	N1	No	
Styrene monomer	2055	3	2G	Cont.	No	TI	IIA	No	O	F	B	N4,Z	No	15.13, 16.6.1, 16.6.2
Sulphur, liquid	2448	3	1G	Open	Vent or pad (gas)		T3	Yes'	O	F-T	No		No	15.10
Sulphuric acid	1830	3	2G	Open	No	NF			O	No	No		No	15.11, 15.16.2
Sulphuric acid, spent	1832	3	2G	Open	No	NF			O	No	No		No	15.11, 15.16.2
Tetrachloroethane	1702	3	2G	Cont.	No	NF			R	T	No		No	15.12, 15.17
Tetraethylenepentamine	2320	3	2G	Open	No			Yes	O	No	A	NI	No	
Tetrahydrofuran	2056	3	2G	Cont.	No	T3	IIB	No	R	F-T	A,D		No	
Toluenediamine	1709	2	2G	Cont.	No			Yes	C	T	B,C,D	N1	E	15.12, 15.17, 15.19
Toluene diisocyanate	2078	2	2G	Cont.	Dry	T1	IIA	Yes	C	F-T	Cc,D	N4	E	15.12, 15.16.2, 15.17, 15.19
o-Toluidine	1708	2	2G	Cont.	No			Yes	C	T	A,C		No	15.12, 15.17, 15.19
1,2,4-Trichlorobenzene	2321	3	2G	Cont.	No			Yes	R	T	C		No	15.19.6
1,1,2-Trichloroethane		3	2G	Cont.	No	NF			R	T	No		No	15.12.1

a	b	c	d	e	f	g			h	i	j	k	l	m
						Electrical equipment								
Product name	*UN number*	*Ship type*	*Tank type*	*Tank vents*	*Tank environmental control*	*Class*	*Group*	*Flashpoint >60 °C*	*Gauging*	*Vapour detection*	*Fire protection*	*Materials of construction*	*Respiratory and eye protection*	*Special requirements*
Trichloroethylene	1710	3	2G	Cont.	No	T2	IIA	Yes	R	T	No		No	15.12, 15.16.1, 15.17
1,2,3-Trichloropropane		2	2G	Cont.	No			Yes	C	T	B,C,D		No	15.12, 15.17, 15.19
Triethanolamine		3	2G	Open	No		IIA	Yes	O	No	A	NI	No	
Triethylamine	1296	2	2G	Cont.	No	T2	IIA	No	R	F-T	B	N2	E	15.12
Triethylenetetramine	2259	3	2G	Open	No	T2	IIA	Yes	O	No	A	N1	No	
Trimethylacetic acid		3	2G	Cont.	No			Yes	R	No	A,C	Y1	No	15.11.2 to 15.11.8
Trimethylhexamethylene diamine (2,2,4- and 2,4,4-isomers)	2327	3	2G	Open	No			Yes	O	No	A,C	N I	No	15.19.6
Trimethylhexamethylene diiso-cyanate (2,2,4- and 2,4,4-isomers)	2328	2	2G	Cont.	Dry			Yes	C	T	A,Cc		No	15.12, 15.16.2, 15.17, 15.19.2
Trimethyl phosphite	2329	3	2G	Cont.	No			No	R	F-T	A,D		No	15.12.1, 15.16.2, 15.19.6
Tritolyl phosphate, containing 1% or more ortho-isomer	2574i	2	2G	Cont.	No	T2	IIA	Yes	C	No	B		No	15.12.3, 15.19
Urea, ammonium solution, containing aqua ammonia		3	2G	Cont.	No	NF			R	T	A	N4	No	
n-Valeraldehyde	**2058**	3	2G	Cont.	Inert	T3	IIB	No	R	F-T	A		No	15.4.6, 15.16.1
Vinyl acetate	1301	3	2G	Cont.	No	T2	HA	No	O	F	A		No	15.13, 16.6.1, 16.6.2
Vinyl ethyl ether	1302	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 chlorida	1303	2	2G	Cont.	Inert	T2	IIA	No	R	F-T	B	N5	E	15.13, 15.14, 16.6.1, 16.6.2
Vinyl neodecanoate		3	2G	Open	No			Yes	O	No	B		No	15.13, 15.16.1, 16.6.1, 16.6.2
Vinyl toluene	2618	3	2G	Cont.	No		IIA	No	R	F	D	NI	No	15.13, 16.6.1, 16.6.2
Xylenols	2261	3	2G	Open	No		IIA	Yes	O	No	B		No	

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

d UN number 1198 only applies if flashpoint is below 60°C.

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

f Applies to hydrochloric acid not below 10%.

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

h UN number 2032 assigned to red fuming nitric acid.

i UN number depends on boiling point of substance.

ɪ UN number assigned to this substance containing more than 3% of ortho-isomer.

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.

l Sulphur, liquid, has a flashpoint above 60°C, however electrical equipment should be certified safe for the gases evolved.

CHAPTER 18—LIST OF CHEMICALS TO WHICH THE CODE DOES NOT APPLY'

1 The following are products which are not considered to come within the scope of the Code. This list may be used as a guide in considering bulk carriage of products whose hazards have not yet been evaluated.

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

3 The products listed below may be subject to reconsideration upon the coming into force of the International Convention for the Prevention of Pollution from Ships, 1973/78.

Chapter 18	UN number
Acetone	1090
Amylacetate, commercial	1104
n-Amyl acetate	1104
sec-Amyl acetate	1104
n-Amyl alcohol	1105
sec-Amyl alcohol	1105
tert-Amyl alcohol	1105
Amyl alcohol, primary	1105
tert-Amylenes	
Benzyl alcohol	
n-Butyl acetate	1123
sec-Butyl acetate	1123
n-Butyl alcohol	1120
sec-Butyl alcohol	1120
tert-Butyl alcohol	1120
Butyl benzyl phthalate	
Butylene glycol	
y-Butyrolactone	
Calcium alkyl salicylate	—
Cumene	1918
Cyclohexane	1145
Cyclohexanol	
p-Cymene	2046

'The product names are not always identical with the names given in the various editions of the Bulk Chemical Code (resolution A.212(VII)).

Chapter 18	UN number
n-Decyl alcohol	
Diacetone alcohol	1148
Dibutyl phthalate	—
Dicyclopentadiene	2048
Diethylbenzene	2049
Diethylene glycol	
Diethylene glycol diethyl ether	
Diethylene glycol monobutyl ether	
Diethylene glycol monobutyl ether acetate	
Diethylene glycol monoethyl ether	
Diethylene glycol monoethyl ether acetate	
Diethylene glycol monomethyl ether	
Diethylene glycol monomethyl ether acetate	
Diisobutylene	2050
Diisobutyl ketone	1157
Diisobutyl phthalate	
Diisoctyl phthalate	
2,2-Dimethyloctanoic acid	
Dioctyl phthalate	
Dipentene	2052
Diphenyl ether	
Dipropylene glycol	
Dipropylene glycol monomethyl ether	
Dodecyl alcohol	
Dodecylbenzene	
Dodecylphenol	
2-Ethoxyethanol	1171
2-Ethoxyethyl acetate	1172
Ethyl acetate	1173
Ethyl acetoacetate	
Ethyl alcohol	1170
Ethylbenzene	1175
Ethylcyclohexane	—
Ethylene carbonate	
Ethylene glycol	
Ethylene glycol methyl butyl ether	
Ethylene glycol monobutyl ether	2369
Ethylene glycol monobutyl ether acetate	
Ethylene glycol monomethyl ether	1188
Ethylene glycol monomethyl ether acetate	1189
Ethylene glycol monophenyl ether	
2-Ethylhexanoic acid	—
Formamide	—
Furfuryl alcohol	2874
Glycerine	—
n-Heptane	1206
Heptanol, all isomers	—
Heptene, mixed isomers	2278
n-Hexane	1208
Hexan-1-ol	2282
1-Hexene	2370
Hexylene glycol	
Isoamyl acetate	1104
Isoamyl alcohol	1105

Chapter 18	UN number
Isobutyl acetate	1213
Isobutyl alcohol	1212
Isobutyl formate	2393
Isodecyl alcohol	
Isopentane	1265
Isopentene	2371
Isophorone	—
Isopropyl acetate	1220
Isopropyl alcohol	1219
Lactic acid	
Latex	—
Methyl acetate	1231
Methyl alcohol	1230
Methylamyl acetate	1233
Methylamyl alcohol	2053
Methyl amyl ketone	1110
Methyl tert-butyl ether	2398
Methyl ethyl ketone	1193
Methyl isobutyl ketone	1245
2-Methyl-l-pentene	—
N-Methy1-2-pyrrolidone	
Molasses	
Naphtha solvent	1256
Nonane	1920
Nonyl alcohol	
Nonylphenol	
Octane	1262
Octanol, all isomers	
Paraffin wax	
n-Pentane	1265
n-Pentene	1108
Petrolatum	
Petroleum naphtha	1255
Perchloroethylene	1897
Pinene	2368
Polypropylene glycols	
n-Propylacetate	1276
n-Propyl alcohol	1274
Propylene glycol	
Propylene glycol monoethyl ether	
Propylene glycol monomethyl ether	
Propylene tetramer	2850
Propylene trimer	2057
Sulpholane	
Tall oil	
Tetrahydronaphthalene	
Toluene	1294
Tributyl phosphate	
1,1,1-Trichloroethane	2831
Tridecanol	
Triethylbenzene	
Triethylene glycol	
Triisopropanolamine	
1,2,4-Trimethylbenzene	
Tripropylene glycol	
Tripropylene glycol monomethyl ether	
Tritolyl phosphate(< 1% ortho-isomer)	
Trixylenyl phosphate	
Turpentine	1299

Chapter 18	UN number
Urea, ammonium nitrate solutions	
Urea, ammonium phosphate solutions	
White spirit	1300
Wines	
Xylenes	1307

CHAPTER 19—REQUIREMENTS FOR SHIPS ENGAGED IN THE INCINERATION AT SEA OF LIQUID CHEMICAL WASTE

19.1 General

19.1.1 Chapters 1 to 16 apply to incinerator ships, as relevant, and as supplemented or modified by the provisions of this chapter.

19.1.2 Information on the composition and the hazards of the waste to be incinerated should be made available to the Administration or port Administration, or both, as appropriate, which may prohibit carriage of those wastes deemed to be too hazardous to be carried in bulk.'

19.1.3 The following additional definitions apply:

.1 *Incinerator space* is a gastight space containing solely the incinerator and its associated auxiliaries.

.2 *Incinerator blower space* is a space containing the blowers which supply combustion air to the incinerator burners.

.3 *Dumping Convention* means the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter at Sea, 1972.

.4 *Cargo area* is that part of the ship defined by 1.3.5, excluding incinerators and chemical waste piping leading to the incinerators.

19.1.4 During the periodical and intermediate surveys required under 1.5.1.2 and .3, all cargo tanks and the cargo piping system should be inspected for corrosion and the remaining thickness of material should be determined. Where severely corrosive wastes have been carried, inspections of cargo tanks and the cargo piping system for corrosion should be held annually and the remaining thickness of materials determined during those inspections.

19.2 Ship survival capability and location of cargo tanks

19.2.1 Ships subject to this chapter should comply with type 2 ship standards and with the requirements for location of cargo tanks in type 2 ships.

19.2.2 Waste mixtures containing substances which would require a type 1 ship standard may be carried in type 2 ships if solely for the purpose of incineration.

19.3 Ship arrangements

19.3.1 Liquid chemical wastes should not be stowed adjacent to oil fuel tanks except those tanks containing oil fuel to be used exclusively for incineration.

19.3.2 Tanks and pumps, other than those described in 19.3.3, which may contain liquids and which are to be used for the incineration process or for washing cargo pipes and cargo tanks may be located adjacent to cargo tanks and should be located within the cargo area. The provisions of 3.1 should apply to such tanks and equipment to the same extent as they apply to cargo tanks.

'The environmental aspects of incineration and dumping of wastes are regulated by the Dumping Convention. In general, for incineration of waste, a permit from the appropriate authority of the Contracting Party to the Convention, where the loading port is situated, is required. Where the loading port is situated in a State not being a Contracting Party to the Convention, the Administration should issue a permit.