



**RULES FOR THE CLASSIFICATION AND  
CONSTRUCTION**

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**PART 1. SEAGOING SHIPS**

**VOLUME X**  
**RULES FOR SHIPS CARRYING DANGEROUS  
CHEMICAL IN BULK**  
**2014 EDITION**

**BIRO KLASIFIKASI INDONESIA**





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## **PART 1. SEAGOING SHIPS**

### **VOLUME X**

# **RULES FOR SHIPS CARRYING DANGEROUS CHEMICAL IN BULK**

## **2014 EDITION**

**Biro Klasifikasi Indonesia**

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## Foreword

Rules for Ships Carrying Dangerous Chemicals in Bulk Volume X 2014 Edition is an amendment of Rules for Ships Carrying Dangerous Chemicals in Bulk Volume X 2013 Edition. Reference sources of the rules are derived from world maritime regulatory developments, IACS Procedural Requirements, IACS Unified Requirements, IMO Code, and inputs from BKI Branch Offices and Technical Division BKI Head Office.

The amendment texts of the Rules have been marked by underline whereas specific requirements of the Society which are additional to the provision of the IBC-Code as well as interpretations of IBC-Code requirements have been marked by a special paragraph number and highlighted.

The Rules consist of the following section:

- Section 1.** General, Character of Classification, Definitions, Surveys and Certification, this section contain requirement for apply to ships having their machinery aft and built for the carriage in bulk of dangerous chemicals.
- Section 2.** Ship Survival Capability and Location of Cargo Tanks. This section contain requirement for flooding assumptions, standard of damage and survival requirement
- Section 3.** Ship Arrangement, this section contain requirement for cargo segregation, Accommodation, service and machinery spaces and control station and arrangement of machinery installations.
- Section 4.** Cargo Containment, this section contain requirement for Tank type, scantling and testing of the cargo tanks
- Section 5.** Cargo Transfer, this section contain requirement for piping scantlings, piping installations and cargo transfer control systems
- Section 6.** Materials of Construction, this section contain requirement for material used for tank construction, piping, pumps, valves, vents and their jointing material.
- Section 7.** Cargo Temperature Control, contain requirement for cargo measuring the cargo temperature
- Section 8.** Cargo Tank Venting and Gas-freeing Arrangement contain requirement for cargo tank venting, Types of tank venting systems, venting requirements for individual products and Cargo tank gas-freeing.
- Section 9.** Environmental Control
- Section 10.** Electrical Installations
- Section 11.** Fire Protection and Fire Extinction, this section complies with SOLAS Regulation and applied to all chemical tankers irrespective of tonnage.
- Section 12.** Mechanical Ventilation in the Cargo Area contains Requirements for ventilation of spaces within the cargo area.
- Section 13.** Instrumentation, this section contain requirement for types of gauging devices and vapour detection.
- Section 14.** Personnel Protection, this section contain requirement for protective equipment and safety equipment.

- Section 15.** Special Requirements contain requirement for special product
- Section 16.** Operational Requirements
- Section 17.** Summary of Minimum Requirements, this section contain minimum requirement of product
- Section 18.** Chemicals to which the Code does not apply
- Section 19.** Transport of Liquid Chemical Waste, this section contain requirement for transboundary movement of liquid chemical wastes in bulk by seagoing ships.
- Section 20** Requirements for Offshore Support Vessels engaged in the Transport and Handling of limited Amounts of Hazardous and noxious liquid Substances in Bulk

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## Rules Amendments Notice

This page contains amendments within the following Sections of the Rules for Ships Carrying Dangerous Chemicals in Bulk, 2014 Edition.

**These amendments are affective from August 1<sup>st</sup> 2014**

Paragraph	Title/ Subject	Status/ Remarks
<b>Section 1. General Character of Classification, Definitions, Surveys and Certification</b>		
<b>A</b>	<b>Application</b>	
A.4	No Title	To adjust in line with IBC Code as amended by IMO-Resolutions MEPC.225(64) and MSC.340(91).
<b>Section 17. Summary of Minimum Requirements</b>		
The existing text of Section 17 is replaced by the Chapter 17 IBC Code as amended by IMO-Resolutions MEPC.225(64) and MSC.340(91), as underlined.		
<b>Section 18. List of Products to which the Code does not apply</b>		
The existing text of Section 18 are replaced by the Chapter 18 IBC Code as amended by IMO-Resolutions MEPC.225(64) and MSC.340(91), as underlined.		

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## Section 1

### General Character of Classification, Definitions, Surveys and Certification

#### A. Application

1. These Rules apply to ships having their machinery aft and built for the carriage in bulk of dangerous chemicals which are listed in Section 17.
2. Further to these Rules the requirements of Part 1, Volume I, Rules for Classification and Surveys as well as the relevant provisions of Part 1, Volume II, Rules for Hull, Sections 1 - 22 and 24 apply.
3. For the machinery and the electrical plant of these ships, Part 1, Volume III, Rules for Machinery Installations, Part 1, Volume IV, Rules for Electrical Installations, and Part 1, Volume VII, Rules for Automation apply.
4. These Rules incorporate the - "International Code for the Construction and Equipment of Ships carrying dangerous Chemicals in Bulk" (IBC-Code), as amended by IMO-Resolutions MEPC.225(64) and MSC.340(91). These Rules apply also to offshore support vessels engaged in the transport and handling of limited amounts of hazardous and noxious substances in bulk (Section 20, incorporating the IMO-Resolution A.673 (16)).

#### **Guidance:**

*For ships carrying hazardous liquid wastes in bulk for the purpose of dumping at sea the provisions of the IMO-Resolution A.582 (14) apply.*

5. Certain requirements of the IBC Code that are not within the scope of classification e.g. para. 6 "Equivalents", Section 14 "Personal Protection", certain operational requirements in Section 15 "Special Requirements" and Section 16 "Operational Requirements" have been included in these rules. Except for para. 6 and the operational requirements as mentioned above they will, however, be applied in such instances where
  - .1 the Society is authorized by Administrations to issue on their behalf the "Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk" or where
  - .2 the Society is authorized to carry out investigations and surveys on behalf of Administrations on the basis of which the "Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk" will be issued by the Administrations or where
  - .3 the Society is requested to certify compliance with the Code.

Operating Requirements have been included for guidance only and will not be looked at by the Society.

Specific requirements of the Society which are additional to the provision of the Code as well as interpretations of Code requirements have been marked by a special para. No. (e.g. 4.2 - 0.1) and highlighted.

Alternations to the preceding Edition are marked by **Underline Text**. Differing from the standard construction of the Rules, which is given in this Section 1, Sections 2 - 20 for direct comparison with the IBC-Code are arranged accordingly.

## **6.      Equivalents**

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

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

## **7.      Application of the IBC-Code**

**7.1**      The IBC-Code applies to ships regardless of size, including those of less than 500 gross tonnage, engaged in the carriage of bulk cargoes of dangerous chemicals or noxious liquid substances (NLS), 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.

**7.2**      The Code is at present limited to the liquids shown in the summary of minimum requirements in Section 17.

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

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

**7.4**      For the purpose of the 1974 SOLAS Convention, the Code applies to ships which are engaged in the carriage of products included in Section 17 on the basis of their safety characteristics and identified as such by an entry of S or S/P in column "d".

**7.5**      For the purpose of MARPOL 73/78, the Code applies only to NLS tankers, as defined in Regulation 1.16.2 of Annex II thereof, which are engaged in the carriage of Noxious Liquid Substances identified as such by an entry of X, Y or Z in column "c" of Section 17.

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

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

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

on or after 1 July, 1986.

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

This conversion provision does not apply to the modification of a ship referred to in regulation 1.14 of Annex II of MARPOL 73/78.

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

## **8. Hazards**

Hazards of products covered by the Code include:

- 8.1** *Fire hazard*, defined by flashpoint, explosive/flammability limits/range and auto ignition temperature of the chemical.

- 8.2** *Health hazard*, defined by:

- .1 corrosive effects on the skin in the liquid state; or
- .2 acute toxic effect, taking into account values of

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

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

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

- .3 Other health effects such as carcinogenicity and sensitization.

- 8.3** *Reactivity hazard*, defined by reactivity:

- .1 with water;
- .2 with air;
- .3 with other products; or
- .4 of the product itself (e.g. polymerization).

- 8.4** *Marine pollution hazard*, as defined by:

- .1 bioaccumulation;
- .2 lack of ready biodegradability;
- .3 acute toxicity to aquatic organisms;

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

## **B. Character of Classification, Entries into the Class Certificate, Documents for Approval**

### **1. Character of Classification, entries into the Class Certificate**

**1.1** Ships complying with the requirements of these Rules will have the Notation CHEMICAL TANKER affixed to the Character of Classification.

#### **Guidance:**

*It is assumed that the provisions of MARPOL 73/78, Annex II will be complied with. Ships not complying with the relevant MARPOL-provisions will not be assigned the notation "Chemical Tanker".*

**1.2** Chemical tankers will be assigned the symbol □ before the Character of Classification for characterizing proof of damage stability according to the IBC-Code (Section 2) and after the Character of Classification the relevant ship type notation (Type 1, 2 and 3). The following data will be entered into an appendix to the Certificate:

**.1** Five digit code for the specification of the proof of damage stability according to Part 1, Volume I, Rules for Classification and Surveys, Section 2, C.2.2.

**.2** Description of the code.

A list stating the chemicals permitted to be carried will be issued as an appendix to the Certificate of Classification<sup>1</sup>. (Chemical tankers whose keel was laid before 12.04.1972 or which were at a similar stage of construction or ships whose conversion into a chemical tanker began before that date will have the relevant ship type notation assigned even if the requirements for survival capability are not complied with. The symbol □ will, however, not be assigned and the data specified in .1 - .3 will not be entered into the appendix to the Certificate).

### **2. Documents for approval**

**2.1** Apart from the drawings and documents listed in Part 1, Volume II, Rules for Hull, Section 1, G., the following documents are to be submitted in triplicate:

- .1** general arrangement plan,
- .2** data on the location and capacity of cargo tanks and products intended to be carried,
- .3** drawings of the cargo tanks and information on the materials to be used,
- .4** data of the foundations and the fastening of the cargo tanks where the cargo tanks are independent from the hull,
- .5** damage stability calculations<sup>2</sup> if this Society is acting in accordance with A.5.1 to A.5.3,

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<sup>1</sup> Ships, for which BKI issues the "Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk", as well as Indonesian flag ships, for which Government issues the respective Certificate, do not have this list annexed, as it forms part of the Certificate of Fitness.

<sup>2</sup> A Computer program may be used for these calculations.

.6 drawings showing the arrangement of access and inspection openings for compliance with the requirements in Section 3.4. (in particular double bottom and double hull).

2.2 Apart from the documents listed in Part 1, Volume III, Rules for Machinery Installations, Section 15, A.3. the following documents are to be submitted in triplicate:

.1 drawings of cargo piping system with pumps including their driving machinery,

.2 drawings of remote-controlled valves including their actuating equipment,

.3 drawings of the tank venting system including pressure/vacuum devices, flame arresters and vapour returns,

.4 drawings of bilge and ballast water lines within the cargo area,

.5 drawings of the cargo heating system,

.6 drawings of the tank washing system,

.7 details of the tank gauging and cargo temperature measuring systems,

.8 details of the overflow control,

.9 details of the materials coming into contact with the cargo and their vapour,

.10 drawings of the fire-extinguishing systems within the cargo area.

.11 drawings of the under water outlet for the discharge of cargo residues.

## C. Definitions

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

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.

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

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

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

5. **Breadth B** [m] 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. For determination of scantlings the Breadth B as per Part 1, Volume II, Rules for Hull, Section 1, H.2.5 is to be taken.

- 6. 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 or slop tanks and also deck areas throughout the entire length and breadth of the part of the ship over the above-mentioned spaces. Where independent tanks are installed in hold spaces, cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forward-most hold space are excluded from the cargo area.
- 7. Cargo pump-room** is a space containing pumps and their accessories for the handling of products covered by these Rules.
- 8. Cargo service spaces** are spaces within the cargo area used for workshops, lockers and store-rooms of more than 2 m<sup>2</sup> in area used for cargo handling equipment.
- 9. Cargo tank** is the envelope designed to contain the cargo.
- 10. Chemical Tanker** is a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product listed in Section 17.
- 11. Cofferdam** is the isolating space between two adjacent steel bulkheads or decks. This space may be a void space or a ballast space.
- 12. Control stations** are those spaces in which ship's radio or main navigating equipment or the emergency source of power is located or where the fire-recording or fire-control equipment is centralized. This does not include special fire-control equipment which can be most practically located in the cargo area.
- 13. Dangerous chemicals** means any liquid chemicals designated as presenting a safety hazard, based on the safety criteria for assigning products to Section 17.
- 14. Density** is the ratio of the mass to the volume of a product, expressed in terms of kilograms per cubic metre. This applies to liquids, gases and vapours.
- 15. Explosive/flammability limits/range** 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.
- 16. Flashpoint** is the temperature in degrees Celsius at which a product will give off enough flammable vapour to be ignited. Values given in the Code are those for a "closed-cup test" determined by an approved flashpoint apparatus.
- 17. Hold space** is the space enclosed by the ship's structure in which an independent cargo tank is situated.
- 18. Independent** means that a piping or venting system, for example, is in no way connected to another system and that there are no provisions available for the potential connection to other systems.
- 19. Length  $L_c$**  in [m] means 96 % of the total length on a waterline at 85 % of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that be greater. In ships designed with a rake of keel, the waterline on which this length is measured shall be parallel to the designed waterline.

For determination of scantlings the length  $L$  as per Part 1, Volume II, Rules for Hull, Section 1, H.2.2 is to be taken.

- 20. Machinery spaces of Category A** are those spaces and trunks to such spaces which contain:
- .1** internal-combustion machinery used for main propulsion; or

**.2** internal-combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; or

**.3** any oil-fired boiler or oil fuel unit or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.

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

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

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

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

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

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

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

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

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

**30. Recognized Standards** are applicable international or national standards acceptable to the Administration or standards laid down and maintained by an organisation which complies with the standards adopted by the Organization<sup>3</sup> and which is recognized by the Administration. (This definition includes the BKI-Rules).

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

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

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

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

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<sup>3</sup> See Appendix 1 to IMO Resolution A.739(18).

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

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

## **D. Surveys and Certification**

### **1. Surveys for class maintenance**

The relevant requirements are given in Part 1, Volume I, Rules for Classification and Surveys, Section 4, C.

### **2. Survey and certification according to IBC-Code**

The relevant requirements of Section 1.5 of the IBC-Code are given in Part 1, Volume I, Rules for Classification and Surveys, Section 4, C.

## **E. Emergency Towing Arrangements**

Emergency towing arrangements are to be fitted on chemical tankers of 20 000 tdw and above in accordance with the SOLAS, Chapter II-1, Reg. 3-4, see also Part 1, Volume II, Rules for Hull, Section 24, A.10.

## **F. Safe Access to Tanker Bows**

Every chemical tanker shall be equipped with means for safe access to the bow in accordance with SOLAS, Chapter II-1, Reg. 3-3, and ICLL, REG. 25 (4), 26 (2), 27(7) (see also IACS U.I. LL50).

## Section 2

### Ship Survival Capability and Location of Cargo Tanks

#### 2.1 General

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

**Guidance :**

*When applying the requirements of this Section, attention should be given to the IMO-document MSC/ Circ. 406 of 14.06.1985 "Guidelines for the Uniform Application of the Survival Requirements of the IBC/IGC-Codes".*

**2.1.2** Ships subject to these Rules shall be designed to one of the following standards:

**.1** A **Type 1** ship is a chemical tanker intended to transport Section 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 Section 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 Section 17 products with sufficiently severe environmental and safety hazards which require a moderate degree of containment to increase survival capability in a damaged condition.

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

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

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

#### 2.2 Freeboard and intact stability

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

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

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

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

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

### **2.3 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 deck-houses on the freeboard deck fitted with weathertight doors shall comply with the requirements of Regulation 22 of the International Convention on Load Lines 1966, except that the choice of valves in paragraph (1) shall be limited to:

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

**2.3.2** For the purpose of this section "summer loadline" and "freeboard deck" have the meanings as defined in the International Convention on Load Lines 1966.

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

**2.3-0.1** Automatic non-return valves are to comply with Part 1, Volume III, Rules for Machinery Installations, Section 11.

### **2.4 Conditions of loading**

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

### **2.5 Damage assumptions**

**2.5.1** The assumed maximum extent of damage shall be in accordance with Table 2.1.:

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

**Table 2.1. Extent of side and bottom damage**

<b>2.5.1.1 Side damage</b>		
<b>.1.1 Longitudinal extent</b>		$1/3 L_c^{2/3}$ or 14.5 m, whichever is less
<b>.1.2 Transverse extent</b>	measured inboard from the ship's side at right angle to the centreline at the level of the summer load line	<b>B/5</b> or 11.5 m, whichever is less
<b>.1.3 Vertical extent</b>	measured from the moulded line of the bottom shell plating at centreline	upwards without limit
<b>2.5.1.2 Bottom damage</b>		
	<b>For <math>0.3 L_c</math> from the forward perpendicular of the ship</b>	<b>Any other part of the ship</b>
<b>.2.1 Longitudinal extent</b>	$1/3 L_c^{2/3}$ or 14.5 m, whichever is less	$1/3 L_c^{2/3}$ or 5 m, whichever is less
<b>.2.2 Transverse extent</b>	<b>B/6</b> or 10 m, whichever is less	<b>B/6</b> or 5 m, whichever is less
<b>.2.3 Vertical extent</b>	<b>B/15</b> or 6 m, whichever is less, measured from the moulded line of the bottom shell plating at centreline (see 2.6.2)	<b>B/15</b> or 6 m, whichever is less, measured from the moulded line of the bottom shell plating at centreline (see 2.6.2)

## **2.6 Location of cargo tanks**

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

**.1 Type 1 ships:** from the side shell plating, not less than the transverse extent of damage specified in 2.5.1.1.2, and from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.

**.2 Type 2 ships:** from the moulded line of the bottom shell plating at centreline, not less than the vertical extent of damage specified in 2.5.1.2.3, and nowhere less than 760 mm from the shell plating. This requirement does not apply to the tanks for diluted slops arising from tank washing.

**.3 Type 3 ships:** no requirement.

**2.6.2** Except for Type 1 ships, suction wells installed in cargo tanks may protrude into the vertical extent of bottom damage specified in 2.5.1.2.3 provided that such wells are as small as practicable and the protrusion below the inner bottom plating does not exceed 25 % of the depth of the double bottom or 350 mm, whichever is less. Where there is no double bottom, the protrusion of the suction well of independent tanks below the upper limit of bottom damage shall not exceed 350 mm. Suction wells installed in accordance with this paragraph may be ignored in determining the compartments affected by damage.

**2.6-0.1** The area of a suction well is not to be greater than that required to accommodate equipment such as cargo pumps, suction pipes, valves, associated heating coils, etc., and to ensure efficient flow and the necessary access for cleaning and maintenance.

## 2.7 Flooding assumptions

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

**2.7.2** The permeabilities of spaces assumed to be damaged shall be as given in Table 2.2.

**Table 2.2. Permeability**

Space	Permeability
Appropriated to stores	0.60
Occupied by accommodation	0.95
Occupied by machinery	0.85
Voids	0.95
Intended for consumable liquids	0 to 0.95 <sup>1</sup>
Intended for other liquids	0 to 0.95 <sup>1</sup>
<sup>1</sup> The permeability of partially filled compartments shall be consistent with the amount of liquid carried in the compartment.	

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

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

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

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

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

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

**.1** they are separated from the damaged space by watertight divisions and the requirements of 2.9.3 in respect of these intact spaces are complied with; and

**.2** openings in such divisions are capable of being closed by remotely operated sliding watertight doors and unprotected openings are not immersed within the minimum range of residual stability required in 2.9; however, the immersion of any other openings capable of being closed weathertight may be permitted.

## 2.8 Standard of damage

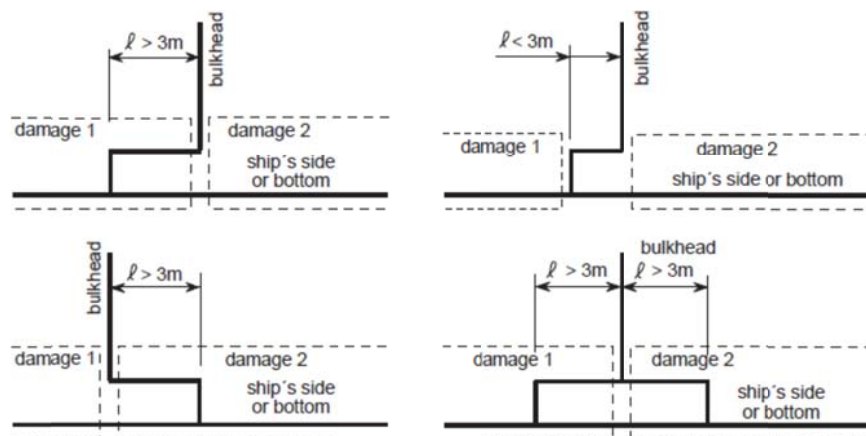
**2.8.1** Ships shall be capable of surviving the damage indicated in 2.5 with the flooding assumptions in 2.7 to the extent determined by the ship's type according to the following standards:

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

**2.8.2** In the case of small Type 2 and Type 3 ships which do not comply in all respects with the appropriate requirements of 2.8.1.3 and 2.8.1.6, special 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 shall be approved and clearly stated and be available to the Port Administration. Any such dispensation shall be duly noted on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

**2.8-0.1** The longitudinal extent of damage to a superstructure in the instance of side damage to a machinery space aft under paragraph 2.8.1 shall be the same as the longitudinal extent of the side damage to the machinery space (see Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Fig. 2.2).

**2.8-0.2** The concept of a stepped machinery space forward bulkhead is already implied in paragraph 3.2.1 of the Code, and in regulation II-2/56 of the **SOLAS**. For damage stability considerations when such a bulkhead contains a step more than 3 m in length, damage shall be treated as shown in Fig. 2.1.



**Fig. 2.1. Damage to stepped machinery space forward bulkhead (Damages are not simultaneous)**

## **2.9 Survival requirements**

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

**2.9.2** In any stage of flooding:

**.1** the waterline, taking into account sinkage, heel, and trim, shall be below the lower edge of any opening through which progressive flooding or down flooding may take place. Such openings shall include air pipes and openings which are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and watertight flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors, and side scuttles of the non opening type;

**.2** the maximum angle of heel due to unsymmetrical flooding shall not exceed 25°, except that this angle may be increased up to 30° if no deck immersion occurs;

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

**2.9.3** At final equilibrium after flooding:

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

**.2** the emergency source of power shall be capable of operating.

**2.9-0.1** The 20° range may be measured from any angle commencing between the position of equilibrium and the angle of 25° (or 30° if no deck immersion occurs) (see Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Fig. 2.3).

## Section 3

### Ship Arrangements

#### 3.1. Cargo Segregation

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

**3.1-0.1** In general oil fuel tanks are not considered as cofferdams. They shall be segregated from cargo tanks by cofferdams.

**3.1.2** Cargo piping shall not pass through any accommodation, service or machinery spaces other than cargo pump-rooms or pump-rooms.

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

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

**3.1-0.2** A cruciform joint may be accepted as a "double barrier" for the purpose of segregation as follows:

- .1** between mutually hazardous reactive cargoes;
- .2** between water reactive cargoes and water.

**Guidance:**

*The relevant compatibility regulations of certain Administrations, if any, may be required to be observed.*

**3.1.4** If cargo piping systems or cargo ventilation systems are to be separated, this separation may be achieved by the use of design or operational methods. Operational methods shall not be used within a cargo tank and shall consist of one of the following types:

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

**3.1.5** Cargoes subject to these Rules are not permitted to be carried in either the fore or aft peak tank.

### 3.2 Accommodation, service and machinery spaces and control stations

**3.2.1** No accommodation or service spaces or control stations shall be located within the cargo area except over a cargo pump-room recess or pump-room recess that complies with Part 1, Volume II, Rules for Hull, Section 24, A.4.3.2 and no cargo or slop tank shall be aft of the forward end of any accommodation.

**3.2.2** In order to guard against the danger of hazardous vapours, due consideration shall be given to the location of air intakes<sup>1</sup> and openings into accommodation, service and machinery spaces and control stations in relation to cargo piping and cargo vent systems.

**3.2-0.1** Compliance with other relevant paragraphs of this Rules and in particular with 3.2.3, 3.7, 8.2.2, 12.1.5 and 15.12 where applicable would also ensure compliance with this paragraph.

**3.2.3** Entrances, air inlets<sup>1</sup> and openings to accommodation, service and machinery spaces and control stations shall not face the cargo area. They shall be located on the end bulkhead not facing the cargo area and/or on the outboard side of the superstructure or deckhouse at a distance of at least  $L_c/25$  but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance, however, need not exceed 5 m. No doors shall be permitted within the limits mentioned above, except that doors to those spaces not having access to accommodation and service spaces and control stations, such as cargo control stations and store rooms, may be fitted. Where such doors are fitted, the boundaries of the space shall be insulated to "A-60" Standard. Bolted plates for removal of machinery may be fitted within the limits specified above. Wheel house doors and wheel house windows may be located within the limits specified above so long as they are so designed that a rapid and efficient gas- and vapour-tightening of the wheelhouse can be ensured. Windows and sidescuttles facing the cargo area and on the sides of the superstructures and deck-houses within the limits specified above shall be of the fixed (non-opening) type. Such sidescuttles in the first tier on the main deck shall be fitted with inside covers of steel or equivalent material.

**3.2-0.2** Air outlets are subject to the same requirements as air inlets and air intakes.

**3.2-0.3** Access facing the cargo area or in prohibited zones are to be restricted to stores for cargo related and safety equipment, cargo control stations as well as decontamination showers and eye wash.

**3.2-0.4** For all chemical tankers regardless of the cargo to be carried where a deckhouse is substituted for a superstructure and liquid could flow along the sides of the house, the house front is to be continued to the sides of the ship in the form of a sill or a separate spillage barrier is to be arranged as required and described in Part I, Volume II, Rules for Hull, Section 24, A.4.3.9.

**3.2-0.5** Access to forecastle spaces containing sources of ignition may be permitted through doors facing cargo area provided the doors are located outside hazardous areas as defined in IEC Publication 60092-502.

#### **Guidance :**

*Ships which are intended to carry "oil" are to comply with the relevant requirements of Part I, Volume II, Rules for Hull, Section 24, A.4.3. However, the requirements of A.4.3.3 concerning main cargo control stations need not be complied with.*

### 3.3 Cargo pump-rooms

**3.3.1** Cargo pump rooms shall be so arranged as to ensure:

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

<sup>1</sup> See 3.2-0.2

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

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

**3.3.4** Normal access ladders shall not be fitted vertical and shall incorporate platforms at suitable intervals (see Part 1, Volume II, Rules for Hull, Section 21, N.).

**3.3-0.1** In general a cargo pump-room shall be provided with one set of access/escape ladders. Where it is envisaged that personnel are normally employed in a pump-room or the pump-room is unusually large, BKI may require an additional means of escape. Two doorways from the pump-room house, emerging above the weather deck are preferable.

**3.3.5** Means shall 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 shall be operable from outside the cargo pump-room. One or more slop tanks for storage of contaminated bilge water or tank washings are to be provided. A shore connection with a standard coupling or other facilities shall be provided for transferring contaminated liquids to on-shore reception facilities.

**3.3-0.2** Any cargo tank may be used for holding contaminated cargo pump-room bilge water and cargo tank washings irrespective of the cargo tank location requirements of paragraph 2.6.

**3.3.6** Pump discharge pressure gauges shall 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 shall be fitted in way of the bulkhead or deck.

**3.3-0.3** Lubrication or other means of ensuring permanence of gastight seals are to be effected from outside the cargo pump-room.

#### **3.4 Access to spaces in the cargo area**

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

**3.4-0.1** To take care of restrictions in the movement of personnel and to limit the time needed for a possible emergency escape, two separate means of access are to be provided in double bottom tanks and similar spaces where obstructions impede movement. The two accesses are to be as widely separated as practicable.

The provision of only one access may be approved in special circumstances if the ability to readily transverse the space or to remove an injured person can be proved to the satisfaction of the Administration.

Although fuel oil tanks are not included in the definition of "cargo area" where such tanks are adjacent to cargo tanks the requirements of paragraph 3.4 are applicable.

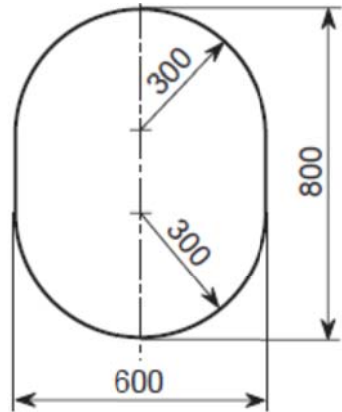
**3.4.2** For access through horizontal openings, hatches or manholes, the dimensions shall be sufficient to allow a person wearing a self-contained air breathing apparatus and protective equipment to ascend or descend any ladder without obstruction and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall be not less than 600 mm by 600 mm.

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

**3.4-0.2** For the purpose of subparagraph 3.4.2 and 3.4.3 the following applies:

**.1** The term "minimum clear opening of not less than  $600 \times 600$  mm" means that such openings may have corner radii up to 100 mm maximum.

**.2** The term "minimum clear opening of not less than  $600 \times 800$  mm" includes also an opening of the following size:

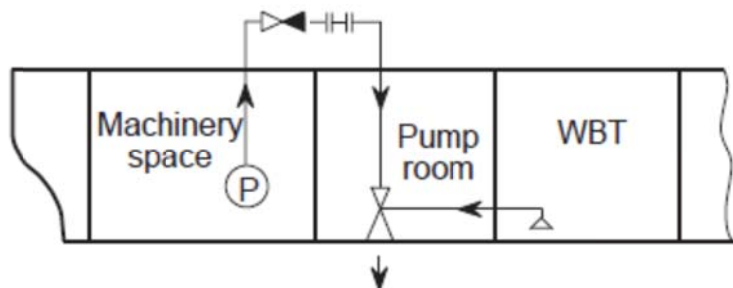


**3.4.4** Smaller dimensions may be approved by the Administration in special circumstances, if the ability to transverse such openings or to remove an injured person can be proved to the satisfaction of the Administration.

### 3.5 Bilge and ballast arrangements

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

**3.5-0.1** An eductor situated in the cargo area using water power from the machinery spaces is acceptable for discharge purposes provided a non-return valve and means of separation are fitted in the supply line and the supply line is above deck level. A non-return valve and means of separation are to be located outside the machinery space (see Fig. 3.1)



**Fig. 3.1 Discharge arrangement of permanent ballast tanks sited immediately adjacent of cargo tanks**

**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.

**3.5-0.2** The filling arrangement may consist of a portable spool piece or flexible hose plus an isolating valve on the inlet to the cargo tank. This isolating valve is in addition to the required non-return valve. Consideration shall be given to the arrangement of in tank piping and the creation of static electricity.

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

**3.5-0.3** The relaxation at the end of paragraph 3.5.3 is limited to spaces not enclosing piping which may contain cargo.

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

### **3.7 Bow or stern loading and unloading arrangements**

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

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

**3.7.3** In addition to 5.1, the following provisions apply:

**.1** The piping outside the cargo area shall be fitted at least 760 mm inboard on the open deck. Such piping shall be clearly identified and fitted with a shutoff valve at its connection to the cargo piping system within the cargo area. At this location, it shall also be capable of being separated by means of a removable spool-piece and blank flanges when not in use.

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

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

**.4** Spray shields shall be provided at the connections specified in 3.7.3.1 as well as collecting trays of sufficient capacity, with means for the disposal of drainage.

**.5** The piping shall be self-draining to the cargo area and preferably into a cargo tank. Alternative arrangements for draining the piping may be accepted by the Society.

**.6** Arrangements shall be made to allow such piping to be purged after use and maintained gas-safe when not in use. The vent pipes connected with the purge shall be located in the cargo area. The relevant connections to the piping shall be provided with a shutoff valve and blank flange.

**3.7.4** Entrances, air inlets<sup>2</sup> and openings to accommodation, service and machinery spaces and control stations shall not face the cargo shore connection location of bow or stern loading and unloading arrangements. They shall be located on the outboard side of the superstructure or deck-house at a distance of at least  $L/25$  but not less than 3 m from the end of the superstructure or deck-house facing the cargo shore-connection location of the bow or stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore connection location and on the sides of the superstructure or deck-house within the distance mentioned above shall be of the fixed (non-opening) type. In addition,

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<sup>2</sup> See also 3.2-0.2

during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deck house side shall be kept closed. Where, in the case of small ships, compliance with 3.2.3 and this paragraph is not possible, the Society may approve relaxations from the above requirements.

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

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

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

**3.7.0.1** The expression "suitable height" means the height of coaming to be of approximately 150 mm, however, nowhere less than 50 mm above upper edge of sheer strake.

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

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

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

## Section 4

### Cargo Containment

#### 4.1. Definitions

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

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

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

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

#### 4.2 Tank type requirements for individual products

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

##### 4.2-0.1 Scantlings and testing

##### 4.2-0.1.1 Ships with inserted and permanently fitted tanks with plane walls, not forming part of the ship's main structure

###### 4.2-0.1.1.1 General

For ships with inserted and permanently fitted tanks with plane walls not forming part of the ship's main structure, the requirements of Part 1, Volume II, Rules for Hull, Section 1 - 22, are applicable unless otherwise mentioned in the following.

For fastening of the tanks the requirements of Chapter 6 - Liquefied Gas Carriers are to be observed. Where the tanks are extending from board to board a longitudinal bulkhead is to be provided.

###### 4.2-0.1.1.2 Scantlings of the cargo tanks

The scantlings of tank structural elements shall be determined by the formulae shown in Part 1, Volume II, Rules for Hull, Section 12, B.

###### 4.2-0.1.2 Ships with tanks independent of the shell plating forming part of the ship's main structure

For ships with tanks independent of the shell plating, which form, however, part of the ship's main structure, the requirements of Part 1, Volume II, Rules for Hull, Section 24, are applicable.

**4.2-0.1.3 Thickness of solid stainless steel and clad steel plating and of lined plating**

**4.2-0.1.3.1** Where solid stainless steel plating or clad stainless steel plating is used the applicable corrosion addition is  $t_k = 0,5$  mm. If gross scantlings result from the formulae in Part I, Volume II, Rules for Hull, Section 12 and Section 24 the corrosion addition according to Part I, Volume II, Rules for Hull, Section 3, K is to be deducted. Afterwards  $t_k = 0,5$  mm is to be added.

Where plating lined with rubber or synthetic material is used, the thickness of plating and stiffeners determined in accordance with Part 1, Volume II, Rules for Hull, Section 12 or Section 24 may be reduced by the values in [mm] shown in table 4.1.

**4.2-0.1.3.2** The thickness of the cladding shall not be less than 1.5 mm for vertical walls and not less than 2.0 mm for tank bottoms.

**Table 4.1**

Arrangement of cargo or water ballast	Plating both sides lined	Plating one side lined
Cargo at both sides	0.5	-
Cargo at one side, other side dry	1.0	1.0
Cargo at one side, other side water ballast	1.0	0.5

**4.2-0.1.3.3** The suitability of stainless steel and rubber or synthetic material lining is to be proved unless already verified in service. See also Section 6.1 - 0.1.

**4.2-0.1.4 Testing**

**4.2-0.1.4.1** Gravity tanks shall be tested according to Part 1, Volume II, Rules for Hull, Section 24, A.15.

All cargo tank bulkheads shall be water tested from at least one side.

**4.2-0.1.4.2** For details of dimensioning and testing of pressure tanks Part 1, Volume III, Rules for Machinery Installation, Section 8, shall be observed.

## Section 5

### Cargo Transfer

#### 5.1. Piping Scantlings

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

$$t = \frac{t_0 + b + c}{1 - a/100} \quad [\text{mm}]$$

$t_0$  = theoretical thickness

$$= \frac{p \cdot D}{2 \cdot K \cdot e + p} \quad [\text{mm}]$$

p = design pressure [MPa] referred to in 5.1.2

D = outside diameter [mm]

K = allowable stress [N/mm<sup>2</sup>] referred to in 5.1.5

e = efficiency factor

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

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

$$= \frac{D \cdot t_0}{2.5 \cdot r} \quad [\text{mm}]$$

r = mean radius of the bend [mm]

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

a = negative manufacturing tolerance for thickness [%].

**5.1.2** The design pressure p in the formula for  $t_0$  in 5.1.1 is the maximum gauge pressure to which the system may be subjected in service, taking into account the highest set pressure on any relief valve on the system.

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

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

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

**5.1.5** For pipes, the allowable stress K to be considered in the formula for  $t_0$  in 5.1.1 is the lower of the following values:

$$\frac{R_m}{A} \quad \text{or} \quad \frac{R_{eH}}{B}$$

$R_m$  = specified minimum tensile strength at ambient temperature [N/mm<sup>2</sup>]

$R_{eH}$  = specified minimum yield stress at ambient temperature [N/mm<sup>2</sup>]

If the stress-strain curve does not show a defined yield stress, the 0.2 % proof stress applies.

A and B shall have values of at least

A = 2.7 and B = 1.8.

**5.1.6.1** The minimum wall thickness shall be in accordance with Part 1, Volume III, Rules for Machinery Installation, Section 11, C.1.

**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 super imposed loads from supports, ship deflection or other causes, the wall thickness shall be increased over that required by 5.1.1 or, if this is impracticable or would cause excessive local stresses, these loads shall be reduced, protected against or eliminated by other design methods.

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

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

## **5.2 Piping fabrication and joining details**

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

**5.2.2** Cargo piping shall be joined by welding except:

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

**5.2-0.1** Cargo piping shall be welded except for necessary flanged connections to valves, expansion joints (as permitted in 5.2.2.1), spool pieces and similar fittings or where required for coating, lining, fabrication, inspection or maintenance.

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

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

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

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

**5.2.5** Welding, post weld heat treatment and non destructive testing shall be performed in accordance with the Part 1, Volume VI, Rules for Welding.

**5.2-0.2** The materials used for pipelines, valves, fittings and pumps which come into contact with the cargo shall be selected in accordance with Part 1, Volume III, Rules for Machinery Installation, Section 11, B. and shall be tested in accordance with the Part 1, Volume V, Rules for Materials.

### **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 shall not be used in nominal size above 50 mm.

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

### **5.4 Test requirements for piping**

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

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

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

### **5.5 Piping arrangements**

**5.5.1** Cargo piping shall not be installed under deck between the 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-room side, provided an additional valve is fitted between the bulkhead valve and the cargo pump. A totally enclosed hydraulically operated valve located outside the cargo tank may, however, be accepted, provided that the valve is:

- .1** designed to preclude the risk of leakage ;(the intent is to guard against the hazard of cargo leaking past a valve gland into the space where the valve is located)
- .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;
- .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 is to be fitted in the line to each tank.

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

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

## **5.6 Cargo transfer control systems**

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

- .1** one stop valve capable of being manually operated on each tank filling and discharge line, located near the tank penetration; if an individual deep well pump is used to discharge the contents of a cargo tank, a stop valve is not required on the discharge line of that tank;

(the provisions of this paragraph are not intended to be additional to those of 5.5.2 and 5.5.3 for cargo piping below deck)

- .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 Section 17 other than in cargo pump-rooms which have been dealt with elsewhere in this Chapter shall not be located below the weather deck.

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

## 5.7 Ship's cargo hoses

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

**5.7-0.1** Paragraph 5.7.1 applies to cargo hoses carried on board the vessel and "compatibility with the cargo" means that:

**.1** the cargo hose does not lose its mechanical strength or deteriorate unduly when in contact with the cargo, and

**.2** the cargo hose material does not affect the cargo in a hazardous way.

Consideration shall be given to internal and external surfaces with respect to the above where hoses may be used as an integral part of, or connected to emergency cargo pumps and submerged in the cargo tank.

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

**5.7.3** For cargo hoses installed on board ships on or after 1 July 2002, each new type of cargo hose, complete with end-fittings, shall be prototype-tested at a normal ambient temperature with 200 pressure cycles from zero to at least twice the specified maximum working pressure. After this cycle pressure test has been carried out, the prototype test shall demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the extreme service temperature. Hoses used for prototype testing shall not be used for cargo service. Thereafter, before being placed in service, each new length of cargo hose produced shall be hydrostatically tested at ambient temperature to a pressure not less than 1.5 times its specified maximum working pressure but not more than two-fifths of its bursting pressure. The hose shall be stencilled or otherwise marked with the date of testing, its specified maximum working pressure and, if used in service other than ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure shall not be less than 1 MPa gauge.

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## Section 6

### Materials of Construction, Protective Linings and Coatings

**6.1** Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, shall be suitable at the temperature and pressure for the cargo to be carried and shall comply with the Part 1, Volume V, Rules for Materials. Steel is assumed to be the normal material of construction.

**6.2** The shipyard is responsible for providing compatibility information to the ship operator and/or master. This must be done in a timely manner before delivery of the ship or on completion of a relevant modification of the material of construction.

**6.3** Where applicable the following is to be taken into account in selecting the material of construction<sup>1</sup>

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

**6-0.1** Selection of materials, coating systems and linings coming into contact with cargo liquid or vapour is to be based on the list of cargoes to be carried and shall take into account the suitability and resistance data supplied and guaranteed by the material or coating manufacturers.

Where chlorides are included in the list of cargoes the molybdenum content of stainless steel is not to be less than 2.5 %.

Where seawater is intended to be carried in stainless steel tanks for an extended period the pitting resistance equivalent

$$W = \% \text{Cr} + 3.3 \% \text{Mo}$$

is not to be less than 30.

**6.4** The shipper of the cargo is responsible for providing compatibility information to the ship operator and/or master. This must be done in a timely manner before transportation of the product. The cargo shall be compatible with all materials of construction such that:

- .1** no damage to the integrity of the materials of construction is incurred; and/or
- .2** no hazardous, or potentially hazardous, reaction is created.

**6.5** When a product is submitted to IMO for evaluation, and where compatibility of the product with materials referred to in paragraph 6.1 renders special requirements, the BLG Product Data Reporting reflected in section 15 and consequentially be referred to in column “o” of Section 17. The reporting form shall also indicate if no special requirements are necessary. The producer of the product is responsible for providing the correct information.

<sup>1</sup> Regarding suitability of materials, see also Section 4-0.1.3.3.

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## Section 7

### Cargo Temperature Control

#### 7.1. General

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

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

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

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

**7.1.5** Means shall be provided for measuring the cargo temperature.

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

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

- .1** which is independent of other ship's services, except for another cargo heating or cooling system, and which does not enter the machinery space; or
- .2** which is external to the tank carrying toxic products; or
- .3** where the medium is sampled to check for the presence of cargo before it is recirculated to other services of the ship or into the machinery space. The sampling equipment shall be located within the cargo area and be capable of detecting the presence of any toxic cargo being heated or cooled. Where this method is used, the coil return shall be tested not only at the commencement of heating or cooling of a toxic product, but also on the first occasion the coil is used subsequent to having carried an unheated or uncooled toxic cargo.

#### 7.2 Additional requirements

For certain products additional requirements contained in Section 15 are shown in column "o" in the table of Section 17.

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## Section 8

### Cargo Tank Venting and Gas-freeing Arrangements

#### 8.1. General

The requirements of this Section apply in lieu of SOLAS Regulation II-2/4.5.3 and 4.5.6.

#### 8.2 Cargo tank venting

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

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

**8.2-0.1** When large amounts of drainage from vent lines is envisaged provision for a hose connection to a drain line draining to a suitable slop tank should be provided.

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

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

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

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

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

### **8.3 Types of tank venting systems<sup>1</sup>**

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

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

**8.3.3** On ships constructed on or after 1 July 2002, controlled tank venting systems shall consist of a primary and a secondary means of allowing full flow relief of vapour to prevent over-pressure or underpressure in the event of failure of one means. Alternatively, the secondary means may consist of pressure sensors fitted in each tank with a monitoring system in the ship's cargo control room or position from which cargo operations are normally carried out. Such monitoring equipment shall also provide an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a tank.

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

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

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

**8.3.6** Controlled tank venting systems fitted to tanks to be used for cargoes having a flashpoint not exceeding 60 °C (closed-cup test) shall be provided with devices to prevent the passage of flame into the cargo tanks. Arrangement and locating of the devices shall comply with the requirements of the Society<sup>3</sup>. Design and testing of the devices shall be certified by an institution recognized by the Administration.

<sup>1</sup> Attention is drawn to Part 1, Volume III, Rules for Machinery Installations, Section 15.

<sup>2</sup> See also 3.2-02.

<sup>3</sup> See Part 1, Volume III, Rules for Machinery Installations, Section 15.

The Standards for the Design, Testing and Locating of Devices to Prevent the Passage of Flame into Cargo Tanks in Tankers (IMO Document MSC/Circ. 677) are at least to be complied with.

Reference is made to the Revised Factors to be taken into Consideration when Designing Cargo Tanks Venting and Gas-Freeing Arrangements (IMO Document MSC/CIRC. 450/Rev.1).

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

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

#### **8.4 Venting requirements for individual products**

Venting requirements for individual products are shown in column "g" and additional requirements in column "o" in the table of Section 17.

#### **8.5 Cargo tank gas-freeing<sup>3</sup>**

**8.5.1** The arrangements for gas-freeing cargo tanks used for cargoes other than those for which open venting is permitted shall be such as to minimize the hazards due to the dispersal of flammable or toxic vapours in the atmosphere and to flammable or toxic vapour mixtures in a cargo tank. Accordingly, gas-freeing operations shall be carried out such that vapour is initially discharged:

- .1** through the vent outlets specified in 8.3.4 and 8.3.5; or
- .2** through outlets at least 2 m above the cargo tank deck level with a vertical exit velocity of at least 30 m/s maintained during the gas freeing operation; or
- .3** through outlets at least 2 m above the cargo tank deck level with a vertical exit velocity of at least 20 m/s which are protected by suitable devices to prevent the passage of flame. When the flammable vapour concentration at the outlets has been reduced to 30 % of the lower flammable limit and, in the case of a toxic product, the vapour concentration does not present a significant health hazard, gas-freeing may thereafter be continued at cargo tank deck level.

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

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

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

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## Section 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 especially 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 Section 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 dew point of -40 °C or below at atmospheric pressure, and maintaining that condition.
- .4 Ventilation** - forced or natural.

**9.1.3** Where inerting or padding of cargo tanks is required:

- .1** An adequate supply of inert gas for use in filling and discharging the cargo tanks shall be carried or shall be manufactured on board unless a shore supply is available. In addition, sufficient inert gas shall be available on the ship to compensate for normal losses during transportation.
- 2** The inert gas system on board the ship shall be able to maintain at least a pressure of 0.007MPa gauge within the containment system at all times. In addition, the inert gas system shall not raise the cargo tank pressure to more than the tank's relief-valve setting.
- .3** Where padding is used, similar arrangements for supply of the padding medium shall be made as required for inert gas in 9.1.3.1 and 9.1.3.2.
- .4** Means shall be provided for monitoring ullage spaces containing a gas blanket to ensure that the correct atmosphere is being maintained.
- .5** Inerting or padding arrangements or both, where used with flammable cargoes, shall be such as to minimize the creation of static electricity during the admission of the inerting medium.

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

**9.2** Environmental control requirements for individual products The required types of environmental control for certain products are shown in column "h" in the table of Section 17.

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## Section 10

### Electrical Installations

#### 10.1. General

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

**10.1-0.1** Regarding Part D, Chapter II-1 of SOLAS see Part 1, Volume IV, Rules for Electrical Installations

**10.1.2.1** Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products.<sup>1</sup>

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

**10.1.3** Unless otherwise required in this Section the provisions of Part 1, Volume IV, Rules for Electrical Installations are to be complied with.

**10.1.4** Electrical equipment, cables and wiring shall not be installed in hazardous locations unless it conforms with the standards not inferior to those acceptable to the Organization. However, for locations not covered by such standards, electrical equipment, cables and wiring which do not conform to the standards may be installed in hazardous locations based on a risk assessment to the satisfaction of the Society, to ensure that an equivalent level of safety is assured.<sup>1</sup>

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

**10.1.6** For guidance, indication is given if the flashpoint of a substance is in excess of 60 °C.

In the case of a heated cargo, carriage conditions might need to be established and the requirements for cargoes having a flashpoint not exceeding 60 °C applied.

#### 10.2 Bonding

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

#### 10.3 Electrical requirements for individual products

Electrical requirements for individual products are shown in column "i" in the table of Section 17.

#### 10.4 Electrical ventilator motors

Requirements for electrical motors for ventilation systems are also given in Section 12.1.8.

<sup>1</sup> Reference is made to the recommendations published by the International Electrotechnical Commission, in particular to Publication IEC 60092-502: 1999.

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## Section 11

### Fire Protection and Fire Extinction

*Refer to MSC-MEPC.2/Circ.4 on the Early Application of the amendments to the fire protection requirements of the revised IBC Code.*

#### 11.1. Application

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

- .1** Regulations 4.5.5, 10.8 and 10.9 shall not apply;
- .2** Regulation 4.5.1.2 (i.e. the requirements for location of the main cargo control station) need not apply;

**11.1-0.1** The requirements of Regulation 4.5.1.2 are given in Part 1, Volume II, Rules for Hull, Section 24, A.4.3.3.

- .3** Regulations 10.2, 10.4 and 10.5 shall apply as they would apply to cargo ships of 2,000 gross tonnage and over;

**11.1-0.2** The requirements of Regulations 10.2, 10.4 and 10.5 are given in Part 1, Volume III, Rules for Machinery Installations, Section 12.

- .4** Regulation 10.5.6 shall apply to ships of 2,000 gross tonnage and over;
- .5** the provisions of 11.3 shall apply in lieu of Regulation 10.8;
- .6** the provisions of 11.2 shall apply in lieu of Regulation 10.9;
- .7** Regulation 4.5.10 shall apply to ships of 500 gross tonnage and over, replacing “hydrocarbon gases” by “flammable vapours” in the Regulation; and
- .8** Regulations 13.3.4 and 13.4.3 shall apply to ships of 500 gross tonnage and over.

**11.1.2** Notwithstanding the provisions of 11.1.1, ships engaged solely in the carriage of products which are non-flammable (entry NF in column “i” of the table in Section 17) need not comply with requirements for tankers specified in SOLAS Chapter II-2, provided that they comply with the requirements for cargo ships of that Chapter, except that Regulation 10.7 need not apply to such ships and 11.2 and 11.3, hereunder, need not apply.

**11.1.3** For ships engaged solely in the carriage of products with a flashpoint of 60 °C and above (entry “Yes” in column “i” of the table in Section 17), the requirements of SOLAS Chapter II-2 may apply as specified in Regulation II-2/1.6.4 in lieu of the provisions of this Section.

**11.1.4** In lieu of the provisions of SOLAS Regulation II-2/1.6.7, the requirements of Regulations II-2/4.5.10.1.1 and II-2/4.5.10.1.4 shall apply and a system for continuous monitoring of the concentration of flammable vapours shall be fitted on ships of 500 gross tonnage and over which were constructed before 1 January 2009 by the date of the first scheduled dry-docking after 1 January 2009, but not later than 1 January 2012. Sampling points or detector heads should be located in suitable positions in order that

potentially dangerous leakages are readily detected. When the flammable vapour concentration reaches a pre-set level which shall not be higher than 10 % of the lower flammable limit, a continuous audible and visual alarm signal shall be automatically effected in the pump-room and cargo control room to alert personnel to the potential hazard. However, existing monitoring systems already fitted having a preset level not greater than 30 % of the lower flammable limit may be accepted. Notwithstanding the above provisions, the Administration may exempt ships not engaged on international voyages from those requirements.

**11.1-0.3** The requirements of Regulation II-2/1.6.4 of the 1974 SOLAS Convention are given in –Part I, Volume III, Rules for Machinery Installations, Section 12, K.

## **11.2 Cargo pump-rooms**

**11.2.1** The cargo pump-room of any ship shall be provided with a fixed carbon dioxide fire-extinguishing system as specified in SOLAS Regulation II-2/10.9.1.1. A notice shall be exhibited at the controls stating that the system is only to be used for fire-extinguishing and not for inerting purposes, due to the electrostatic ignition hazard. The alarms referred to in SOLAS Regulation II-2/10.9.1.1.1 shall be safe for use in a flammable cargo vapour/air mixture. For the purpose of this requirement, an extinguishing system shall be provided which would be suitable for machinery spaces. However, the amount of gas carried shall be sufficient to provide a quantity of free gas equal to 45 % of the gross volume of the cargo pump-room in all cases.

**11.2-0.1** The requirements of Regulation II-2/10.9.1.1 of the 1974 SOLAS Convention are given in –Part I, Volume III, Rules for Machinery Installations, Section 12, G. and 12. I.

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

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

## **11.3 Cargo area**

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

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

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

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

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

- .1** 2 ℓ/(m<sup>2</sup> • min) of the cargo tanks deck area, where “cargo tanks deck area” means the maximum breadth of the ship times the total longitudinal extent of the cargo tank spaces;
- .2** 20 ℓ/(m<sup>2</sup> • min) of the horizontal sectional area of the single tank having the largest such area;

- .3** 10  $\ell/(\text{m}^2 \cdot \text{min})$  of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1,250  $\ell/(\text{m}^2 \cdot \text{min})$ . For ships of less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the Society.

**11.3.6** Sufficient foam concentrate shall 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.

**11.3.7** Foam from the fixed foam system shall be supplied by means of monitors and foam applicators.

At least 50 % of the foam rate required in 11.3.5.1 or 11.3.5.2 shall be delivered from each monitor. The capacity of any monitor shall be at least 10  $\ell/\text{min}$  of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of that monitor. Such capacity shall be not less than 1,250  $\ell/\text{min}$ . For ships of less than 4,000 tonnes dead-weight, the minimum capacity of the monitor shall be to the satisfaction of the Society.

**11.3-0.1** For ships of less than 4,000 tonnes dead-weight mentioned in 11.3.5.3 and 11.3.7 the minimum capacity of a monitor should be 1,000  $\ell/\text{min}$  and the application rate should be at least 10  $\ell/(\text{m}^2 \cdot \text{min})$  of the surface to be protected.

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

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

**11.3.10** Applicators shall be provided for flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator shall be not less than 400  $\ell/\text{min}$  and the applicator throw in still air conditions shall be not less than 15 m. The number of foam applicators provided shall be not less than four. The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed to any part of the cargo tanks deck area.

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

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

**11.3-0.2** The simultaneous use of the minimum number of jets of water shall be possible on deck over the full length of the ship, in the accommodation, service spaces, control spaces and machinery spaces.

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

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

**11.3-0.3** The capacity of portable fire-extinguishing equipment should be as specified in the 1974 SOLAS Convention.

**11.3.15** Where flammable cargoes shall be carried, all sources of ignition shall be excluded from hazardous locations unless such sources conform to Section 10.2.

**11.3.16** Ships fitted with bow or stern loading and unloading arrangements shall be provided with one additional foam monitor meeting the requirements of 11.3.7 and one additional applicator meeting the requirements of 11.3.10. The additional monitor shall be located to protect the bow or stern loading and

unloading arrangements. The area of the cargo line forward or aft of the cargo area shall be protected by the above-mentioned applicator.

#### **11.4 Special requirements**

Fire-extinguishing media determined to be effective for each product are listed in column "I" in the table of Section 17.

**11.4-0.1** For dry powder systems see Part 1, Volume III, Rules for Machinery Installations, Section 12, M

## Section 12

### Mechanical Ventilation in the Cargo Area

*The requirements of this Section replace the requirements for ventilation of spaces within the cargo area as required in Part 1, Volume III, Rules for Machinery Installations, Section 15.*

*For ships to which these Rules apply, the requirements of this Section replace the requirements of SOLAS regulations II-2/4.5.2.6 and 4.5.4.*

*However, for products addressed under paragraphs 11.1.2 and 11.1.3, except acids and products for which paragraph 15.17 applies, SOLAS regulations II-2/4.5.2.6 and 4.5.4 may apply in lieu of the provisions of this Section.*

#### **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 shall be fitted with mechanical ventilation systems, capable of being controlled from outside such spaces.

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

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

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

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

**12.1-0.1** The height of ventilation outlets is not to be less than 3 m above the weather deck or 2 m above the fore and aft gangway if fitted within 3 m of the gangway. For certain products increased heights are prescribed in 15.17.

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

**12.1-0.2** The ventilation intakes are to be fitted in locations at least 3 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. The height of ventilation intakes is not to be less than 3 m above the weather deck.

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

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

- .1** impellers or housing of non-metallic construction, due regard being paid to be 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 shall not be used in these places.

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

**12.1.10** Protection screens of not more than 13 mm square mesh shall 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 shall be fitted with mechanical ventilation systems, capable of being controlled from outside such spaces and complying with the requirements of 12.1.3, except that the capacity shall not be less than 20 changes of air per hour based upon the total volume of the space. Provision shall be made to ventilate such spaces prior to personnel entering (see also 12.1.2).

**12.2-0.1**A pump-room is subject to this paragraph whether or not control for pumps and valves is fitted external to the pump-room.

**12.2-0.2**The provisions of 12.1.5, 12.1-0.1 and 12.1-0.2 apply except that the distance of the ventilation outlets specified in 12.1.5 may be reduced to not less than 3 m.

### **12.3 Spaces not normally entered**

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

## Section 13

### Instrumentation

#### 13.1. Gauging

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

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

**13.1.2** Gauging devices shall be independent of the equipment required under 15.19 (see also 15.19-0.1).

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

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

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

#### 13.2 Vapour detection

**13.2.1** Ships carrying toxic or flammable products or both shall be equipped with at least two instruments designed and calibrated for testing for the specific vapours in question. If such instruments are not capable of testing for both toxic concentrations and flammable concentrations, then two separate sets of instruments shall be provided.

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

**13.2.3** When toxic-vapour-detection equipment is not available for some products which require such detection, as indicated in column "k" in the table of Section 17, the ship may be exempted 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 necessity for additional breathing air supply shall be recognized and an entry shall be made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk drawing attention to the provisions of 14.2.4 if relevant and 16.4.2.2.

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

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## Section 14

### Personnel Protection

#### 14.1. Protective equipment

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

**14.1.2** Work clothes and protective equipment shall be kept in easily accessible places and in special lockers. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. The Administration may, however, approve storage-rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passage ways, dining rooms, bathrooms, etc.

**14.1-0.1** Lockers for work clothes and protective equipment which are not new or have not undergone a thorough cleaning process are not permitted to open directly into accommodation spaces.

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

#### 14.2. Safety equipment

**14.2.1** Ships carrying cargoes for which 15.12, 15.12.1 or 15.12.3 is listed in column "o" in the table of Section 17 shall have on board sufficient but not less than three complete sets of safety equipment, each permitting personnel to enter a gas-filled compartment and perform work there for at least 20 min. Such equipment shall be in addition to that required by SOLAS Regulation II-2/10.10.

**14.2.2** One complete set of safety equipment shall consist of:

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

**14.2.3** For the safety equipment required in 14.2.1, all ships shall carry either:

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

**14.2.4** A cargo pump-room on ships carrying cargoes which are subject to the requirements of 15.18 or cargoes for which in column "k" in the table of Section 17 toxic vapour-detection-equipment is required but is not available shall have either:

- .1** a low-pressure line system with hose connections suitable for use with the breathing apparatus required by 14.2.1. This system shall provide sufficient high-pressure air capacity to supply, through pressure-reduction devices, enough low-pressure air to enable two men to work in a gas-dangerous space for at least 1 h without using the air bottles of the breathing apparatus. Means shall be provided for recharging the fixed air bottles and the breathing apparatus air bottles from a special air compressor suitable for the supply of high-pressure air of the required purity; or
- .2** an equivalent quantity of spare bottled air in lieu of the low-pressure air line.

**14.2-0.1** The equivalent quantity of spare bottled air in lieu of the low-pressure air line shall be at least 4,800 ℓ.

**14.2.5** At least one set of safety equipment as required by 14.2.2 shall be kept in a suitable clearly

marked locker in a readily accessible place near the cargo pump-room. The other sets of safety equipment shall also be kept in suitable, clearly marked, easily accessible places.

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

### **14.3 Emergency equipment**

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

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

**14.3.2** The ship shall have on board medical first-aid equipment, including oxygen resuscitation equipment and antidotes for cargoes to be carried, based on the guidelines developed by the Organization<sup>1</sup>.

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

**14.3.4** Suitably marked decontamination showers and an eyewash should be available on deck in convenient locations. The showers and eyewash shall be operable in all ambient conditions (i.e. also below 0 °C).

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<sup>1</sup> Reference is made to the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), which provides advice on the treatment of casualties in accordance with the symptoms exhibited as well as equipment and antidotes that may be appropriate for treating the casualty.

## Section 15

### Special Requirements

#### 15.1. General

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

#### 15.2 Ammonium nitrate solution (93 % or less)

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

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

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

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

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

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

**15.2-0.1** For the purpose of injecting ammonia the cargo may be circulated by means of the cargo pump. Gaseous ammonia may be injected into the circulating cargo.

**15.2.7** Cargo pumps shall be of the centrifugal deep well type or of the centrifugal type with water flushed seals.

**15.2-0.2** The seal for the centrifugal pump shall be a stuffing box provided with a lantern ring. Fresh water under pressure shall be injected into the stuffing box at the location of the lantern ring.

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

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

### **15.3 Carbon disulphide**

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

#### **Carriage under water pad**

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

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

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

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

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

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

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

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

**15.3.9** Safety relief valves shall be of stainless steel construction.

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

#### **Carriage under suitable inert gas pad**

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

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

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

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

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

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

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

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

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

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

**15.3.21** A water spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling and the tank domes. The arrangement of piping and nozzles shall be such as to give an uniform distribution rate of 10 ℓ/m<sup>2</sup> /min. Remote manual operation shall be arranged such that remote starting of pumps supplying the water-spray system and remote operation of any normally closed valves in the system can be carried out from a suitable location outside the cargo area adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected. The water-spray system shall be capable of both local and remote manual operation, and the arrangement shall ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle when atmospheric temperature permits shall be connected ready for immediate use during loading and unloading operations.

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

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

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

$V$  = volume of the tank

$\rho_R$  = density of cargo at the reference temperature (R)

$\rho_L$  = density of cargo at the loading temperature

$R$  = reference temperature, i.e. the temperature at which the vapour pressure of the cargo corresponds to the set pressure of the pressure relief valve

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

**15.3.25** Electrical equipment in zones on open deck, or in semi-enclosed spaces on open deck within three metres of a tank outlet, gas or vapour outlet, cargo pipe flange or cargo valve of a tank certified to carry

carbon disulphide, shall comply with the requirements specified in column "i", Section 17. Also, within the specified zone, no other heat sources, like steam piping with surface temperatures in excess of 80 °C shall be allowed.

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

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

## **15.4 Diethyl ether**

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

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

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

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

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

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

## **15.5 Hydrogen peroxide solutions**

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

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

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

**15.5.1.3** Pump-rooms shall not be used for cargo transfer operations.

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

**15.5.1.5** Tanks intended for the carriage of hydrogen peroxide solution shall not be used for sea water ballast.

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

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

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

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

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

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

**15.5-0.1** Piping/hose failure shall be assumed to be total.

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

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

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

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

**15.5.2.2** Hydrogen peroxide shall be carried in tanks thoroughly and effectively cleaned of all traces of previous cargoes and their vapours or ballast. Procedures for inspection, cleaning, passivation and loading of tanks shall be in accordance with procedures specified in 15.5.3. A certificate shall be on board the vessel indicating that the procedures have been followed. The passivation requirement may be waived by an Administration for domestic shipments of short duration. Particular care in this respect is essential to ensure the safe carriage of hydrogen peroxide:

- .1** When hydrogen peroxide is carried, no other cargoes shall be carried simultaneously.
- .2** Tanks which have contained hydrogen peroxide may be used for other cargoes after cleaning in accordance with the procedures specified in 15.5.3.16.
- .3** Consideration in design shall provide minimum internal tank structure, free draining, no entrapment and ease of visual inspection.

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

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

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

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

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

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

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

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

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

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

**15.5.2.12** During transfer of hydrogen peroxide, the related piping system shall be separate from all other systems. Cargo hoses used for transfer of hydrogen peroxide solutions shall be marked

“FOR HYDROGEN PEROXIDE SOLUTION TRANSFER ONLY ”.

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

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

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

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

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

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

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

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

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

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

- .1** New welds and other repaired parts shall be cleaned and finished using stainless steel wire brush, chisel, sandpaper or buff. Rough surfaces are to be given a smooth finish. A final polishing is necessary.
- .2** Fatty and oily residues shall be removed by the use of appropriate organic solvents or detergent solutions in water. The use of chlorine containing compounds shall be avoided as they can seriously interfere with passivation.
- .3** The residues of the degreasing agent shall be removed, followed by a washing with water.

- .4 In the next step, scale and rust shall be removed by the application of acid (e.g. a mixture of nitric and hydrofluoric acids), followed again by a washing with clean water.
- .5 All the metal surfaces which can come into contact with hydrogen peroxide shall be passivated by the application of nitric acid of a concentration between 10 and 35 % by mass. The nitric acid must be free from heavy metals, other oxidizing agents or hydrogen fluoride. The passivation process shall continue for 8 to 24 h, depending upon the concentration of acid, the ambient temperature and other factors. During this time a continuous contact between the surfaces to be passivated and the nitric acid shall be ensured. In the case of large surfaces this may be achieved by recirculating the acid. Hydrogen gas may be evolved in the passivation process, leading to the presence of an explosive atmosphere in the tanks. Therefore, appropriate measures must be taken to avoid the build-up or the ignition of such an atmosphere.
- .6 After passivation, the surfaces shall be thoroughly washed with clean filtered water. The washing process shall be repeated until the effluent water has the same pH-value as the incoming water.
- .7 Surfaces treated according to the above steps may cause some decomposition when coming into contact with hydrogen peroxide for the first time. This decomposition will cease after a short time (usually within two or three days). Therefore an additional flushing with hydrogen peroxide for a period of at least two days is recommended.
- .8 Only degreasing agents and acid cleaning agents which have been recommended for this purpose by the manufacturer of the hydrogen peroxide solutions shall be used in the process.

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

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

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

**15.5.3.12** The hydrogen peroxide solution shall be loaded under intermittent visual supervision of the interior of the tank from an appropriate opening.

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

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

**15.5.3.15** Actions described in 15.5.3.2 to 15.5.3.8 shall be carried out under the supervision of the master or shipper. Actions described in 15.5.3.9 to 15.5.3.14 shall be carried out under the onsite supervision and responsibility of a representative of the hydrogen peroxide solution manufacturer or under supervision and responsibility of another person familiar with the safety-relevant properties of hydrogen peroxide.

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

- .1** Hydrogen peroxide solution cargo residues shall be drained as completely as possible from tanks and equipment.
- .2** Tanks and equipment shall be rinsed with clean water, and subsequently thoroughly washed with clean water.
- .3** The interior of the tank shall be dried and inspected for any residues. Steps .1 to .3, in 15.5.3.16, shall be carried out under the supervision of the master or the shipper. Step .3, in 15.5.3.16, shall be carried out by a person familiar with the safety-relevant properties of the chemical to be transported and of hydrogen peroxide.

Special Cautions:

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

## **15.6 Motor fuel anti-knock compound (containing lead alkyls)**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**15.8.9** Gaskets shall be constructed of materials which do not react with, dissolve in, or lower the auto ignition temperature of these products and which are fire-resistant and possess adequate mechanical behaviour. The surface presented to the cargo shall be polytetrafluoroethylene (PTFE), or materials giving a similar degree of safety by their inertness. Spirally wound stainless steel, with a filler of PTFE or similar fluorinated polymer, may be accepted.

**15.8-0.1** Gaskets of other types and/or other materials shall be type approved by BKI.

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

**15.8.11** The following materials are generally found unsatisfactory for gaskets, packing and similar uses in containment systems for these products and would require testing before being approved by the Society:

- .1 neoprene or natural rubber, if it comes into contact with the products;
- .2 asbestos, or binders used with asbestos;
- .3 materials containing oxides of magnesium, such as mineral wools.

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

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

**15.8.14.1** The containment system for a tank containing these products shall have a valve vapour return connection.

**15.8.14.2** The products shall be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a containment system for the product shall be independent of all other containment systems.

**15.8.14.3** During discharge operations, the pressure in the cargo tank must be maintained above 0.007 MPa gauge.

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

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

**15.8.17** Cargo hoses used for transfer of these products shall be marked

"FOR ALKYLENE OXIDE TRANSFER ONLY".

**15.8.18** Cargo tanks, void spaces and other enclosed spaces adjacent to an integral gravity cargo tank carrying propylene oxide shall either contain a compatible cargo (those cargoes specified in 15.8.2 are examples of substances considered incompatible) or be inerted by injection of a suitable inert gas. Any hold space in which an independent cargo tank is located shall be inerted. Such inerted spaces and tanks shall be monitored for these products and oxygen. The oxygen content of these spaces shall be maintained below 2 %. Portable sampling equipment is satisfactory.

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

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

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

**15.8.22.1** Tanks for the carriage of propylene oxide with a design pressure less than 0.06 MPa gauge and tanks for the carriage of ethylene oxide/propylene oxide mixtures with a design pressure of less than 0.12 MPa gauge shall have a cooling system to maintain the cargo below the reference temperature. Reference temperature means for the purpose of these products the temperature corresponding to the vapour pressure of these products at the set pressure of the pressure relief valve.

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

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

**15.8.23.2** An alternative arrangement may consist of three cooling plants, any two of which shall be sufficient to maintain the liquid temperatures below the reference temperature<sup>1</sup>.

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

**15.8.23.4** Cooling systems requiring compression of the products shall not be used. **15.8.24** Pressure-relief-valve settings shall not be less than 0.02 MPa gauge and for pressure tanks not greater than 0.7 MPa gauge for the carriage of propylene oxide and not greater than 0.53 MPa gauge for carriage of propylene oxide/ethylene oxide mixtures.

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

**15.8.25.2** These products may be transported only in accordance with cargo-handling plans that have been approved by the Society. Each intended loading arrangement shall be shown on a separate cargo handling plan. Cargo-handling plans shall show the entire cargo piping system and the locations for installation of blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan shall be maintained on board the ship. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be endorsed to include reference to the approved cargo handling plans.

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

#### **Guidance :**

*The "responsible person" may be e.g. the ship's master or the local Society's Surveyor.*

**15.8.26.1** No cargo tanks shall be more than 98 % liquid full at the reference temperature<sup>1</sup>.

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

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

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

$V$  = volume of the tank

$\rho_R$  = density of cargo at the reference temperature (R)

$\rho_L$  = density of cargo at the loading temperature

<sup>1</sup> See 15.8.21.1

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

**15.8.27** The cargo shall be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system shall be installed to prevent the tank pressure falling below 0.007 MPa gauge in the event of product temperature fall due to ambient conditions or maloperation of refrigeration systems. Sufficient nitrogen shall be available on board to satisfy the demand of the automatic pressure control. Nitrogen of commercially pure quality (99.9 % by volume) shall be used for padding. A battery of nitrogen bottles connected to the cargo tanks through a pressure-reduction valve satisfies the intention of the expression "automatic" in this context.

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

**15.8.29** A water-spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling, and the tank domes. The arrangement of piping and nozzles shall be such as to give a uniform distribution rate of 10 l/(m<sup>2</sup> · min). Remote manual operation shall be arranged such that remote starting of pumps supplying the water-spray system and remote operation of any normally closed valves in the system can be carried out from a suitable location outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected. The water spray system shall be capable of both local and remote manual operation, and the arrangement shall ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle, when atmospheric temperatures permit, shall be connected ready for immediate use during loading and unloading operations.

**Guidance :**

*For ships trading to the territorial waters of the United States of America the relevant requirements of the U.S. Coast Guard shall be complied with, i.e. the water spray system required by 15.8.29 shall operate automatically in case of a fire.*

**15.8.30** A remotely operated, controlled closing rate, shut-off valve shall be provided at each cargo hose connection used during cargo transfer. 15.9 Sodium chlorate solution (50 % or less by mass)

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

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

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

**15.10 Sulphur (molten)**

**15.10.1** Cargo tank ventilation shall be provided to maintain the concentration of hydrogen sulphide below one half of its lower explosive limit 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 shall be provided to give warning if the system fails.

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

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

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

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

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

## **15.11 Acids**

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

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

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

**15.11.4** Flanges of the loading and discharge manifold connections shall be provided with shields, which may be portable, to guard against the danger of the cargo being sprayed; and, in addition, drip trays shall also be provided to guard against leakage onto the deck.

**15.11.5** Because of the danger of evolution of hydrogen, when these substances are being carried, the electrical arrangements shall comply with 10.1.4. The certified safe type equipment shall be suitable for use in hydrogen/air mixtures. Other sources of ignition shall not be permitted in such spaces.

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

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

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

## **15.12 Toxic products**

**15.12.1** Exhaust openings of tank vent systems shall be located:

- .1** at a height of B/3 or 6 m, whichever is greater, above the weather deck or, in the case of a deck tank, the access gangway;
- .2** not less than 6 m above the fore-and-aft gangway, if fitted within 6 m of the gangway;
- .3** 15 m from any opening or air intake<sup>2</sup> 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 an approved type are fitted, directing the vapour/air mixture upwards in an unimpeded jet with an exit velocity of at least 30 m/s.

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<sup>2</sup> See also 3.2-0.2

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

**15.12.3** Products shall:

- .1** not be stowed adjacent to oil fuel tanks;
- .2** have separate piping systems; and
- .3** have tank vent systems separate from tanks containing non-toxic products. (See also Section 3.7.2).

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

### **15.13 Cargoes protected by additives**

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

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

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

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

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

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

\* For equivalency arrangements for the carriage of styrene monomer, see MSC/Circ.879 as amended by MSC/Circ.879/Corr.1.

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

**15.13-0.1** Internal obstructions shall be avoided beyond the requirement for pressure vacuum valves and flame screens which shall be accessible for inspection and maintenance.

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

#### **15.14 Cargo with a vapour pressure greater than 0.1013 MPa absolute at 37.8 °C**

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

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

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

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

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

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

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

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

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

$V$  = volume of the tank

$\rho_R$  = density of cargo at the reference temperature (R)

$\rho_L$  = density of cargo at the loading temperature

$R$  = reference temperature, i.e. the temperature at which the vapour pressure of the cargo corresponds to the set pressure of the pressure relief valve

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

**15.15 [Deleted]****15.16 Cargo contamination****15.16.1 [Deleted]**

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

- .1** Air inlets to pressure/vacuum relief valves of tanks containing the cargo shall be situated at least 2 m above the weather deck.
- .2** Water or steam shall not be used as the heat transfer media in a cargo temperature control system required by Section 7.
- .3** The cargo shall not be carried in cargo tanks adjacent to permanent ballast or water tanks unless the tanks are empty and dry.
- .4** The cargo shall not be carried in tanks adjacent to slop tanks or cargo tanks containing ballast or slops or other cargoes containing water which may react in a dangerous manner. Pumps, pipes or vent lines serving such tanks shall be separate from similar equipment serving tanks containing the cargo. Pipelines from slop tanks or ballast lines shall not pass through tanks containing the cargo unless encased in a tunnel.

**15.17 Increased ventilation requirements**

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

**15.17-0.1** The height of the ventilation outlets shall not be less than 4 m above the tank deck or 2 m above the fore-and-aft gangway if fitted within 4 m of the gangway.

**15.18 Special cargo pump-room requirements**

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

**15.18-0.1** No circumstances can be foreseen where an Administration might allow any relaxation.

**15.19 Overflow control**

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

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

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

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

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

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

**15.19.7** A tank overflow-control system required by this Sub-Section shall:

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

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

$$L_R = \frac{3600 \cdot U}{t} \quad [\text{m}^3/\text{h}]$$

U = ullage volume [m<sup>3</sup>] at operating signal level;

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

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

**15.19-0.1** Independency of systems in almost all cases a cargo which requires a high level alarm and overflow-control also requires a closed gauging device. A cargo tank containing such a product therefore requires three sensors:

- .1** level gauging
- .2** high-level alarm
- .3** overflow-control

The sensing elements for .1, .2 and .3 shall be separated although sensors for .2 and .3 (reed switches, float chambers, electronic devices, etc.) may be contained in the same tube.

Electronic, pneumatic, hydraulic circuits required for sensors .1, .2 and .3 shall be independent of each other such that a fault on any one will not render either of the others inoperative.

Where processing units are used to give digital or visual indication such as in a bridge space, the independency of circuitry is to be maintained at least beyond this point. The power shall be supplied from distribution boards.

Where a control room or a bridge space containing a modular unit is envisaged, separate level indication and visual alarms shall be provided for each of the functions .1, .2 or .3. An audible alarm shall also be provided but since this is not directional it need not be separate. An audible alarm shall also be arranged in the cargo area. Where there is no control room an audible and visual alarm is to be arranged at the cargo control station.

Testing of sensors shall be arranged from outside the tanks although entry into product clean tanks is not precluded.

Simulation testing of electronic circuits or circuits which are self-monitoring is acceptable.

#### **15.20 Alkyl (C7 – C9) nitrates, all isomers**

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

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

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

**15.21 Temperature sensors** Temperature sensors shall be used to monitor the cargo pump temperature to detect overheating due to pump failures.

**15.21-0.1** The temperature sensors shall be used on any type of cargo pump, i.e. where cargo pumps are installed in conventional type pump rooms as well as on deep well pumps.

## Section 16

### Operational Requirements

#### 16.1. Maximum allowable quantity of cargo pertank

**16.1.1** The quantity of a cargo required to be carried in a Type 1 ship shall not exceed 1,250 m<sup>3</sup> in any one tank.

**16.1.2** The quantity of a cargo required to be carried in a Type 2 ship shall not exceed 3,000 m<sup>3</sup> in any one tank.

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

#### 16.2 Cargo information

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

**16.2.2** Any cargo offered for bulk shipment should be indicated in the shipping documents by the product name under which it is listed in Section 17 or 18 of these Rules or the latest edition of MEPC.2/Circ. or under which it has been provisionally assessed. Where the cargo is a mixture, an analysis indicating the dangerous components contributing significantly to the total hazard of the product shall be provided, or a complete analysis if this is available. Such an analysis shall be certified by the manufacturer or by an independent expert acceptable to the Administration.

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

- .1** a full description of the physical and chemical properties, including reactivity, necessary for the safe containment of the cargo;
- .2** action to be taken in the event of spills or leaks;
- .3** countermeasures against accidental personal contact;
- .4** fire-fighting procedures and fire-fighting media; and
- .5** procedures for cargo transfer, tank cleaning, gas-freeing and ballasting;

**16.2.3.2** For those cargoes required to be stabilized or inhibited, the cargo shall be refused if the appropriate certificate required by 15.13.3 is not supplied.

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

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

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

**16.2.7** [Deleted]

**16.2.8** [Deleted]

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

### **16.3 Personnel training**

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

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

**16.3.3** Officers shall be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo and a sufficient number of them shall be instructed and trained in essential first aid for cargoes carried, based on the guidelines developed by the Organization<sup>1</sup>.

### **16.4 Opening of and entry into cargo tanks**

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

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

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

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

### **16.5 Stowage of cargo samples**

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

**16.5.2** The stowage space shall be:

- .1** cell-divided in order to avoid shifting of the bottles at sea;

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<sup>1</sup> Refer to the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG), which provides advice on the treatment of casualties in accordance with the symptoms exhibited as well as equipment and antidotes that may be appropriate for treating the casualty, and to the relevant provisions of the STCW Code, parts A and B.

- .2 made of material fully resistant to the different liquids intended to be stowed; and
- .3 equipped with adequate ventilation arrangements.

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

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

## **16.6 Cargoes not to be exposed to excessive heat**

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

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

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

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

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## Section 17

### Summary of Minimum Requirements

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

#### Explanatory Notes

<b>Product name</b> (column a)	The product name shall be used in the shipping document for any cargo offered for bulk shipments. Any additional name may be included in brackets after the product name. In some cases, the product names are not identical with the names given in previous issues of the Code, see also chapter 19 of MEPC 225 (64) as reference.		
<b>UN number</b> (column b)	Deleted		
<b>Pollution category</b> (column c)	The letter X, Y, Z means the Pollution Category assigned to each product under MARPOL Annex II.		
<b>Hazards</b> (column d)	"S"	means that the product is included because of its safety hazards;	
	"P"	means that the product is included because of its pollution hazards; and	
	"S/P"	means that the product is included because of both its safety and pollution hazards.	
<b>Ship type</b> (column e)	1	=	Ship type 1 (2.1.2.1)
	2	=	Ship type 2 (2.1.2.2)
	3	=	Ship type 3 (2.1.2.3)
<b>Tank type</b> (column f)	1	=	independent tank (4.1.1)
	2	=	integral tank (4.1.2)
	G	=	gravity tank (4.1.3)
	P	=	pressure tank (4.1.4)
<b>Tank vents</b> (column g)	<u>Open</u>	=	open venting
	<u>Cont</u>	=	controlled venting
<b>Tank environmental control</b> (column h)	Inert	=	inerting (9.1.2.1)
	Pad	=	liquid or gas padding (9.1.2.2)
	Dry	=	drying (9.1.2.3)
	Vent	=	natural or forced ventilation (9.1.2.4)
	No	=	no special requirements under this Rules

<b>Electrical equipment</b> (column i)	Temperature classes	(i')	T1 to T6	-	indicates no requirements	
				blank	no information	
	Apparatus Group	(i'')	II A, IIB or IIC	-	indicates no requirements	
				blank	no information	
	Flashpoint	(i''')	NF:	non-flammable product	(10.1.6)	
		No:	flashpoint not exceeding 60 °C	(10.1.6)		
		Yes:	flashpoint exceeding 60 °C	(10.1.6)		
<b>Gauging</b> (column j)	O	=	open gauging	(13.1.1.1)		
	R	=	restricted gauging	(13.1.1.2)		
	C	=	closed gauging	(13.1.1.3)		
<b>Vapour detection</b> (column k)	F	=	flammable vapours			
	T	=	toxic vapours			
	No	=	indicates no special requirements under this Section			
<b>Fire Protection</b> (column l)	A	=	alcohol-resistant foam or multi-purpose foam			
	B	=	regular foam, encompasses all foams that are not of an alcohol-resistant type, including fluoroprotein and aqueous-film-forming foam (AFFF)			
	C	=	water-spray			
	D	=	dry chemical			
	No	=	no special requirements under this Section			
	Dry chemical powder systems, when used, may require an additional water system for boundary cooling. This is normally provided in sufficient quantities by the standard fire main system required by SOLAS II-2/4 as amended.					
<b>Materials of construction</b> (column m)	Deleted					
<b>Emergency equipment</b> (column n)	Yes	=	see 14.3.1			
	No	=	no special requirements under this Rules			
<b>Specific and operational requirements</b> (column o)	When specific reference is made to subsections 15 and/or 16, these requirements shall be additional to the requirements in any other column.					

**Note: The following pages are numbered according to the database generation.**

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Acetic acid	Z	S/P	3	2G	Cont	No	T1	IIA	No	R	F	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.9	1050	40	485	118
Acetic anhydride	Z	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6	1080	49	330	140
Acetochlor	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1117	>100	-	162
Acetone cyanohydrin	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A	Yes	15.12, 15.13, 15.17, 15.18, 15.19, 16.6.1, 16.6.2, 16.6.3	930	75	688	82
Acetonitrile	Z	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	No	15.12, 15.19.6	780	2	525	82
Acetonitrile (low purity grade)	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	F-T	A, C	No	15.12.3, 15.12.4, 15.19.6	<u>780</u>	<u>2</u>	<u>525</u>	<u>82</u>
Acid oil mixture from soyabean, corn (maize) and sunflower oil refining	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Acrylamide solution (50% or less)	Y	S/P	2	2G	Open	No			NF	C	No	No	No	15.12.3, 15.13, 15.19.6, 16.2.9, 16.6.1	1050	-	-	102
Acrylic acid	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12.3, 15.12.4, 15.13, 15.17,	1050	54	374	140
Acrylonitrile	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	F-T	A	Yes	15.12, 15.13, 15.17, 15.19	800	-5	480	77
Acrylonitrile-Styrene copolymer dispersion in polyether polyol	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	900			
Adiponitrile	Z	S/P	3	2G	Cont	No		IIB	Yes	R	T	A	No	16.2.9	960	93		295
Alachlor technical (90% or more)	X	S/P	2	2G	Open	No			Yes	O	No	A, C	No	15.19.6, 16.2.9	1120			
Alcohol (C9-C11) poly(2.5-9)ethoxylate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9				
Alcohol (C6-C17) (secondary) poly(3-6)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1000			
Alcohol (C6-C17) (secondary) poly(7-12)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1000			

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Alcohol (C12-C16) poly(1-6)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	900			
Alcohol (C12-C16) poly(20+)ethoxylates	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	930			
Alcohol (C12-C16) poly(7-19)ethoxylates	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9				
Alcohols (C13+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	790	>80		
<u>Alcohols (C12+), primary, linear</u>	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Alcohols (C8-C11), primary, linear and essentially linear	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9				
Alcohols (C12-C13), primary, linear and essentially linear	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Alcohols (C14-C18), primary, linear and essentially linear	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6				
Alkanes (C6-C9)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	600-700	<60		
Iso- and cyclo-Alkanes (C10-C11)	Y	P	3	2G	Cont	No	-	-	No	R	F	A	No	15.19.6				
Iso- and cyclo-Alkanes (C12+)	Y	P	3	2G	Cont	No	-	-	No	R	F	A	No					
<u>Alkanes (C10-C26), linear, and branched, (flash point &gt;60 degC)</u>	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.9.6				
n-Alkanes (C10+)	Y	P	3	2G	Cont	No	-	-	No	R	F	A	No	15.19.6				
Alkaryl polyethers (C9-C20)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	<1000	>60		
<u>Alkenoic acid, polyhydroxy ester borated</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.6				
Alkenyl (C11+) amide	X	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	<u>900</u>			
Alkenyl (C16-C20) succinic anhydride	Z	S/P	3	2G	Cont	No			Yes	C	T	No	Yes	15.12, 15.17, 15.19				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Alkyl acrylate-Vinylpyridine copolymer in toluene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	890	<20		110
Alkylaryl phosphate mixtures (more than 40% Diphenyl tolyl phosphate, less than 0.02% ortho-isomers)	X	S/P	1	2G	Cont	No	T1	IIA	Yes	C	T	A, B, C	No	15.12, 15.17, 15.19				
Alkylated (C4-C9) hindered phenols	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	B, D	No	15.19.6, 16.2.6, 16.2.9	<u>998</u>	<u>&gt;60</u>		
Alkylbenzene, alkylindane, alkylindene mixture (each C12-C17)	Z	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	860	185		284
Alkyl benzene distillation bottoms	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6				
Alkylbenzene mixtures (containing at least 50% of toluene)	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	F-T	A, B, C	No	15.12, 15.17, 15.19.6	964	135	400	-
Alkyl (C3-C4) benzenes	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	<u>870</u>	<u>&lt;60</u>		
Alkyl (C5-C8) benzenes	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	<u>900</u>	<u>&gt;60</u>		
Alkyl(C9+)benzenes	Y	P	3	2G	Open	No	-	-	Yes	O	No	A, B	No		<u>880</u>	<u>100-170</u>		
Alkyl (C11-C17) benzene sulphonic acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6				
Alkylbenzene sulphonic acid, sodium salt solution	Y	S/P	2	2G	Open	No	-	-	NF	O	No	No	No	15.19.6, 16.2.6, 16.2.9	1000			
Alkyl (C12+) dimethylamine	X	P	1	2G	Open	No	-	-	Yes	O	No	A	No	15.12, 15.17, 15.19				
Alkyl dithiocarbamate (C19-C35)	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9				
Alkyl dithiothiadiazole (C6-C24)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6	<u>&lt;1000</u>	<u>&gt;60</u>	-	
Alkyl ester copolymer (C4-C20)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9				
Alkyl (C8-C10)/(C12-C14); (40% or less/60% or more) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	15.19.6, 16.2.6, 16.2.9				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Alkyl (C8-C10)/(C12-C14):(60% or more/40% or less) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	16.2.6, 16.2.9				
Alkyl (C7-C9) nitrates	Y	S/P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 15.20, 16.6.1, 16.6.2, 16.6.3	960	~70		
Alkyl(C7-C11)phenol poly(4-12)ethoxylate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1050	240	-	-
Alkyl (C8-C40) phenol sulphide	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Alkyl (C8-C9) phenylamine in aromatic solvents	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6		40		
Alkyl (C9-C15) phenyl propoxylate	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Alkyl (C8-C10) polyglucoside solution (65% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	16.2.6				
Alkyl (C8-C10)/(C12-C14):(50%/50%) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	16.2.6, 16.2.9				
Alkyl (C12-C14) polyglucoside solution (55% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	15.19.6, 16.2.9				
<u>Alkyl (C12-C16) propoxyamine ethoxylate</u>	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, C	Yes	15.12, 15.17, 15.19, 16.2.6				
Alkyl (C10-C20, saturated and unsaturated) phosphite	Y	P	2	2G	Open	No			Yes	O	No	A	No	16.2.9				
Alkyl sulphonic acid ester of phenol	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	870	<60		
Alkyl (C18+) toluenes	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.9				
Alkyl (C18-C28) toluenesulfonic acid	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12, 15.17, 15.19, 16.26, 16.29				
Alkyl (C18-C28) toluenesulfonic acid, calcium salt, borated	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.26				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Alkyl (C18-C28) toluenesulfonic acid, calcium salt, low overbase	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.26				
Alkyl (C18-C28) toluenesulfonic acid, calcium salt, high overbase	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.26				
Allyl alcohol	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	F-T	A	Yes	15.12, 15.17, 15.19	850	21	375	97
Allyl chloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A	Yes	15.12, 15.17, 15.19	940	<-20	390	45
<u>Aluminium chloride/Hydrogen chloride solution</u>	Y	S/P	2	2G	Cont	No	-	-	NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19				
Aluminium sulphate solution	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	<u>1620</u>			
2-(2-Aminoethoxy)ethanol	Z	S/P	3	2G	Open	No			Yes	O	No	A, D	No	15.19.6	1060	107		221
Aminoethyldiethanolamine/Aminoethyl ethanolamine solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	<u>1030</u>	<u>&gt;200</u>	=	
Aminoethyl ethanolamine	Z	S/P	3	2G	Open	No	T2	IIA	Yes	O	No	A	No		1030	129	365	243
N-Aminoethylpiperazine	Z	S/P	3	2G	Cont	No			Yes	R	T	A	No	15.19.6, 16.2.9	980	107	308	220
2-Amino-2-methyl-1-propanol	Z	P	3	2G	Open	No			Yes	O	No	A	No		930	67	165	
Ammonia aqueous (28% or less)	Y	S/P	2	2G	Cont	No			NF	R	T	A, B, C	Yes	15.19.6	900	-	-	
<u>Ammonium chloride solution (less than 25%) (*)</u>	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No					
Ammonium hydrogen phosphate solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>1400</u>	<u>&gt;60</u>		
Ammonium lignosulphonate solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	<u>1260</u>			
Ammonium nitrate solution (93% or less)	Z	S/P	2	1G	Open	No			NF	O	No	No	No	15.2, 15.11.4, 15.11.6, 15.18, 15.19.6, 16.2.9	~1750	-	-	
Ammonium polyphosphate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No		<u>~1300</u>	<u>&gt;60</u>		
Ammonium sulphate solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>~1400</u>	=	-	

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a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Ammonium sulphide solution (45% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A	Yes	15.12, 15.17, 15.19, 16.6.1, 16.6.2, 16.6.3	993	22		38-100
Ammonium thiosulphate solution (60% or less)	Z	P	3	2G	Open	No			NF	O	No	No	No	16.2.9	~1500	-	-	
Amyl acetate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	880	~37		~130
n-Amyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>810</u>	<u>48</u>		
Amyl alcohol, primary	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>810</u>	<u>~40</u>		
sec-Amyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>810</u>	<u>33</u>		
tert-Amyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A	No		<u>810</u>	<u>20</u>		
tert-Amyl methyl ether	X	P	2	2G	Cont	No	T3		No	R	F	A	No	15.19.6	<u>770</u>			
Aniline	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A	No	15.12, 15.17, 15.19	1020	76	770	184
Aryl polyolefins (C11-C50)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	<u>&lt;1000</u>	<u>&gt;60</u>		
Aviation alkylates (C8 paraffins and iso-paraffins BPT 95-120°C)	X	P	2	2G	Cont	No			No	R	F	B	No	15.19.6	700	<u>-12 to 13</u>		
Barium long chain (C11-C50) alkaryl sulphonate	Y	S/P	2	2G	Open	No			Yes	O	No	A, D	No	15.12.3, 15.19, 16.2.6, 16.2.9				
Benzene and mixtures having 10% benzene or more (i)	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	F-T	A, B	No	15.12.1, 15.17, 15.19.6, 16.2.9	880	-11	555	80
Benzene sulphonyl chloride	Z	S/P	3	2G	Cont	No			Yes	R	T	A, D	No	15.19.6, 16.2.9	1378	128		252
Benzenetricarboxylic acid, trioctyl ester	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	<u>1270</u>	<u>≥110</u>		
Benzyl acetate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1060			
Benzyl alcohol	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1050	100	436	206
Benzyl chloride	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A, B	Yes	15.12, 15.13, 15.17, 15.19	1100	~68	585	179

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
<u>Bio-fuel blends of Diesel/gas oil and Alkanes (C10-C26), linear and branched with a flashpoint &gt;60°C (&gt;25% but &lt;99% by volume)</u>	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6				
<u>Bio-fuel blends of Diesel/gas oil and Alkanes (C10-C26), linear and branched with a flashpoint ≤ 60°C (&gt;25% but &lt;99% by volume)</u>	X	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6				
<u>Bio-fuel blends of Diesel/gas oil and FAME (&gt;25% but &lt;99% by volume)</u>	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6				
<u>Bio-fuel blends of Diesel/gas oil and vegetable oil (&gt;25% but &lt;99% by volume)</u>	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6				
<u>Bio-fuel blends of Gasoline and Ethyl alcohol (&gt;25% but &lt;99% by volume)</u>	X	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	A	No	15.12, 15.17, 15.19.6				
Brake fluid base mix: Poly(2-8)alkylene (C2-C3) glycols/Polyalkylene (C2-C10) glycols monoalkyl (C1-C4) ethers and their borate esters	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No		1200	>80		
Bromochloromethane	Z	S/P	3	2G	Cont	No			NF	R	T	No	No		1930	-	-	68
Butene oligomer	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	660			
Butyl acetate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	883	33	421	126
Butyl acrylate (all isomers)	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	F-T	A	No	15.13, 15.19.6, 16.6.1, 16.6.2	900	37	275	148
tert-Butyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A	No		790	4		
Butylamine (all isomers)	Y	S/P	2	2G	Cont	No			No	R	F-T	A	Yes	15.12, 15.17, 15.19.6	700-750	-20	~300	44-78
Butylbenzene (all isomers)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	860	~52	412	183
Butyl benzyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1120	199		
Butyl butyrate (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	870	54		166

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Butyl/Decyl/Cetyl/Eicosyl methacrylate mixture	Y	S/P	2	2G	Cont	No			Yes	R	No	A, D	No	15.13, 15.19.6, 16.6.1, 16.6.2				
Butylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		1020	>85		
1,2-Butylene oxide	Y	S/P	3	2G	Cont	Inert	T2	IIB	No	R	F	A, C	No	15.8.1 to 15.8.7, 15.8.12, 15.8.13, 15.8.16, 15.8.17, 15.8.18, 15.8.19, 15.8.21, 15.8.25, 15.8.27, 15.8.29, 15.19.6	890	-20		65
n-Butyl ether	Y	S/P	3	2G	Cont	Inert	T4	IIB	No	R	F-T	A	No	15.4.6, 15.12, 15.19.6	770	25	194	141
Butyl methacrylate	Z	S/P	3	2G	Cont	No		IIA	No	R	F-T	A, D	No	15.13, 15.19.6, 16.6.1, 16.6.2	900	-54	290	165
n-Butyl propionate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	870	32	425	146
Butyraldehyde (all isomers)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F-T	A	No	15.19.6	800	-7	230	76
Butyric acid	Y	S/P	3	2G	Cont	No			Yes	R	No	A	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6	958	72	450	164
gamma-Butyrolactone	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	1140	98		
Calcium alkaryl sulphonate (C11-C50)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9				
Calcium alkyl (C10-C28) salicylate	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9				
Calcium hydroxide slurry	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	~1900			
Calcium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No			NF	R	No	No	No	15.19.6	1140	-	-	
Calcium hypochlorite solution (more than 15%)	X	S/P	1	2G	Cont	No			NF	R	No	No	No	15.19, 16.2.9	1200	-	-	
Calcium lignosulphonate solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	1260			
Calcium long-chain alkyl (C5-C10) phenate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6				
Calcium long-chain alkyl (C11-C40) phenate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6				

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a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Calcium long-chain alkyl phenate sulphide (C8-C40)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	<u>1000</u>	<u>&gt;60</u>		
Calcium long-chain alkyl salicylate (C13+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	~970	>60		
<u>Calcium long-chain alkyl (C18-C28) salicylate</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9				
Calcium nitrate/Magnesium nitrate/Potassium chloride solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	920	47		
epsilon-Caprolactam (molten or aqueous solutions)	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>1020</u>	<u>125</u>		
Carbolic oil	Y	S/P	2	2G	Cont	No			Yes	C	F-T	A	No	15.12, 15.19.6, 16.2.9	1060			
Carbon disulphide	Y	S/P	2	1G	Cont	Pad + inert	T6	IIC	No	C	F-T	C	Yes	15.3, 15.12, 15.19	1260	<-20	95	46
Carbon tetrachloride	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19.6	1590	-	-	76
Cashew nut shell oil (untreated)	Y	S	2	2G	Cont	No			Yes	R	T	A, B	No	15.19.6, 16.2.6, 16.2.9	950	>100		
Castor oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	<u>945-965</u>	<u>230</u>		
<u>Cesium formate solution (*)</u>	Y	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6				
Cetyl/Eicosyl methacrylate mixture	Y	S/P	2	2G	Open	No			Yes	O	No	A, D	No	15.13, 15.19.6, 16.2.9, 16.6.1, 16.6.2	860	149		370
Chlorinated paraffins (C10-C13)	X	P	1	2G	Open	No			Yes	O	No	A	No	15.19, 16.2.6	1100			
Chlorinated paraffins (C14-C17) (with 50% chlorine or more, and less than 1% C13 or shorter chains)	X	P	1	2G	Open	No	-	-	Yes	O	No	A	No	15.19				
Chloroacetic acid (80% or less)	Y	S/P	2	2G	Cont	No			NF	C	No	No	No	15.11.2, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12.3, 15.19, 16.2.9	1330	-	-	186
Chlorobenzene	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	F-T	A, B	No	15.19.6	1110	28	590	132

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Chloroform	Y	S/P	3	2G	Cont	No			NF	R	T	No	Yes	15.12, 15.19.6	1480	-	-	61
Chlorohydrins (crude)	Y	S/P	2	2G	Cont	No		IIA	No	C	F-T	A	No	15.12, 15.19	1200			213
4-Chloro-2-methylphenoxyacetic acid, dimethylamine salt solution	Y	P	2	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1350			
o-Chloronitrobenzene	Y	S/P	2	2G	Cont	No			Yes	C	T	A, B, D	No	15.12, 15.17, 15.18, 15.19, 16.2.6, 16.2.9	1368	127	>149	246
1-(4-Chlorophenyl)-4,4-dimethyl-pentan-3-one	Y	P	2	2G	Open	No			Yes	O	No	A, B, D	No	15.19.6, 16.2.6, 16.2.9				
2- or 3-Chloropropionic acid	Z	S/P	3	2G	Open	No			Yes	O	No	A	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 16.2.9	1260	107	550	185
Chlorosulphonic acid	Y	S/P	1	2G	Cont	No			NF	C	T	No	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.5, 15.11.6, 15.11.7, 15.11.8, 15.12, 15.16.2, 15.19	1770	-	-	158
m-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A, B	No	15.19.6	1072			162
o-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A, B	No	15.19.6	1077			159
p-Chlorotoluene	Y	S/P	2	2G	Cont	No			No	R	F-T	A, B	No	15.19.6, 16.2.9	1067			166
Chlorotoluenes (mixed isomers)	Y	S/P	2	2G	Cont	No			No	R	F-T	A, B	No	15.19.6	1070	43		162
Choline chloride solutions	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>1090</u>			
Citric acid (70% or less)	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>~1250</u>			
Coal tar	X	S/P	2	2G	Cont	No	T2	IIA	Yes	R	No	B, D	No	15.19.6, 16.2.6, 16.2.9	1180-1300	120-150	336	230-330
Coal tar naphtha solvent	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F-T	A, D	No	15.19.6, 16.2.9	880	15-30	555	80
Coal tar pitch (molten)	X	S/P	2	1G	Cont	No	T2	IIA	Yes	R	No	B, D	No	15.19.6, 16.2.6, 16.2.9	~1300	~280	~550	
Cocoa butter	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	<u>864</u>	<u>&gt;60</u>		
Coconut oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	<u>920</u>	<u>&gt;200</u>		

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Coconut oil fatty acid	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	900			
Coconut oil fatty acid methyl ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	853	108		
Copper salt of long chain (C17+) alkanolic acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9				
Corn oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~920	254		
Cotton seed oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~920	252		~220
Creosote (coal tar)	X	S/P	2	2G	Cont	No	T2	IIA	Yes	R	T	A, D	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9	1070	74		200-400
Cresols (all isomers)	Y	S/P	2	2G	Open	No	T1	IIA	Yes	O	No	A, B	No	15.19.6, 16.2.9	1040	>81	555	191
Cresylic acid, dephenolized	Y	S/P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	1040	86		250
Cresylic acid, sodium salt solution	Y	S/P	2	2G	Open	No			Yes	O	No	No	No	15.19.6, 16.2.9	1400			
Crotonaldehyde	Y	S/P	2	2G	Cont	No	T3	IIB	No	R	F-T	A	Yes	15.12, 15.17, 15.19.6	850	13	230	102
1,5,9-Cyclododecatriene	X	S/P	1	2G	Cont	No			Yes	R	T	A	No	15.13, 15.19, 16.6.1, 16.6.2	890	80		231
Cycloheptane	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	809	<38		117
Cyclohexane	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	780	-18	260	81
Cyclohexanol	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	937	68		
Cyclohexanone	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A	No	15.19.6	950	43	430	156
Cyclohexanone, Cyclohexanol mixture	Y	S/P	3	2G	Cont	No			Yes	R	F-T	A	No	15.19.6	950			
Cyclohexyl acetate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	970	57		
Cyclohexylamine	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F-T	A, C	No	15.19.6	860	-32	290	134
1,3-Cyclopentadiene dimer (molten)	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.6, 16.2.9	980			
Cyclopentane	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	740			
Cyclopentene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	750			

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
p-Cymene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	855	47		177
Decahydronaphthalene	Y	P	2	2G	Cont	No			No	R	F	A, B	No	15.19.6	893	58		187
Decanoic acid	X	P	2	2G	Open	No			Yes	O	No	A	No	16.2.9	900			270
Decene	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	740			172
Decyl acrylate	X	S/P	1	2G	Open	No	T3	IIA	Yes	O	No	A, C, D	No	15.13, 15.19, 16.6.1, 16.6.2	890	127		
Decyl alcohol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9 (e)	~830	~82		233
<u>Decyl/Dodecyl/Tetradecyl alcohol mixture</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.9				
Decyloxytetrahydrothiophene dioxide	X	S/P	2	2G	Cont	No			Yes	R	T	A	No	15.19.6, 16.2.9	1030	130		>100
Diacetone alcohol	Z	P	3	2G	Cont	No			No	R	F	A	No		941	13		
Dialkyl (C8-C9) diphenylamines	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Dialkyl (C7-C13) phthalates	X	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	~980	200-238		
<u>Dialkyl (C9 - C10) phthalates</u>	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6				
<u>Dialkyl thiophosphates sodium salts solution</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9				
Dibromomethane	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.19	2400	-	-	99
Dibutylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A, C, D	No	15.19.6	760	42	260	161
Dibutyl hydrogen phosphonate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	980	-120		121
2,6-Di-tert-butylphenol	X	P	1	2G	Open	No	-	-	Yes	O	No	A, B, C, D	No	15.19, 16.2.9				
Dibutyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1048	171		340
<u>Dibutyl terephthalate</u>	Y	P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.9				
Dichlorobenzene (all isomers)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	R	T	A, B, D	No	15.19.6	1304-1460	66	~645	~175

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
3,4-Dichloro-1-butene	Y	S/P	2	2G	Cont	No			No	C	F-T	A, B, C	Yes	15.12.3, 15.17, 15.19.6	1150	29	450	119
1,1-Dichloroethane	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A	Yes	15.19.6	1170	-10	457	57
Dichloroethyl ether	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	No	15.19.6	1220	55	365	178
1,6-Dichlorohexane	Y	S/P	2	2G	Cont	No			No	R	T	A, B	No	15.19.6	1060			
2,2-Dichloroisopropyl ether	Y	S/P	2	2G	Cont	No			Yes	R	T	A, C, D	No	15.12, 15.17, 15.19	1130	95	-	187
Dichloromethane	Y	S/P	3	2G	Cont	No	T1	IIA	Yes	R	T	No	No	15.19.6	1330	-	605	40
2,4-Dichlorophenol	Y	S/P	2	2G	Cont	Dry			Yes	R	T	A	No	15.19.6, 16.2.6, 16.2.9	1380	114		210
2,4-Dichlorophenoxyacetic acid, diethanolamine salt solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1280	-	-	94
2,4-Dichlorophenoxyacetic acid, dimethylamine salt solution (70% or less)	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1230	-	-	
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.6, 16.2.9	1230	-	-	100
1,1-Dichloropropane	Y	S/P	2	2G	Cont	No			No	R	F-T	A, B	No	15.12, 15.19.6	1200			
1,2-Dichloropropane	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	F-T	A, B	No	15.12, 15.19.6	1160	15	555	97
1,3-Dichloropropene	X	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A, B	Yes	15.12, 15.17, 15.18, 15.19	1230	29		104
Dichloropropene/Dichloropropane mixtures	X	S/P	2	2G	Cont	No			No	C	F-T	A, B, D	Yes	15.12, 15.17, 15.18, 15.19	1200	19		82-149
2,2-Dichloropropionic acid	Y	S/P	3	2G	Cont	Dry			Yes	R	No	A	No	15.11.2, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.9	1390			190
Dicyclopentadiene, Resin Grade, 81-89%	Y	S/P	2	2G	Cont	Inert	T2	IIB	No	C	FT	ABC	Yes	15.12, 15.13, 15.17, 15.19				
Diethanolamine	Y	S/P	3	2G	Open	No	T1	IIA	Yes	O	No	A	No	16.2.6, 16.2.9	1090	-138	660	269
Diethylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A	Yes	15.12, 15.19.6	706	<-25	310	56

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Diethylaminoethanol	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A, C	No	15.19.6	890	-60	260	161
2,6-Diethylaniline	Y	S/P	3	2G	Open	No			Yes	O	No	B, C, D	No	15.19.6, 16.2.9	960			
Diethylbenzene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	865	56	430	180
Diethylene glycol dibutyl ether	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	A	No		<u>885</u>	<u>118</u>		
Diethylene glycol diethyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No		<u>910</u>	<u>82</u>		
Diethylene glycol phthalate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6	<u>1290</u>			
Diethylenetriamine	Y	S/P	3	2G	Open	No	T2	IIA	Yes	O	No	A	No	15.19.6	954	102	395	207
Diethylenetriaminepentaacetic acid, pentasodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No		<u>1300</u>			
Diethyl ether	Z	S/P	2	1G	Cont	Inert	T4	IIB	No	C	F-T	A	Yes	15.4, 15.14, 15.19	704	-45	180	35
Di-(2-ethylhexyl) adipate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	<u>927</u>	<u>196</u>		
Di-(2-ethylhexyl)phosphoric acid	Y	S/P	2	2G	Open	No			Yes	O	No	A, D	No	15.19.6	973	196		>200
Diethyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1118	152		299
Diethyl sulphate	Y	S/P	2	2G	Cont	No			Yes	C	T	A	No	15.19.6	1180	104	436	208
Diglycidyl ether of bisphenol A	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1160	252		
Diglycidyl ether of bisphenol F	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1160			
Diheptyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	<u>990</u>	<u>200</u>		
Di-n-hexyl adipate	X	P	1	2G	Open	No			Yes	O	No	A	No	15.19	939	163		
Dihexyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	<u>1020</u>	<u>194</u>		
Diisobutylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A, C, D	No	15.12.3, 15.19.6	745	29		139
Diisobutylene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	723	-7		101
Diisobutyl ketone	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	<u>810</u>	<u>49</u>		

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Diisobutyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1040	196		327
Diisononyl adipate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	≤1000	≥200		
Diisooctyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	980	232		
Diisopropanolamine	Z	S/P	3	2G	Open	No	T2	IIA	Yes	O	No	A	No	16.2.9	989	127		249
Diisopropylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A	Yes	15.12, 15.19	720	-7	285	82
Diisopropylbenzene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	857	77		203
Diisopropyl naphthalene	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	987	140		
N,N-Dimethylacetamide	Z	S/P	3	2G	Cont	No	-	-	Yes	C	T	A, C, D	No	15.12, 15.17				
N,N-Dimethylacetamide solution (40% or less)	Z	S/P	3	2G	Cont	No			Yes	R	T	B	No	15.12.1, 15.17	940	66		165
Dimethyl adipate	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1070			
Dimethylamine solution (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A, C, D	No	15.12, 15.19.6	~700	<-18	<400	54
Dimethylamine solution (greater than 45% but not greater than 55%)	Y	S/P	2	2G	Cont	No			No	C	F-T	A, C, D	Yes	15.12, 15.17, 15.19	~800	<-18	<400	45
Dimethylamine solution (greater than 55% but not greater than 65%)	Y	S/P	2	2G	Cont	No			No	C	F-T	A, C, D	Yes	15.12, 15.14, 15.17, 15.19	~850	<-18	<400	
N,N-Dimethylcyclohexylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A, C	No	15.12, 15.17, 15.19.6	850	39	215	162
Dimethyl disulphide	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	B	No	15.12.3, 15.12.4, 15.19.6				
N,N-Dimethyldodecylamine	X	S/P	1	2G	Open	No			Yes	O	No	B	No	15.19				
Dimethylethanolamine	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F-T	A, D	No	15.19.6	890	-41	220	135
Dimethylformamide	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A, D	No	15.19.6	950	58	440	153
Dimethyl glutarate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1070			
Dimethyl hydrogen phosphite	Y	S/P	3	2G	Cont	No			Yes	R	T	A, D	No	15.12.1, 15.19.6	1200	147		162

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Dimethyloctanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	902	13		254
Dimethyl phthalate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1190	146		282
Dimethylpolysiloxane	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	1200			
2,2-Dimethylpropane-1,3-diol (molten or solution)	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9				
Dimethyl succinate	Y	P	3	2G	Open	No			Yes	O	No	A	No	16.2.9	1120			
Dinitrotoluene (molten)	X	S/P	2	2G	Cont	No			Yes	C	T	A	No	15.12, 15.17, 15.19, 15.21, 16.2.6, 16.2.9, 1664	1328	150	312	285
Dinonyl phthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	968			
Diocetyl phthalate	X	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	990	218		
1,4-Dioxane	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	F-T	A	No	15.12, 15.19, 16.2.9	1036	12	375	101
Dipentene	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	847	45	237	175
Diphenyl	X	P	2	2G	Open	No			Yes	O	No	B	No	15.19.6, 16.2.6, 16.2.9	1040	113	570	256
Diphenylamine (molten)	Y	P	2	2G	Open	No	-	-	Yes	O	No	B, D	No	15.19.6, 16.2.6, 16.2.9				
Diphenylamine, reaction product with 2,2,4-Trimethylpentene	Y	S/P	1	2G	Open	No			Yes	O	No	A	No	15.19, 16.2.6	980	>180		>200
Diphenylamines, alkylated	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1010	356		
Diphenyl/Diphenyl ether mixtures	X	P	2	2G	Open	No			Yes	O	No	B	No	15.19.6, 16.2.9	1060			
Diphenyl ether	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1075	115	618	259
Diphenyl ether/Diphenyl phenyl ether mixture	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1200			
Diphenylmethane diisocyanate	Y	S/P	2	2G	Cont	Dry	-	-	Yes (a)	C	T (a)	A, B, C (b), D	No	15.12, 15.16.2, 15.17, 15.19.6, 16.2.6, 16.2.9	1230	249		230
Diphenylolpropane-Epichlorohydrin resins	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1300			

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Di-n-propylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A	No	15.12.3, 15.19.6	718	7		42
Dipropylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		1020	138		
Dithiocarbamate ester (C7-C35)	X	P	2	2G	Open	No			Yes	O	No	A, D	No	15.19.6, 16.2.9				
Ditridecyl adipate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6				
Ditridecyl phthalate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	951	238		
Diundecyl phthalate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	<1000	>200		
Dodecane (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A, B	No	15.19.6	750	43-74		
tert-Dodecanethiol	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	A, B, D	Yes	15.12, 15.17, 15.19				
Dodecene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	760			213
Dodecyl alcohol	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	836	>100		259
Dodecylamine/Tetradecylamine mixture	Y	S/P	2	2G	Cont	No			Yes	R	T	A, D	No	15.19.6, 16.2.9	790			
Dodecylbenzene	Z	P	3	2G	Open	No			Yes	O	No	A, B	No		860			
Dodecyl diphenyl ether disulphonate solution	X	S/P	2	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.6	1160	-	-	
Dodecyl hydroxypropyl sulphide	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6				
Dodecyl methacrylate	Z	S/P	3	2G	Open	No			Yes	O	No	A	No	15.13	870	132		133
Dodecyl/Octadecyl methacrylate mixture	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.13, 15.19.6, 16.2.6, 16.6.1, 16.6.2				
Dodecyl/Pentadecyl methacrylate mixture	Y	S/P	2	2G	Open	No			Yes	O	No	A, D	No	15.13, 15.19.6, 16.6.1, 16.6.2	860	110		290
Dodecylphenol	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	940	163		154
Dodecylxylene	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	880			
Drilling brines (containing zinc salts)	X	P	2	2G	Open	No			Yes	O	No	No	No	15.19.6				

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a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Drilling brines, including: calcium bromide solution, calcium chloride solution and sodium chloride solution	Z	P	3	2G	Open	No			Yes	O	No	A	No					
Epichlorohydrin	Y	S/P	2	2G	Cont	No		IIB	No	C	F-T	A	Yes	15.12, 15.17, 15.19.6	1180	21	385	116
Ethanolamine	Y	S/P	3	2G	Open	No	T2	IIA	Yes	O	F-T	A	No	16.2.9	1018	-93		171
2-Ethoxyethyl acetate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	970	49	380	
Ethoxylated long chain (C16+) alkyloxyalkylamine	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B	No	15.19.6, 16.2.9				
Ethoxylated tallow amine (> 95%)	X	S/P	2	2G	Cont	Inert	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9				
Ethyl acetate	Z	P	3	2G	Cont	No			No	R	F	A, B	No		900	-4		
Ethyl acetoacetate	Z	P	3	2G	Open	No			Yes	O	No	A	No		1030	85		
Ethyl acrylate	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	F-T	A	Yes	15.13, 15.19.6, 16.6.1, 16.6.2	920	9	350	100
Ethylamine	Y	S/P	2	1G	Cont	No	T2	IIA	No	C	F-T	C, D	Yes	15.12, 15.14, 15.19.6	689	-49	384	17
Ethylamine solutions (72% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A, C	Yes	15.12, 15.14, 15.17, 15.19	800	-30		38
Ethyl amyl ketone	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	820	44		
Ethylbenzene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	867	15	432	136
Ethyl tert-butyl ether	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6				
Ethyl butyrate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	880			
Ethylcyclohexane	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	787	35	262	55
N-Ethylcyclohexylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A	No	15.19.6	850	46	245	167
S-Ethyl dipropylthiocarbamate	Y	P	2	2G	Open	No			Yes	O	No	A	No	16.2.9				
Ethylene chlorohydrin	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	A, D	Yes	15.12, 15.17, 15.19	1210	55	425	129
Ethylene cyanohydrin	Y	S/P	3	2G	Open	No		IIB	Yes	O	No	A	No	15.19.6	1040	129		117

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Ethylenediamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	No	15.19.6, 16.2.9	900	34	385	116
Ethylenediaminetetraacetic acid, tetrasodium salt solution	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	<u>1310</u>			
Ethylene dibromide	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.19.6, 16.2.9	2170	-	515	132
Ethylene dichloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A, B	No	15.19	1250	13	440	84
Ethylene glycol	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	<u>1110</u>	<u>111</u>		
Ethylene glycol acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	<u>1108</u>	<u>102</u>		
Ethylene glycol butyl ether acetate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	942	88		192
Ethylene glycol diacetate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1106	96		188
Ethylene glycol methyl ether acetate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1010	49		
Ethylene glycol monoalkyl ethers	Y	S/P	3	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	900			
Ethylene glycol phenyl ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	<u>1110</u>	<u>121</u>		
Ethylene glycol phenyl ether/Diethylene glycol phenyl ether mixture	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	<u>1150</u>	<u>&gt;120</u>		
Ethylene oxide/Propylene oxide mixture with an ethylene oxide content of not more than 30% by mass	Y	S/P	2	1G	Cont	Inert	T2	IIB	No	C	F-T	A, C	No	15.8, 15.12, 15.14, 15.19	~845	<-20	~430	27
Ethylene-Vinyl acetate copolymer (emulsion)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	<u>&lt;1000</u>			
Ethyl-3-ethoxypropionate	Y	P	3	2G	Cont	No			No	R	No	A	No	15.19.6				
2-Ethylhexanoic acid	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	<u>910</u>	<u>126</u>		
2-Ethylhexyl acrylate	Y	S/P	3	2G	Open	No	T3	IIB	Yes	O	No	A	No	15.13, 15.19.6, 16.6.1, 16.6.2	890	-82	245	229
2-Ethylhexylamine	Y	S/P	2	2G	Cont	No			No	R	F-T	A	No	15.12, 15.19.6	790	-60	265	169

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
2-Ethyl-2-(hydroxymethyl)propane-1,3-diol (C8-C10) ester	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9				
Ethylidenenorbornene	Y	S/P	2	2G	Cont	No			No	R	F-T	A, D	No	15.12.1, 15.19.6	900	38	272	148
Ethyl methacrylate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F-T	A, D	No	15.13, 15.19.6, 16.6.1, 16.6.2	910	-27		120
N-Ethylmethylallylamine	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	F	A, C	Yes	15.12.3, 15.17, 15.19				
Ethyl propionate	Y	P	3	2G	Open	No			No	R	F	A	No	15.19.6				
2-Ethyl-3-propylacrolein	Y	S/P	3	2G	Cont	No		IIA	No	R	F-T	A	No	15.19.6, 16.2.9	850	68	-	175
Ethyltoluene	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	860	60	475	
Fatty acid (saturated C13+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	~1030	≥60		
Fatty acid methyl esters (m)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9				
Fatty acids, C8-C10	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19, 16.2.6, 16.2.9				
Fatty acids, C12+	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9				
Fatty acids, C16+	Y	P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6				
Fatty acids, essentially linear (C6-C18) 2-ethylhexy ester	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6				
Ferric chloride solutions	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.11, 15.19.6, 16.2.9	1410	-	-	
Ferric nitrate/Nitric acid solution	Y	S/P	2	2G	Cont	No			NF	R	T	No	Yes	15.11, 15.19	1290	-	-	
Fish oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Fluorosilic acid (20-30%) in water solution	Y	S/P	3	1G	Cont	No	-	-	NF	R	T	No	Yes	15.11, 15.19.6		-	-	
Formaldehyde solutions (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A	Yes	15.19.6, 16.2.9	1110	50	420	97
Formamide	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	1150	154		

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
<u>Formic acid (85% or less acid)</u>	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T (g)	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.9	1220	42	520	101
<u>Formic acid (over 85% acid)</u>	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	FT (g)	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.9	1220	42	520	101
<u>Formic acid mixture (containing up to 18% propionic acid and up to 25% sodium formate)</u>	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T(g)	AC	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12.3, 15.12.4, 15.19.6				
Furfural	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A	No	15.19.6	1160	60	~315	162
Furfuryl alcohol	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1129	65	391	170
Glucitol/Glycerol blend propoxylated (containing less than 10% amines)	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6				
Glutaraldehyde solutions (50% or less)	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6	1120	-	-	188
Glycerol monooleate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	<u>950</u>	<u>224</u>		
Glycerol propoxylated	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	A, B, C	No	15.12.3, 15.12.4, 15.19.6				
Glycerol, propoxylated and ethoxylated	Z	P	3	2G	Open	No	-	-	Yes	O	No	A, B, C	No					
Glycerol/sucrose blend propoxylated and ethoxylated	Z	P	3	2G	Open	No	-	-	Yes	O	No	A, B, C	No					
Glyceryl triacetate	Z	P	3	2G	Open	No			Yes	O	No	A, B	No		<u>1160</u>	<u>138</u>		
Glycidyl ester of C10 trialkylacetic acid	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1100			
Glycine, sodium salt solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		<u>1200</u>			
Glycolic acid solution (70% or less)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6, 16.2.9				
Glyoxal solution (40% or less)	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	<u>1130</u>			
Glyoxylic acid solution (50% or less)	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	A, C, D	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.9, 16.6.1, 16.6.2,				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Glyphosate solution (not containing surfactant)	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9				
Groundnut oil	Y	P	2 <sub>(k)</sub>	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~920	282		
Heptane (all isomers)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	680	-4	223	98
n-Heptanoic acid	Z	P	3	2G	Open	No			Yes	O	No	A, B	No		918	≥110		
Heptanol (all isomers) (d)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	~820	~60		~156
Heptene (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	711	~6		190
Heptyl acetate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	880			
1-Hexadecylnaphthalene / 1,4-bis(hexadecyl)naphthalene mixture	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6				
Hexamethylenediamine (molten)	Y	S/P	2	2G	Cont	No			Yes	C	T	C	Yes	15.12, 15.17, 15.18, 15.19.6, 16.2.9	830			
Hexamethylenediamine adipate (50% in water)	Z	P	3	2G	Open	No			Yes	O	No	A	No		1070			
Hexamethylenediamine solution	Y	S/P	3	2G	Cont	No			Yes	R	T	A	No	15.19.6	900	80		123
Hexamethylene diisocyanate	Y	S/P	2	1G	Cont	Dry	T1	IIB	Yes	C	T	A, C (b), D	Yes	15.12, 15.17, 15.16.2, 15.18, 15.19				
Hexamethylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		950	130		
Hexamethylenimine	Y	S/P	2	2G	Cont	No			No	R	F-T	A, C	No	15.19.6	880	18	255	138
Hexane (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	659	-23	260	69
1,6-Hexanediol, distillation overheads	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.12.3, 15.12.4, 15.19.6, 16.2.9				
Hexanoic acid	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	930	110		
Hexanol	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	820	65		
Hexene (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	680	<-20		64
Hexyl acetate	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	870	59		164

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Hydrochloric acid	Z	S/P	3	1G	Cont	No			NF	R	T	No	Yes	15.11	1010-1210	-	-	110
Hydrogen peroxide solutions (over 60% but not over 70% by mass)	Y	S/P	2	2G	Cont	No			NF	C	No	No	No	15.5.1, 15.19.6	1288	-	-	
Hydrogen peroxide solutions (over 8% but not over 60% by mass)	Y	S/P	3	2G	Cont	No			NF	C	No	No	No	15.5.2, 15.18, 15.19.6	1245	-	-	
2-Hydroxyethyl acrylate	Y	S/P	2	2G	Cont	No			Yes	C	T	A	No	15.12, 15.13, 15.19.6, 16.6.1, 16.6.2	1104			
N-(Hydroxyethyl)ethylenediaminetriacetic acid, trisodium salt solution	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	<u>1290</u>			
2-Hydroxy-4-(methylthio)butanoic acid	Z	P	3	2G	Open	No			Yes	O	No	A	No		~1200			
Illipe oil	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Isoamyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>815</u>	<u>45</u>		
Isobutyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>800</u>	<u>28</u>		
Isobutyl formate	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>910</u>	<u>10</u>		
Isobutyl methacrylate	Z	P	3	2G	Cont	No	-	-	No	R	F	A	No	15.12, 15.13, 15.17, 16.6.1, 16.6.2	<u>890</u>	<u>49</u>	<u>390</u>	<u>155</u>
Isophorone	Y	S/P	3	2G	Cont	No			Yes	R	No	A	No	15.19.6	<u>920</u>	<u>84</u>		
Isophoronediamine	Y	S/P	3	2G	Cont	No			Yes	R	T	A	No	16.2.9	930	115	380	247
Isophorone diisocyanate	X	S/P	2	2G	Cont	Dry			Yes	C	T	A, B, D	No	15.12, 15.16.2, 15.17, 15.19.6	1060	158	430	310
Isoprene	Y	S/P	3	2G	Cont	No	T3	IIB	No	R	F	B	No	15.13, 15.14, 15.19.6, 16.6.1, 16.6.2	680	-48	220	34
Isopropanolamine	Y	S/P	3	2G	Open	No	T2	IIA	Yes	O	F-T	A	No	15.19.6, 16.2.6, 16.2.9	960	-71	335	159
Isopropyl acetate	Z	P	3	2G	Cont	No			No	R	F	A, B	No		<u>870</u>	<u>16</u>		
Isopropylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	F-T	C, D	Yes	15.12, 15.14, 15.19	690	<-20	400	32

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Isopropylamine (70% or less) solution	Y	S/P	2	2G	Cont	No			No	C	F-T	C, D	Yes	15.12, 15.19.6, 16.2.9	782	-26	402	47,8
Isopropylcyclohexane	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	~800	35		
Isopropyl ether	Y	S/P	3	2G	Cont	Inert			No	R	F	A	No	15.4.6, 15.13.3, 15.19.6	720	-18	440	67
Jatropha oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6				
Lactic acid	Z	P	3	2G	Open	No			Yes	O	No	A	No		1200	≥110		
Lactonitrile solution (80% or less)	Y	S/P	2	1G	Cont	No			Yes	C	T	A, C, D	Yes	15.12, 15.13, 15.17, 15.18, 15.19, 16.6.1, 16.6.2, 16.6.3	988	-		182-184
Lard	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	920	180		
Latex, ammonia (1% or less), inhibited	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	940			
Latex: Carboxylated styrene-Butadiene copolymer; Styrene-Butadiene rubber	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9				
Lauric acid	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	860			225
Ligninsulphonic acid, magnesium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No					
Ligninsulphonic acid, sodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	1260			
Linseed oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~935	222		
Liquid chemical wastes	X	S/P	2	2G	Cont	No			No	C	F-T	A	Yes	15.12, 15.19.6, 20.5.1	1100-1400			
Long-chain alkaryl polyether (C11-C20)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Long-chain alkaryl sulphonic acid (C16-C60)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.9	~1000	≥60		
Long-chain alkylphenate/Phenol sulphide mixture	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~1000	150		
L-Lysine solution (60% or less)	Z	P	3	2G	Open	No			Yes	O	No	A	No					

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Magnesium chloride solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		1320			
Magnesium long-chain alkaryl sulphamate (C11-C50)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Magnesium long-chain alkaryl salicylate (C11+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Maleic anhydride	Y	S/P	3	2G	Cont	No			Yes	R	No	A, C (f)	No	16.2.9	1480	103	475	202
Mango kernel oil	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Mercaptobenzothiazol, sodium salt solution	X	S/P	2	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1250	-	-	107
Mesityl oxide	Z	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A	No	15.19.6	857	32	346	130
Metam sodium solution	X	S/P	1	2G	Open	No			NF	O	No	No	No	15.19, 16.2.9	1210			
Methacrylic acid	Y	S/P	3	2G	Cont	No			Yes	R	T	A	No	15.13, 15.19.6, 16.2.9, 16.6.1	1015	77		161
Methacrylic acid-Alkoxypoly(alkylene oxide)methacrylate copolymer, sodium salt aqueous solution (45% or less)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	A, C	No	16.2.9				
Methacrylic resin in ethylene dichloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A, B	No	15.19, 16.2.9				
Methacrylonitrile	Y	S/P	2	2G	Cont	No			No	C	F-T	A	Yes	15.12, 15.13, 15.17, 15.19	789	13		90
3-Methoxy-1-butanol	Z	P	3	2G	Cont	No			No	R	F	A	No		920	74		
3-Methoxybutyl acetate	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	950	>60		
N-(2-Methoxy-1-methylethyl)-2-ethyl-6-methylchloroacetanilide	X	P	1	2G	Open	No			Yes	O	No	A	No	15.19, 16.2.6	1120	>100	510	282
Methyl acetate	Z	P	3	2G	Cont	No			No	R	F	A	No		930	-10		
Methyl acetoacetate	Z	P	3	2G	Open	No			Yes	O	No	A	No		1080	78		
Methyl acrylate	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	F-T	A	Yes	15.13, 15.19.6, 16.6.1, 16.6.2	957	-3	415	80
Methyl alcohol	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	790	11		

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Methylamine solutions (42% or less)	Y	S/P	2	2G	Cont	No			No	C	F-T	A, C, D	Yes	15.12, 15.17, 15.19	900	~10	430	49
Methylamyl acetate	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	860	-43		146
Methylamyl alcohol	Z	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	808	-41		132
Methyl amyl ketone	Z	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	817	49		151
<u>N-Methylaniline</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6				
<u>alpha-Methylbenzyl alcohol with acetophenone (15% or less)</u>	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9				
Methylbutenol	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	<1000	23-43		
Methyl tert-butyl ether	Z	P	3	2G	Cont	No			No	R	F	A, B	No		740	-10		
Methyl butyl ketone	Y	P	3	2G	Cont	No			No	R	F	A, B	No	15.19.6	830	35		
Methylbutynol	Z	P	3	2G	Cont	No			No	R	F	A	No		867	25		
Methyl butyrate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	890	14		102
Methylcyclohexane	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	770	-4	285	101
Methylcyclopentadiene dimer	Y	P	2	2G	Cont	No			No	R	F	B	No	15.19.6	934	60		78-183
Methylcyclopentadienyl manganese tricarbonyl	X	S/P	1	1G	Cont	No	-	-	Yes	C	T	A, B, C, D	Yes	15.12, 15.18, 15.19, 16.2.9				
Methyl diethanolamine	Y	S/P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1040	>100		
2-Methyl-6-ethylaniline	Y	S/P	3	2G	Open	No			Yes	O	No	A, D	No	15.19.6	970	102	-	231
Methyl ethyl ketone	Z	P	3	2G	Cont	No			No	R	F	A	No		810	-7		
2-Methyl-5-ethylpyridine	Y	S/P	3	2G	Open	No		IIA	Yes	O	No	A, D	No	15.19.6	920	-74		178
Methyl formate	Z	S/P	2	2G	Cont	No			No	R	F-T	A	Yes	15.12, 15.14, 15.19	980	-19	456	32
<u>2-Methylglutaronitrile with 2-Ethylsuccinonitrile (12% or less)</u>	Z	S	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
2-Methyl-2-hydroxy-3-butyne	Z	S/P	3	2G	Cont	No		IIA	No	R	F-T	A, B, D	No	15.19.6, 16.2.9	867	25		104
Methyl isobutyl ketone	Z	P	3	2G	Cont	No			No	R	F	A, B	No		800	23		
Methyl methacrylate	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A	No	15.13, 15.19.6, 16.6.1, 16.6.2	940	10	430	101
3-Methyl-3-methoxybutanol	Z	P	3	2G	Open	No			Yes	O	No	A	No		927	>60		
Methylnaphthalene (molten)	X	S/P	2	2G	Cont	No			Yes	R	No	A, D	No	15.19.6				
2-Methyl-1,3-propanediol	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No					
2-Methylpyridine	Z	S/P	2	2G	Cont	No			No	C	F	A	No	15.12.3, 15.19.6	950	25		54
3-Methylpyridine	Z	S/P	2	2G	Cont	No			No	C	F	A, C	No	15.12.3, 15.19	940	40	535	128
4-Methylpyridine	Z	S/P	2	2G	Cont	No			No	C	F-T	A	No	15.12.3, 15.19, 16.2.9	957	57		145
N-Methyl-2-pyrrolidone	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1027	96		
Methyl salicylate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1185	101	454	222
alpha-Methylstyrene	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	F-T	A, D (j)	No	15.13, 15.19.6, 16.6.1, 16.6.2	906	54	574	166
3-(Methylthio)propionaldehyde	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	F-T	B, C	Yes	15.12, 15.17, 15.19	1030	58	255	165
Molybdenum polysulfide long chain alkyl dithiocarbamide complex	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9				
Morpholine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	A	No	15.19.6	1000	-38	310	129
Motor fuel anti-knock compounds (containing lead alkyls)	X	S/P	1	1G	Cont	No	T4	IIA	No	C	F-T	A, C	Yes	15.6, 15.12, 15.18, 15.19	~1800		145	180
Myrcene	X	P	2	2G	Cont	No	-	-	No	R	F	A	No	15.19.6, 16.2.9	806			
Naphthalene (molten)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	R	No	A, D	No	15.19.6, 16.2.9	1140	80	540	218
Naphthalenesulphonic acid-Formaldehyde copolymer, sodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	~960	>60		
Neodecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	920			

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Nitrating acid (mixture of sulphuric and nitric acids)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.16.2, 15.17, 15.19	~1800	-	-	90
Nitric acid (70 % and over)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.19	~1500	-	-	84
Nitric acid (less than 70%)	Y	S/P	2	2G	Cont	No			NF	R	T	No	Yes	15.11, 15.19	~1420	-	-	122
Nitrilotriacetic acid, trisodium salt solution	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6				
Nitrobenzene	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A, D	No	15.12, 15.17, 15.18, 15.19, 16.2.9	1200	88	480	211
Nitroethane	Y	S/P	3	2G	Cont	No		IIB	No	R	F-T	A (f)	No	15.19.6, 16.6.1, 16.6.2, 16.6.4	1050	30.5	414	114
Nitroethane (80%)/Nitropropane (20%)	Y	S/P	3	2G	Cont	No		IIB	No	R	F-T	A (f)	No	15.19.6, 16.6.1, 16.6.2, 16.6.3	1030	32	416	112 - 133
Nitroethane, 1-Nitropropane (each 15% or more) mixture	Y	S/P	3	2G	Cont	No	-	-	No	R	F	A	No	15.19.6, 16.2.6, 16.6.1, 16.6.2, 16.6.3				
o-Nitrophenol (molten)	Y	S/P	2	2G	Cont	No			Yes	C	T	A, D	No	15.12, 15.19.6, 16.2.6, 16.2.9	1300			214
1- or 2-Nitropropane	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F-T	A	No	15.19.6	1000 990	(49) (39)	~420	131 120
Nitropropane (60%)/Nitroethane (40%) mixture	Y	S/P	3	2G	Cont	No			No	R	F-T	A (f)	No	15.19.6	1010	34	421	112
o- or p-Nitrotoluenes	Y	S/P	2	2G	Cont	No		IIB	Yes	C	T	A, B	No	15.12, 15.17, 15.19.6	1299	106		238
Nonane (all isomers)	X	P	2	2G	Cont	No			No	R	F	B, C	No	15.19.6	722	30	206	151
Nonanoic acid (all isomers)	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	900	100		
Non-edible industrial grade palm oil	Y	S/P	2	2G	Cont	No	-	-	Yes	R	No	A, B, C	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9	~870	67		
Nonene (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	743	25		150
Nonyl alcohol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	829	74		215
Nonyl methacrylate monomer	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	980	>60		
Nonylphenol	X	P	1	2G	Open	No			Yes	O	No	A	No	15.19, 16.2.6, 16.2.9	950	141		315

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Nonylphenol poly(4+)ethoxylate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6	1040			
Noxious liquid, NF, (1) n.o.s. (trade name ..., contains ...) ST1, Cat. X	X	P	1	2G	Open	No	-	-	Yes	O	No	A	No	15.19, 16.2.6				
Noxious liquid, F, (2) n.o.s. (trade name ..., contains ...) ST1, Cat. X	X	P	1	2G	Cont	No	T3	IIA	No	R	F	A	No	15.19, 16.2.6				
Noxious liquid, NF, (3) n.o.s. (trade name ..., contains ...) ST2, Cat. X	X	P	2	2G	Open	No	-		Yes	O	No	A	No	15.19, 16.2.6				
Noxious liquid, F, (4) n.o.s. (trade name ..., contains ...) ST2, Cat. X	X	P	2	2G	Cont	No	T3	IIA	No	R	F	A	No	15.19, 16.2.6				
Noxious liquid, NF, (5) n.o.s. (trade name ..., contains ...) ST2, Cat. Y	Y	P	2	2G	Open	No	-		Yes	O	No	A	No	15.19, 16.2.6, 16.2.9 (I)				
Noxious liquid, F, (6) n.o.s. (trade name ..., contains ...) ST2, Cat. Y	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	A	No	15.19, 16.2.6, 16.2.9 (I)				
Noxious liquid, NF, (7) n.o.s. (trade name ..., contains ...) ST3, Cat. Y	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19, 16.2.6, 16.2.9 (I)				
Noxious liquid, F, (8) n.o.s. (trade name ..., contains ...) ST3, Cat. Y	Y	P	3	2G	Cont	No	T3	IIA	No	R	F	A	No	15.19, 16.2.6, 16.2.9 (I)				
Noxious liquid, NF, (9) n.o.s. (trade name ..., contains ...) ST3, Cat. Z	Z	P	3	2G	Open	No	-		Yes	O	No	A	No					
Noxious liquid, F, (10) n.o.s. (trade name ..., contains ...) ST3, Cat. Z	Z	P	3	2G	Cont	No	T3	IIA	No	R	F	A	No					
<u>Octamethylcyclotetrasiloxane</u>	Y	P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6, 16.2.9				
Octane (all isomers)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	703	13	220	126
Octanoic acid (all isomers)	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	910	132		
Octanol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A	No		830	~70		~185
Octene (all isomers)	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	720	21		~125
n-Octyl acetate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	869	82		199

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Octyl aldehydes	Y	P	3	2G	Cont	No	-	-	No	R	F	A	No	15.19.6, 16.2.9	820	52		163
Octyl decyl adipate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.9	980	>60		
Olefin-Alkyl ester copolymer (molecular weight 2000+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
<u>Olefin Mixture (C7-C9) C8 rich, stabilised</u>	X	S/P	2	2G	Cont	No	T3	IIB	No	R	F	ABC	No	15.13, 15.19.6				
Olefin mixtures (C5-C7)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	~700	-20		
Olefin mixtures (C5-C15)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	~750	0-38		
Olefins (C13+, all isomers)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	~800	>70		
alpha-Olefins (C6-C18) mixtures	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	~800	0-25		
Oleic acid	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9	895	>175		
Oleum	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11.2 to 15.11.8, 15.12.1, 15.16.2, 15.17, 15.19, 16.2.6	<1980	-	-	130
Oleylamine	X	S/P	2	2G	Cont	No			Yes	R	T	A	No	15.19.6, 16.2.9	828	~93		>100
Olive oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~920	224		
Oxygenated aliphatic hydrocarbon mixture	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	A, B, C	No					
Palm acid oil	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Palm fatty acid distillate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Palm kernel acid oil	Y	S/P	2	2G	Open	No			Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	870			
Palm kernel oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9				
Palm kernel olein	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Palm kernel stearin	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Palm mid fraction	Y	P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				

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a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
			(k)															
Palm oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	952	>200		
Palm oil fatty acid methyl ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.9	850	>60		
Palm olein	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Palm stearin	Y	P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	<1000	>60		
Paraffin wax	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	900	199		
Paraldehyde	Z	S/P	3	2G	Cont	No	T3	IIB	No	R	F	A	No	15.19.6, 16.2.9	990	36	238	125
Paraldehyde-Ammonia reaction product	Y	S/P	2	2G	Cont	No			No	C	F-T	A	No	15.12.3, 15.19		29		
Pentachloroethane	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12, 15.17, 15.19.6	1680	-	-	16
1,3-Pentadiene	Y	P	3	2G	Cont	No			No	R	F-T	A, B	No	15.13, 15.19.6, 16.6.1, 16.6.2, 16.6.3	680	-43	>200	42
<u>1,3-Pentadiene (greater than 50%), cyclopentene and isomers, mixtures</u>	Y	S/P	2	2G	Cont	Inert	T3	IIB	No	C	FT	ABC	Yes	15.12, 15.13, 15.17, 15.19				
Pentaethylenhexamine	X	S/P	2	2G	Open	No			Yes	O	No	B	Yes	15.19		>60		
Pentane (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.14, 15.19.6	626	-49	308	36
Pentanoic acid	Y	P	3	2G	Open	No			Yes	O	No	A, B	No	15.19.6	939	96		
n-Pentanoic acid (64%)/2-Methylbutyric acid (36%) mixture	Y	S/P	2	2G	Open	No	T2		Yes	C	No	A, D	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12.3, 15.19				
Pentene (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.14, 15.19.6	656	-18	~270	30-37
n-Pentyl propionate	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6		40		
Perchloroethylene	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.1, 15.12.2, 15.19.6	1625	-	-	121
Petrolatum	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	828-905	110		
Phenol	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	A	No	15.12, 15.19, 16.2.9	1070	82	715	182

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
1-Phenyl-1-xylyl ethane	Y	P	3	2G	Open	No			Yes	O	No	A, B	No		988	149		290
Phosphate esters, alkyl (C12-C14) amine	Y	P	2	2G	Cont	No	-	-	No	R	F	A	No	15.19.6, 16.2.6, 16.2.9				
Phosphoric acid	Z	S/P	3	2G	Open	No			NF	O	No	No	No	15.11.1, 15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 16.2.9	1500-1700	-	-	200
Phosphorus, yellow or white	X	S/P	1	1G	Cont	Pad + (vent or inert)			No (c)	C	No	C	Yes	15.7, 15.19, 16.2.9	1820	-	-	282
Phthalic anhydride (molten)	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	R	No	A, D	No	15.19.6, 16.2.6, 16.2.9	1530	152	580	285
alpha-Pinene	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	864	32		70
beta-Pinene	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	877	47		73
Pine oil	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	970	78		>180
Polyacrylic acid solution (40% or less)	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	A, C	No					
Polyalkyl (C18-C22) acrylate in xylene	Y	P	2	2G	Cont	No			No	R	F	A, B	No	15.19.6, 16.2.6, 16.2.9	1100			
<u>Polyalkylalkenaminesuccinimide, molybdenum oxysulphide</u>	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6				
Poly(2-8)alkylene glycol monoalkyl (C1-C6) ether	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No		930-1030	>60		
Poly(2-8)alkylene glycol monoalkyl (C1-C6) ether acetate	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	1040	~80-115		
Polyalkyl (C10-C20) methacrylate	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	1020			
Polyalkyl (C10-C18) methacrylate/Ethylene-Propylene copolymer mixture	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9				
Polybutene	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6	910	>115		

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Polybutenyl succinimide	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	933	176		
Poly(2+)cyclic aromatics	X	P	1	2G	Cont	No			Yes	R	No	A, D	No	15.19, 16.2.6, 16.2.9	~900	>60		
Polyether (molecular weight 1350+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6				
Polyethylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		<1000	>100		
Polyethylene glycol dimethyl ether	Z	P	3	2G	Open	No			Yes	O	No	A	No		~910	~150		
<u>Poly(ethylene glycol) methylbutenyl ether (MW&gt;1000)</u>	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9				
Polyethylene polyamines	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	1050	>150		>200
Polyethylene polyamines (more than 50% C5-C20 paraffin oil)	Y	S/P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9				
Polyferric sulphate solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6	1460	-	-	
Poly(iminoethylene)-graft-N-poly(ethyleneoxy) solution (90% or less)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	A, C	No	16.2.9				
Polyisobutenamine in aliphatic (C10-C14) solvent	Y	P	3	2G	Open	No	T3	IIA	Yes	O	No	A	No	15.19.6				
Polyisobutenyl anhydride adduct	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Poly(4+)isobutylene	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.9				
Polymethylene polyphenyl isocyanate	Y	S/P	2	2G	Cont	Dry			Yes (a)	C	T (a)	A	No	15.12, 15.16.2, 15.19.6, 16.2.9	1190	218		
Polyolefin (molecular weight 300+)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~900	>60		
Polyolefin amide alkeneamine (C17+)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6				
Polyolefin amide alkeneamine borate (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9		>60		
Polyolefin amide alkeneamine polyol	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9	920	-210		
Polyolefinamine (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Polyolefinamine in alkyl (C2-C4) benzenes	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.6, 16.2.9	900	38-44	>425	148
Polyolefinamine in aromatic solvent	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.6, 16.2.9	900			
Polyolefin aminoester salts (molecular weight 2000+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9				
Polyolefin anhydride	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	910	-182		
Polyolefin ester (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Polyolefin phenolic amine (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Polyolefin phosphorsulphide, barium derivative (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9		~200		
Poly(20)oxyethylene sorbitan monooleate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~1080	>60		
Poly(5+)propylene	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.9	900			
Polypropylene glycol	Z	S/P	3	2G	Cont	No			Yes	O	No	A, B, C	No	15.19.6	<1000	>200		
Polysiloxane	Y	P	3	2G	Cont	No			No	R	F	A, B	No	15.19.6, 16.2.9	1030	58		
Potassium chloride solution	Z	S/P	3	2G	Open	No	-	-	NF	O	No	A	No	16.2.9	~1000			
Potassium hydroxide solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6	1500	-	-	150
Potassium oleate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~1300	very high		
Potassium thiosulphate (50% or less)	Y	P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	720			
n-Propanolamine	Y	S/P	3	2G	Open	No			Yes	O	No	A, D	No	15.19.6, 16.2.9	980	>80		188
<u>2-Propene-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride, homopolymer solution</u>	Y	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6				
beta-Propiolactone	Y	S/P	2	2G	Cont	No		IIA	Yes	R	T	A	No	15.19.6	1150	-74		155
Propionaldehyde	Y	S/P	3	2G	Cont	No			No	R	F-T	A	Yes	15.17, 15.19.6	810	<-20	207	49

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Propionic acid	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	F	A	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6	990	50	485	141
Propionic anhydride	Y	S/P	3	2G	Cont	No	T2	IIA	Yes	R	T	A	No	15.19.6	1020	-74		167
Propionitrile	Y	S/P	2	1G	Cont	No	T1	IIB	No	C	F-T	A, D	Yes	15.12, 15.17, 15.18, 15.19	780	35		97
n-Propyl acetate	Y	P	3	2G	Cont	No			No	R	F	A, B	No	15.19.6	890	15		
n-Propyl alcohol	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	800	~20		
n-Propylamine	Z	S/P	2	2G	Cont	Inert	T2	IIA	No	C	F-T	A, D	Yes	15.12, 15.19	720	<-20	~320	49
Propylbenzene (all isomers)	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	860			
Propylene glycol methyl ether acetate	Z	P	3	2G	Cont	No			No	R	F	A	No		969	47		
Propylene glycol monoalkyl ether	Z	P	3	2G	Cont	No			No	R	F	A, B	No		980	>36		
Propylene glycol phenyl ether	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Propylene oxide	Y	S/P	2	2G	Cont	Inert	T2	IIB	No	C	F-T	A, C	No	15.8, 15.12.1, 15.14, 15.19	830	<-20	430	34
Propylene tetramer	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	760			
Propylene trimer	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	740	40		
Pyridine	Y	S	3	2G	Cont	No	T1	IIA	No	R	F	A	No	15.19.6	980	17	550	115
Pyrolysis gasoline (containing benzene)	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	F-T	A, B	No	15.12, 15.17, 15.19.6	840	27		>80
Rapeseed oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~915	163		
<u>Rapeseed oil (low erucic acid containing less than 4% free fatty acids)</u>	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9				
Rape seed oil fatty acid methyl esters	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6				
Resin oil, distilled	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	F-T	A, B, C	No	15.12, 15.17, 15.19.6				
Rice bran oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~920	>200		
Rosin	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	1000			

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Safflower oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	927	>60		
Shea butter	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	1550			
Sodium alkyl (C14-C17) sulphonates (60-65% solution)	Y	P	2	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.6, 16.2.9	1070	-	-	-
Sodium aluminosilicate slurry	Z	P	3	2G	Open	No			Yes	O	No	A, B	No		1390			
Sodium benzoate	Z	P	3	2G	Open	No			Yes	O	No	A	No		~1350			
Sodium borohydride (15% or less)/Sodium hydroxide solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.6, 16.2.9	1400	-	-	100
<u>Sodium bromide solution (less than 50%) (*)</u>	Y	S/P	3	2G	Open	No	-	-	NF	R	No	No	No	15.19.6				
Sodium carbonate solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		~1600			
Sodium chlorate solution (50% or less)	Z	S/P	3	2G	Open	No			NF	O	No	No	No	15.9, 16.2.9	1500	-	-	170
Sodium dichromate solution (70% or less)	Y	S/P	2	2G	Open	No			NF	C	No	No	No	15.12.3, 15.19	1720	-	-	120
Sodium hydrogen sulphide (6% or less)/Sodium carbonate (3% or less) solution	Z	P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1300	-		
Sodium hydrogen sulphite solution (45% or less)	Z	S/P	3	2G	Open	No			NF	O	No	No	No	16.2.9	1300	-	-	-
Sodium hydrosulphide/Ammonium sulphide solution	Y	S/P	2	2G	Cont	No			No	C	F-T	A	Yes	15.12, 15.14, 15.17, 15.19, 16.6.1, 16.6.2, 16.6.3	1282	10		38-121
Sodium hydrosulphide solution (45% or less)	Z	S/P	3	2G	Cont	Vent or pad (gas)			NF	R	T	No	No	15.19.6, 16.2.9	1300	-	-	-
Sodium hydroxide solution	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.6, 16.2.9	1000-1530	-	-	150

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Sodium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No	-	-	NF	R	No	No	No	15.19.6	1220			
<u>Sodium methylate 21-30% in methanol</u>	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19, 16.2.6(only if >28%), 16.2.9				
Sodium nitrite solution	Y	S/P	2	2G	Open	No			NF	O	No	No	No	15.12.3.1, 15.12.3.2, 15.19, 16.2.9	1200	-	-	
Sodium petroleum sulphonate	Y	S/P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1050	205	-	>100
Sodium poly(4+)acrylate solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No	16.2.9	1350			
Sodium silicate solution	Y	P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1200	-		
Sodium sulphide solution (15% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	No	15.19.6, 16.2.9	1427			
Sodium sulphite solution (25% or less)	Y	P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9	1220	-		
Sodium thiocyanate solution (56% or less)	Y	P	3	2G	Open	No			Yes	O	No	No	No	15.19.6, 16.2.9	~1000			
Soyabean oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	929	282		
Styrene monomer	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	F	A, B	No	15.13, 15.19.6, 16.6.1, 16.6.2	910	32	490	145
Sulphohydrocarbon (C3-C88)	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	~980	>60		
Sulpholane	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	~1270	166		
Sulphur (molten)	Z	S	3	1G	Open	Vent or pad (gas)	T3		Yes	O	F-T	No	No	15.10, 16.2.9	1800	~165	-	445
Sulphuric acid	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.11, 15.16.2, 15.19.6	1560-1840	-	-	338
Sulphuric acid, spent	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.11, 15.16.2, 15.19.6	~1100	-	-	
Sulphurized fat (C14-C20)	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Sulphurized polyolefinamide alkene (C28-C250) amine	Z	P	3	2G	Open	No	-	-	Yes	O	No	A	No					

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a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Sunflower seed oil	Y	S/P	2 <sup>(k)</sup>	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Tall oil, crude	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.2.6	1000	180		
Tall oil, distilled	Y	P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6	1000	180		
Tall oil fatty acid (resin acids less than 20%)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6	1000			
Tall oil pitch	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	A, B, C	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9	1000	180		
Tallow	Y	P	2 <sup>(k)</sup>	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	860	256		
Tallow fatty acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	<1000	>60		
Tetrachloroethane	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12, 15.17, 15.19.6	1600	-	-	146
Tetraethylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		1120	174		
Tetraethylenepentamine	Y	S/P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	1000	-163		333
Tetrahydrofuran	Z	S	3	2G	Cont	No	T3	IIB	No	R	F-T	A	No	15.19.6	890	-20	321	64
Tetrahydronaphthalene	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	981	71	384	206
Tetramethylbenzene (all isomers)	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	896			197
Titanium dioxide slurry	Z	P	3	2G	Open	No			Yes	O	No	A, B	No					
Toluene	Y	P	3	2G	Cont	No			No	R	F	A	No	15.19.6	866	4	536	111
Toluenediamine	Y	S/P	2	2G	Cont	No			Yes	C	T	A, D	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9	~1000		450	280
Toluene diisocyanate	Y	S/P	2	2G	Cont	Dry	T1	IIA	Yes	C	F-T	A, C (b), D	Yes	15.12, 15.16.2, 15.17, 15.19, 16.2.9	1200	132	620	251
o-Toluidine	Y	S/P	2	2G	Cont	No			Yes	C	T	A	No	15.12, 15.17, 15.19	1000	85	480	200
Tributyl phosphate	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	978	146		292
1,2,3-Trichlorobenzene (molten)	X	S/P	1	2G	Cont	No			Yes	C	T	A, C, D	Yes	15.12.1, 15.17, 15.19, 16.2.6, 16.2.9	1160	15	555	96
1,2,4-Trichlorobenzene	X	S/P	1	2G	Cont	No			Yes	R	T	A, B	No	15.19, 16.2.9	1460	110	-	213

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
1,1,1-Trichloroethane	Y	P	3	2G	Open	No			Yes	O	No	A	No	15.19.6	1325			75
1,1,2-Trichloroethane	Y	S/P	3	2G	Cont	No			NF	R	T	No	No	15.12.1, 15.19.6	1440	-	-	113
Trichloroethylene	Y	S/P	2	2G	Cont	No	T2	IIA	Yes	R	T	No	No	15.12, 15.17, 15.19.6	1462	-	410	87
1,2,3-Trichloropropane	Y	S/P	2	2G	Cont	No			Yes	C	T	A, B, D	No	15.12, 15.17, 15.19	1390	82	304	156
1,1,2-Trichloro-1,2,2-Trifluoroethane	Y	P	2	2G	Open	No			NF	O	No	No	No	15.19.6	1420			48
Tricresyl phosphate (containing 1% or more ortho-isomer)	Y	S/P	1	2G	Cont	No	T2	IIA	Yes	C	No	A, B	No	15.12.3, 15.19, 16.2.6	1180	238	385	440
Tricresyl phosphate (containing less than 1% ortho-isomer)	Y	S/P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1160	225	410	420
Tridecane	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6	760	79		
Tridecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6, 16.2.9	845	>110		312
Tridecyl acetate	Y	P	3	2G	Open	No	-	-	Yes	O	No	A	No	15.19.6	<1000			
Triethanolamine	Z	S/P	3	2G	Open	No		IIA	Yes	O	No	A	No	16.2.9	1130	179		360
Triethylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F-T	A, C	Yes	15.12, 15.19.6	730	-17	230	89
Triethylbenzene	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	860	111		
Triethylenetetramine	Y	S/P	2	2G	Open	No	T2	IIA	Yes	O	No	A	No	15.19.6	980	135	335	278
Triethyl phosphate	Z	P	3	2G	Open	No			Yes	O	No	A	No		1065	116		
Triethyl phosphite	Z	S/P	3	2G	Cont	No			No	R	F-T	A, B	No	15.12.1, 15.19.6, 16.2.9				
Triisopropanolamine	Z	P	3	2G	Open	No			Yes	O	No	A	No		1020	160		
Triisopropylated phenyl phosphates	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1100-1400	200 - 245		
Trimethylacetic acid	Y	S/P	2	2G	Cont	No			Yes	R	No	A	No	15.11.2, 15.11.3, 15.11.4, 15.11.5, 15.11.6, 15.11.7, 15.11.8, 15.19.6, 16.2.6, 16.2.9	910	71		164

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Trimethylamine solution (30% or less)	Z	S/P	2	2G	Cont	No			No	C	F-T	A, C	Yes	15.12, 15.14, 15.19, 16.2.9	920			
Trimethylbenzene (all isomers)	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	876	54		169
Trimethylol propane propoxylated	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	A, B, C	No					
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	Z	P	3	2G	Open	No			Yes	O	No	A, B	No		<1000			
2,2,4-Trimethyl-1,3-pentanediol-1-isobutyrate	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	960	118		182
1,3,5-Trioxane	Y	S/P	3	2G	Cont	No			No	R	F	A, D	No	15.19.6, 16.2.9	1170			
Tripropylene glycol	Z	P	3	2G	Open	No			Yes	O	No	A	No		1020	141		
Trixylyl phosphate	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.6	1150	232		
Tung oil	Y	S/P	2 (k)	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9	~940	290		
Turpentine	X	P	2	2G	Cont	No			No	R	F	A	No	15.19.6	880	32	253	
Undecanoic acid	Y	P	2	2G	Open	No			Yes	O	No	A	No	16.2.6, 16.2.9	890			284
1-Undecene	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	700			
Undecyl alcohol	X	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6, 16.2.9	834	93		
Urea/Ammonium nitrate solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		<1300			
Urea/Ammonium nitrate solution (containing less than 1% free ammonia)	Z	S/P	3	2G	Cont	No			NF	R	T	A	No	16.2.9				
Urea/Ammonium phosphate solution	Y	P	2	2G	Open	No			Yes	O	No	A	No	15.19.6	<1300			
Urea solution	Z	P	3	2G	Open	No			Yes	O	No	A	No		1160			
Valeraldehyde (all isomers)	Y	S/P	3	2G	Cont	Inert	T3	IIB	No	R	F-T	A	No	15.4.6, 15.19.6	810	12	~215	103
Vegetable acid oils (m)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				
Vegetable fatty acid distillates (m)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	A, B, C	No	15.19.6, 16.2.6, 16.2.9				

Product name	Pollution Category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Temperature classes	Apparatus group	Flash point	Gauging	Vapour detection	Fire protection	Emergency equipment	Specific and operational requirements	Density [kg/m <sup>3</sup> ]	Flash point [°C]	Auto-ignition temperature [°C]	Boiling point [°C]
a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o	q	r	s	t
Vinyl acetate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	A	No	15.13, 15.19.6, 16.6.1, 16.6.2	930	-8	427	73
Vinyl ethyl ether	Z	S/P	2	1G	Cont	Inert	T3	IIB	No	C	F-T	A	Yes	15.4, 15.13, 15.14, 15.19.6, 16.6.1, 16.6.2	754	-45	200	36
Vinylidene chloride	Y	S/P	2	2G	Cont	Inert	T2	IIA	No	R	F-T	B	Yes	15.13, 15.14, 15.19.6, 16.6.1, 16.6.2	1210	(-10)	460	32
Vinyl neodecanoate	Y	S/P	2	2G	Open	No			Yes	O	No	A, B	No	15.13, 15.19.6, 16.6.1, 16.6.2	880	>80	309	
Vinyltoluene	Y	S/P	2	2G	Cont	No		IIA	No	R	F	A, B	No	15.13, 15.19.6, 16.6.1, 16.6.2	890	54	494	170
Waxes	Y	P	2	2G	Open	No	-	-	Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	<1000			
White spirit, low (15-20%) aromatic	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9	750	~40	232	
<u>Wood lignin with sodium acetate/oxalate</u>	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No					
Xylenes	Y	P	2	2G	Cont	No			No	R	F	A	No	15.19.6, 16.2.9 (h)	~890	27		
Xylenes/Ethylbenzene (10% or more) mixture	Y	P	2	2G	Cont	No	-	-	No	R	F	A	No	15.19.6				
Xylenol	Y	S/P	2	2G	Open	No		IIA	Yes	O	No	A, B	No	15.19.6, 16.2.9	1020			
Zinc alkaryl dithiophosphate (C7-C16)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6, 16.2.9	~1000	>60		
Zinc alkenyl carboxamide	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	930	175		
Zinc alkyl dithiophosphate (C3-C14)	Y	P	2	2G	Open	No			Yes	O	No	A, B	No	15.19.6, 16.2.6	~1000	>60		

- a If the product to be carried contains flammable solvents such that the flashpoint does not exceed 60 °C, then special electrical systems and a flammable-vapour detector shall be provided.
- b Although water is suitable for extinguishing open-air fires involving chemicals to which this footnote applies, water shall not be allowed to contaminate closed tanks containing these chemicals because of the risk of hazardous gas generation.
- c 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.
- d Requirements are based on those isomers having a flashpoint of 60 °C, or less; some isomers have a flashpoint greater than 60°C, and therefore the requirements based on flammability would not apply to such isomers.
- e Applies to n-decyl alcohol only.
- f Dry chemical shall not be used as fire-extinguishing media.
- g Confined spaces shall be tested for both formic acid vapours and carbon monoxide gas, a decomposition product.
- h Applies to p-xylene only.
- i For mixtures containing no other components with safety hazards and where the pollution category is Y or less.
- j Only certain alcohol-resistant foams are effective.
- k Requirements for Ship Type identified in column e might be subject to regulation 4.1.3 of Annex II of **MARPOL 73/78**.
- l Applicable when the melting point is equal to or greater than 0 °C.
- m From vegetable oils, animal fats and fish oils specified in the IBC Code.

## Section 18

### List of Products to which these Rules does not apply

**8.1.** The following are products which have been reviewed for their safety and pollution hazards and determined not to present hazards to such an extent as to warrant application of these Rules.

**18.2** Although the products listed in this Section fall outside the scope of these Rules, the attention of Administrations is drawn to the fact that some safety precautions may be needed for their safe transportation. Accordingly, Administrations shall prescribe appropriate safety requirements.

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

**18.4** Liquid mixtures which are assessed or provisionally assessed under regulation 6.3 of MARPOL 73/78 Annex II as falling into Pollution Category Z or OS, and which do not present safety hazards, may be carried under the appropriate entry in this Section for "Noxious or Non-Noxious Liquid Substances, not otherwise specified (n.o.s.)".

### Explanatory Notes

Product name: The product name shall be used in the shipping document for any cargo offered for bulk shipments. Any additional name may be included in brackets after the product name. In some cases, the product names are not identical with the names given in previous issues of the Code.

Pollution Category: Z = Pollution Category assigned to each product under Annex II of MARPOL 73/78.

OS = The product was evaluated and found to fall outside Categories X, Y, or Z.

### Notes:

*In accordance with Annex II of MARPOL 73/78 an "International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk" (NLS-Certificate) issued by the Flag Administration is required for the carriage in bulk of category Z products.*

*Columns with density and flashpoints are for guidance only. The date included therein has been taken from different publications.*

**Table 18.1 List of Products to which the Code does not apply**

Product name	<u>Pollution Category</u>	Density [kg/m <sup>3</sup> ]	Flashpoint [°C]
Acetone	<u>Z</u>	<u>790</u>	<u>-18</u>
Alcoholic beverages, n.o.s.	<u>Z</u>	<u>&lt; 1000</u>	<u>&gt; 20</u>
Apple juice	<u>OS</u>	<u>&lt; 1000</u>	<u>-</u>
n-Butyl alcohol	<u>Z</u>	<u>810</u>	<u>29</u>
sec-Butyl alcohol	<u>Z</u>	<u>810</u>	<u>24</u>
Calcium carbonate slurry	<u>OS</u>	<u>~ 2200</u>	<u>-</u>
Calcium nitrate solutions (50% or less) (a)	<u>Z</u>		
Clay slurry	<u>OS</u>	<u>~ 2000</u>	<u>-</u>
Coal slurry	<u>OS</u>	<u>~ 2000</u>	<u>-</u>
Diethylene glycol	<u>Z</u>	<u>1120</u>	<u>143</u>
Ethyl alcohol	<u>Z</u>	<u>790</u>	<u>13</u>
Ethylene carbonate	<u>Z</u>	<u>1320</u>	<u>143</u>
Glucose solution	<u>OS</u>	<u>1560</u>	<u>-</u>
Glycerine	<u>Z</u>	<u>1260</u>	<u>160</u>
Glycerol ethoxylated	<u>OS</u>		
Hexamethylenetetramine solutions	<u>Z</u>	<u>~ 1200</u>	<u>-</u>
Hexylene glycol	<u>Z</u>	<u>920</u>	<u>96</u>
Hydrogenated starch hydrolysate	<u>OS</u>		
Isopropyl alcohol	<u>Z</u>	<u>790</u>	<u>22</u>
Kaolin slurry	<u>OS</u>	<u>1800 - 2600</u>	<u>-</u>
Lecithin	<u>OS</u>		
Magnesium hydroxide slurry	<u>Z</u>	<u>~ 1530</u>	<u>-</u>
Maltitol solution	<u>OS</u>		
Methyl propyl ketone	<u>Z</u>	<u>809</u>	<u>-14</u>
Molasses	<u>OS</u>	<u>1450</u>	<u>&gt; 60</u>
Microsilica slurry	<u>OS</u>	<u>1370-1410</u>	
N-Methylglucamine solution (70% or less)	<u>Z</u>	<u>1150</u>	<u>&gt; 95</u>
Noxious liquid, (11) n.o.s. (trade name ..., contains ...) Cat. Z	<u>OS</u>		
Non noxious liquid, (12) n.o.s. (trade name ..., contains ...) Cat. OS	<u>Z</u>		
<u>Orange juice (concentrated)</u>	<u>OS</u>		
<u>Orange juice (not concentrated)</u>	<u>OS</u>		
Polyaluminium chloride solution	<u>Z</u>	<u>1190 - 1300</u>	<u>-</u>
Polyglycerin, sodium salt solution (containing less than 3% sodium hydroxide)	<u>Z</u>	<u>1270</u>	<u>&gt; 150</u>
<u>Potassium chloride solution (less than 26%)</u>	<u>OS</u>		
Potassium formate solutions	<u>Z</u>		
Propylene carbonate	<u>Z</u>		
Propylene glycol	<u>Z</u>	<u>1040</u>	<u>99</u>
Sodium acetate solutions	<u>Z</u>	<u>1450</u>	
<u>Sodium bicarbonate solution (less than 10%)</u>	<u>OS</u>		
Sodium sulphate solutions	<u>Z</u>		<u>&gt; 60</u>
Sorbitol solution	<u>OS</u>	<u>1470</u>	<u>-</u>
Sulphonated polyacrylate solution	<u>Z</u>		
Tetraethyl silicate monomer/oligomer (20% in ethanol)	<u>Z</u>		
Triethylene glycol	<u>Z</u>	<u>1130</u>	<u>166</u>
Vegetable protein solution (hydrolysed)	<u>OS</u>	<u>1200</u>	<u>-</u>
Water	<u>OS</u>	<u>1000</u>	<u>-</u>

## **Section 19**

### **Transport of Liquid Chemical Waste**

#### **19.1. Preamble**

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

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

#### **19.2 Definitions**

For the purpose of this Section:

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

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

#### **19.3 Applicability**

**19.3.1** The requirements of this Section are applicable to the transboundary movement of liquid chemical wastes in bulk by seagoing ships and shall be considered in conjunction with all other requirements of these Rules.

**19.3.2** The requirements of this Section do not apply to:

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

#### **19.4 Permitted shipments**

**19.4.1** Transboundary movement of wastes is permitted to commence only when:

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

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

## **19.5 Documentation**

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

## **19.6 Classification of liquid chemical wastes**

**19.6.1** For the purpose of the protection of the marine environment, all liquid chemical wastes transported in bulk shall be treated as Category X noxious liquid substances, irrespective of the actual evaluated category.

## **19.7 Carriage and handling of liquid chemical wastes**

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

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

## **Section 20**

### **Requirements for Offshore Support Vessels Engaged in the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk**

#### **20.1. General**

##### **20.1.1 Application**

**20.1.1.1** Section 1 to 16 of these Rules apply to offshore support vessels as relevant and as supplemented or modified by the provisions of this Section. These requirements apply in addition to the provisions of Part I, Volume II, Rules for Hull, Section 34.

**20.1.1.2** The Rules of this Section incorporate the IMO-Resolution A.673 (16) "Guidelines for the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk in Offshore Support Vessels".

**20.1.1.3** The Rules of this Section apply to the design, construction and operation of offshore support vessels regardless of size or voyage which transport limited quantities of hazardous and noxious liquid substances in bulk identified in 20.7 for the servicing and resupplying of offshore platforms, mobile offshore drilling units and other offshore installations, including those employed in the search for and recovery of hydrocarbons from the sea-bed.

**20.1.1.4** For the purpose of the Rules of this Section limited quantities means that the aggregate quantity of bulk liquids identified in 20.1.2.1 that is carried is any amount not exceeding a maximum which is the lesser of 800 m<sup>3</sup> or a volume in cubic metres equal to 40 % of the vessel's deadweight calculated at a cargo density of 1,0. For ships referred to in 20.1.3.4.2, such as well-stimulation vessels, the carriage of more than the maximum amount specified above may be permitted.

**20.1.1.5** For other ships carriage of more than the relevant maximum amount specified in 20.1.1.4 may be permitted provided that the survival capability requirements of Section 2 of this Rules or of Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk are complied with.

##### **20.1.2 Products**

**20.1.2.1** Products which may be carried subject to the Guidelines (see 20.1.1.2) are:

**.1** those hazardous and noxious liquids listed in 20.7 and those other products which may be assigned to 20.7 based on the following criteria:

**.1.1** products which for safety reasons may be assigned for carriage on a type 3 ship and which are not required to meet the requirements for toxic products in Section 15.12,

**.1.2** noxious liquid substances which would be permitted for carriage on a type 3 ship;

**.2** flammable liquids.

**20.1.2.2** Additives which are considered to fall outside the scope of products in .1 above may be carried in limited amounts in accordance with special requirements, e.g. the aggregate amount of such additives which may be transported is not to exceed 10 % of the vessel's maximum authorized quantity of products subject to

these requirements. An individual tank shall, contain not more than 10 m<sup>3</sup> of these additives. The discharge of these additives into the sea from offshore support vessels is prohibited.

**20.1.2.3** Carriage of products not listed in 20.7 may be undertaken only in accordance with suitable preliminary carriage conditions prescribed by the Administration.

### **20.1.3 Definitions**

Unless expressly provided otherwise in this Section, the definitions contained in Sections 1 and 4 apply.

**20.1.3.1** Cargo area is that part of the offshore support vessel where cargo and cargo vapours are likely to be present and includes cargo tanks, cargo pump rooms, hold spaces in which independent tanks are located, cofferdams surrounding integral tanks and the following deck areas:

- .1** within 3 m of a cargo tank installed on deck;
- .2** within 3 m of a cargo tank outlet in case of independent tanks installed below deck;
- .3** within 3 m of a cargo tank outlet in case of integral tanks installed below deck and separated from the weather deck by a cofferdam;
- .4** the deck area above an integral tank without an overlaying cofferdam plus the deck area extending transversally and longitudinally for a distance of 3 m beyond each side of the tank;
- .5** within 3 m of any cargo liquid or vapour pipe, flange, cargo valve, gas or vapour outlet, or entrance or ventilation opening to a cargo pump room.

**20.1.3.2** Deadweight means the difference in [t] between the displacement of an offshore support vessel in water of a density of 1,025 at the load waterline corresponding to the assigned summer freeboard and the lightweight of the ship.

**20.1.3.3** Lightweight means the displacement of an offshore support vessel in [t] without cargo, fuel, lubrication oil, ballast water, fresh water and feed water in tanks, consumable stores, and passengers and crew and their effects.

**20.1.3.4** Offshore support vessels are:

- .1** vessels which are primarily engaged in the transport of stores, materials and equipment to and from mobile offshore drilling units, fixed and floating platforms and other similar offshore installations;  
or
- .2** vessels, including well-stimulation vessels, but excluding mobile offshore drilling units, derrick barges, pipe laying barges and floating accommodation units, which are otherwise primarily engaged in supporting the work of offshore installations.

**20.1.3.5** Hazardous substance is any substance either listed in Section 17 or having a hazard more severe than one of the minimum hazard criteria given in criteria for hazard evaluation of bulk chemicals as approved by the Organization.

**20.1.3.6** Pollution hazard only substance means a substance having an entry only of "P" in column d in Section 17.

**20.1.3.7** Safety hazard substance means a substance having an entry of "S" or "SP" in column d in Section 17.

**20.1.3.8** Flammable liquid is any liquid having a flashpoint not exceeding 60 °C (closed cup test).

#### **20.1.4 Character of Classification, Surveys and Certification**

**20.1.4.1** Vessels complying with the requirements of this Section will be assigned, in addition to the appropriate class notation, e.g. **SUPPLY VESSEL** the Notation **“EQUIPPED FOR THE CARRIAGE OF CHEMICALS IN BULK”**.

**20.1.4.2** The provisions concerning surveys and certification stipulated in Section 1, D. apply as relevant.

### **20.2 Stability and cargo tank location**

#### **20.2.1 Stability**

**20.2.1.1** Offshore support vessels built in accordance with these requirements are to be designed to meet the requirements for intact stability and for subdivision and damage stability contained in the "Guidelines for the Design and Construction of Offshore Supply Vessels" (IMO-Resolution MSC.235(82)).

**20.2.1.2** Well-stimulation vessels which are permitted to carry more than the "limited quantities" specified in 20.1.1.4 are to be designed to meet the requirements for intact stability and for subdivision and damage stability.

#### **20.2.2 Cargo tank location**

Cargo tanks containing products subject to the provisions of this Section are to be located at least 760 mm measured inboard from the side of the vessel perpendicular to the centreline at the level of the summer load waterline.

### **20.3 Ship design**

#### **20.3.1 Cargo segregation**

**20.3.1.1** Tanks containing cargo or residues of cargo subject to the provisions of these requirements are to be segregated from machinery spaces, propeller shaft tunnels, if fitted, dry cargo spaces, accommodation and service spaces and from drinking water and stores for human consumption, by means of a cofferdam, void space, cargo pump room, empty tank, oil fuel tank, or other similar space. On-deck stowage of independent tanks or installing independent tanks in otherwise empty hold spaces are to be considered as satisfying this requirement.

**20.3.1.2** Cargoes which react in a hazardous manner with other cargoes or oil fuels are to:

- .1** be segregated from such other cargoes or oil fuels 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 are not to pass through other cargo tanks containing such cargoes, unless encased in a tunnel; and
- .3** have separate tank venting systems.

**20.3.1.3** Cargo piping is not to pass through any accommodation, service or machinery space other than cargo pump rooms or pump rooms.

**20.3.1.4** Pumps, ballast lines, vent lines and other similar equipment serving permanent ballast tanks are to be independent of similar equipment serving cargo tanks.

**20.3.1.5** Bilge pumping arrangement for cargo pump rooms or for hold spaces in which independent cargo tanks are installed are to be situated entirely within the cargo area.

**20.3.1.6** Where not bounded by bottom shell plating, fuel oil tanks, a cargo pump room or a pump room, integral cargo tanks are to be surrounded by cofferdams. Tanks for other purposes (except fresh water and lubricating oils) may be accepted as cofferdams for these tanks.

**20.3.1.7** For access to all spaces, the minimum spacing between cargo tank boundaries and adjacent ship's structures is to be 600 mm.

**20.3.1.8** Cargo tanks may extend to the deck plating, provided dry cargo is not handled in that area. Where dry cargo is handled on the deck area above a cargo tank, the cargo tank is not to extend to the deck plating unless a continuous, permanent deck sheathing of wood or other suitable material of appropriate thickness and construction is fitted.

**20.3.1.9** Cargoes subject to this Section are not permitted to be carried in either the fore or aft peak tanks.

**20.3.1.10** For pollution hazard only substances having a flashpoint above 60 °C (closed cup test) the arrangements referred to in 20.3.1.1 and 20.3.1.3 may be waived provided that the segregation requirements for accommodation spaces, drinking water and stores for human consumption are observed. Additionally, 20.3.1.6 and 20.3.1.7 need not be applied.

### **20.3.2 Accommodation, service and machinery spaces and control stations**

**20.3.2.1** Accommodation or service spaced, or control stations are not to be located within the cargo area.

**20.3.2.2** Unless they are spaced at least 7 m away from the cargo area containing flammable products, entrances, air inlets<sup>1</sup> and openings to accommodation, service and machinery spaces and control stations must not face the cargo area. Doors to spaces not having access to accommodation, service and machinery spaces and control stations, such as cargo control stations and store rooms, may be permitted within the 7 m zone specified above, provided the boundaries of the spaces are insulated to A-60 standard. When arranged within the 7 m zone specified above, windows and side scuttles facing the cargo area are to be of a fixed type. Such side scuttles in the first tier on the main deck are to be fitted with inside covers of steel or equivalent material.

**20.3.2.3** In order to guard against the danger of hazardous vapours, due consideration is to be given to the location of air intakes<sup>1</sup> and openings into accommodation, service and machinery spaces and control stations in relation to cargo piping and cargo vent systems.

**20.3.2.4** For pollution hazard only substances having a flashpoint above 60 °C, the arrangements referred to in 20.3.2.1 to 20.3.2.3 may be waived.

### **20.3.3 Access to spaces in the cargo area**

For access to spaces within the cargo area the requirements of Section 3.4 apply.

### **20.3.4 Cargo tank construction**

**20.3.4.1** Cargo tanks should be at least of the type required for the cargo by Section 17 or by Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 19 as applicable.

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<sup>1</sup> See 3.2-0.2.

**20.3.4.2** Instead of the use of permanently attached deck-tanks, portable tanks meeting the requirements of the International Maritime Dangerous Goods (IMDG) Code or other portable tanks specifically approved by the Administration may be used for cargoes indicated in paragraph 20.1.2.2, provided that the tanks are properly located and secured to the vessel.

**20.3.4.3** Except for the tank connections to cargo pump rooms, all tank openings and connections to the tank are to terminate above the weather deck and are to be located in the tops of the tanks. Where cofferdams are provided over integral tanks, small trunks may be used to penetrate the cofferdam.

**20.3.4.4** The greater of the following design pressures (gauge) are to be used for determining scantlings of independent pressure tanks:

- .1** 0.07 MPa;
- .2** the vapour pressure of the cargo at 45 °C;
- .3** the vapour pressure of the cargo at 15 °C above the temperature at which it is normally carried, or
- .4** the pressure which occurs in the tank during the loading or unloading.

The design of the tanks are to comply with standards acceptable to the Society taking into account the carriage temperature and relative density of cargo. Due consideration is also to be given to dynamic forces and any vacuum pressure to which the tanks may be subjected.

**20.3.4.5** Integral and independent gravity tanks are to be constructed and tested in accordance with Section 4 taking into account the carriage temperature and relative density of cargo.

**20.3.4.6** For pollution hazard only substances having a flashpoint above 60 °C, the requirements of 20.3.4.3 need not be applied.

### **20.3.5 Materials of construction**

Materials of construction for tanks, piping, fittings and pumps should be in accordance with Section 6, or Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 6, as applicable.

### **20.3.6 Cargo tank vent systems**

**20.3.6.1** Independent pressure tanks are to be fitted with pressure relief devices that are so designed as to direct the discharge away from personnel and that have a set pressure and capacity which is in accordance with Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 8, taking into account the design pressure referred to in 20.3.4.4.

**20.3.6.2** Cargo tank vent systems of integral or independent gravity tanks shall meet the requirements of Section 8 except that the height specified in Section 8.3.4 may be reduced to 2 m.

**20.3.6.3** The locations of cargo tank vent outlets for independent pressure tanks and for cargo tanks used to carry pollution hazard only substances with a flash point above 60 °C (closed cup test) may be specially considered.

**20.3.6.4** Cargo tank vent systems of portable tanks allowed under 20.3.4.2 may be specially considered taking into account the requirements of 20.3.6.1 and 20.3.6.2.

### **20.3.7 Cargo transfer**

**20.3.7.1** The cargo transfer system is to comply with the requirements of Section 5 or Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, as applicable and practical.

**20.3.7.2** The remote shut-down devices for all cargo pumps and similar equipment, required by Section 5.6.1.3 is to be capable of being activated from a dedicated cargo control location which is manned at the time of cargo transfer and from at least one other location outside the cargo area and at a safe distance from it.

### **20.3.8 Electrical installations**

For electrical installations the requirements of Section 10 apply.

### **20.3.9 Fire-fighting requirements**

**20.3.9.1** For the carriage of flammable liquids identified in 20.7, the requirements for tankers in Chapter II-2 of the 1974 SOLAS Convention apply irrespective of tonnage, including vessels of less than 500 tons gross tonnage, except that:

- .1** Regulations 4.5.5, 10.8 and 10.9 do not apply;
- .2** Regulation 4.5.1.1 (i.e., positioning of machinery spaces aft of cargo tanks, slop tanks, cargo pump rooms and cofferdams), Regulation 4.5.1.2 (i.e., the requirements for location of the main cargo control station), Regulations 4.5.1.4 and 4.5.2.1 to 4.5.2.3 need not apply. Additionally, Regulation 9.2.4.2.5 need not apply provided that the exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation are spaced at least 7 m away from the cargo area. The insulation of such boundaries is however to be to the satisfaction of the Society.
- .3** with regard to Regulation 9.2.4.1, the use of a method other than IC as defined in Regulation 9.2.3.1.1 may be permitted where considered appropriate;
- .4** the requirements of Regulation 9.2.3 may be applied in lieu of those in Regulation 9.2.4.2, where considered appropriate;
- .5** the provisions of Regulations 4.5.3, 4.5.4 and 4.5.6 to 4.5.8 need be applied only where considered appropriate, taking into account the requirement in 20.3.6.2 that cargo tank vent systems shall meet the relevant requirements of Section 8;
- .6** Regulations 10.2, 10.4 and 10.5 except Regulation 10.5.6, should apply as they would apply to tankers of 2,000 gross tonnages and over;

**20.3.0.1** The requirements of Regulations 4 and 7 are given in Part 1, Volume III, Rules for Machinery Installations, Section 12.

**.7** the provisions of 20.3.9.2.3 apply in lieu of Regulation 10.8; and

**.8** the provisions of 20.3.9.2.5 apply in lieu of Regulation 10.9.

**20.3.9.2** The following provisions also apply for the carriage of flammable liquids identified in 20.7:

- .1** During cargo transfer, water pressure is to be maintained on the fire main system.
- .2** Fire hoses, fitted with approved dual-purpose nozzles (i.e. spray/jet type with a shut-off), are to be attached to each fire hydrant in the vicinity of the flammable liquid to be carried.
- .3** Either a fixed deck foam system or a fixed fire extinguishing system of the dry chemical type complying with the following is to be provided:
  - .3.1** the system is to be located to protect the deck within the cargo area;

- .3.2** the system is to be capable of covering the deck within the cargo area without being moved;
- .3.3** when a fixed deck foam system is provided, it is to comply with the requirements Section 11.3.3 to 11.3.12. Only foam suitable for the products carried shall be used.
- .3.4** A fixed dry chemical fire-extinguishing system may be approved provided that:
  - .3.4.1** on a deck area of 45 m<sup>2</sup> or less, there are two or more dry chemical extinguishers whose total capacity is not less than 135 kg;
  - .3.4.2** on a deck area of more than 45 m<sup>2</sup>, there are three or more dry chemical extinguishers whose total capacity of extinguishing agent is not less than:
$$C = 3 A \quad [\text{kg}]$$
where A is the deck area, in [m<sup>2</sup>]
  - .3.4.3** the minimum rate of supply of the extinguishing agent is not less than 3 kg/min/m<sup>2</sup>.
- .4** An alternative to the systems required in 20.3.9.2.3 may be approved in accordance with the procedures contained in SOLAS Regulation II-2/22.
- .5** The cargo pump room where flammable liquids are handled is to be provided with a fixed fire extinguishing system in accordance with Section 11.2.

**20.3.9.3** For vessels which carry only liquids identified as non-flammable in 20.7, the fire-fighting requirements are to be to the satisfaction of the Society.

#### **20.3.10 Acid spill protection**

**20.3.10.1** Floors or decks under acid storage tanks and pumps and piping for acid are to have a lining or coating of corrosion-resistant material extending up to a minimum height of 500 mm on the bounding bulk heads or coamings. Hatches or other openings in such floors or decks are to be raised to a minimum height of 500 mm; however, where it is determined that this height is not practicable a lesser height may be permitted.

**20.3.10.2** Flanges or other detachable pipe connections are to be covered by spray shields.

**20.3.10.3** Portable shield covers for connecting the flanges of the loading manifold are to be provided. Drip trays of corrosion-resistant material are to be provided under loading manifolds for acids.

**20.3.10.4** Spaces for acid storage tanks and acid pumping and piping are to be provided with drainage arrangements of corrosion-resistant materials.

**20.3.10.5** Deck spills are to be kept away from accommodation and service areas by means of a permanent coaming of suitable height and extension (see Section 3.7-0.1).

#### **20.3.11 Ventilation of spaces in the cargo area**

The requirements of Section 12 apply. Relaxations concerning the distances required in Section 12.1.5 may, however, be granted.

#### **20.3.12 Vapour detection**

**20.3.12.1** Vapour detection for the cargoes carried is to be provided in accordance with the requirements contained in Section 13.

**20.3.12.2** Enclosed and semi-enclosed spaces containing installations for acid are to be fitted with fixed vapour detection and alarm systems which provide visual and audible indication. The vapour detection systems are to be capable of detecting hydrogen except that, in the case where only hydrochloric acid is carried, a hydrogen chloride vapour detection system is to be provided.

**20.3.12.3** At least two portable instruments for detecting flammable vapour concentration are to be provided when cargoes with a flashpoint not exceeding 60 °C (closed cup test) are carried.

**20.3.12.4** At least two portable instruments suitable for measuring the concentration of oxygen in atmospheric air are to be provided.

### **20.3.13 Special requirements – General**

The special requirements for the cargo as referred to in Section 17 or Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 19, are applicable; however, the requirement in Section 15.19.6 for a visual and audible high-level alarm may be waived taking into account the cargo carriage arrangements and cargo loading procedures.

### **20.3.14 Special requirements for the carriage of liquefied gases**

**20.3.14.1** Each enclosed space used for handling or storage of a liquefied gas is to be fitted with a sensor continuously monitoring the oxygen content of the space and an alarm indicating low oxygen concentration. For semi-enclosed spaces portable equipment may also be acceptable.

**20.3.14.2** Drip trays resistant to cryogenic temperatures are to be provided at manifolds transferring liquefied gases or at other flanged connections in the liquefied gas system.

**20.3.14.3** For the carriage of liquid nitrogen the requirements of Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 17.19 apply.

**20.3.14.4** For the construction of cargo tanks and cargo piping systems for liquefied nitrogen and liquid carbon dioxide the provisions of Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk apply as applicable.

**20.3.14.5** Emergency shut-off valves are to be provided in liquid outlet lines from each liquefied gas tank. The controls for the emergency shut-off valves shall meet the requirements given in 20.3.7.2 for remote shut-down devices.

### **20.3.15 Gauging and level detection**

Each cargo tank is to have an acceptable level gauging system. As a minimum the system shall meet the relevant requirements of Section 13 and Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 13. The systems for process tanks on board well-stimulation vessels are to be to the satisfaction of the Society.

### **20.3.16 Emergency remote shut-down**

In the case of transfer operations involving pressures in excess of 5 MPa, arrangements for emergency depressurizing and disconnection of the transfer hose are to be provided. The controls for activating emergency depressurization and disconnection of the transfer hose are to meet the requirements given in 20.3.7.2 for remote shut-down devices.

## **20.4 Pollution requirements**

**20.4.1** Each ship certified to carry a noxious liquid substance should be provided with a Cargo Record Book, a Procedures and Arrangements Manual and a Shipboard Marine Emergency Plan developed for the ship in accordance with Annex II to MARPOL 73/78 and approved by the Society.

**20.4.2** Discharge into the sea of residues of noxious liquid substances permitted for the carriage in Ship Type 3, or products listed in appendix 1 or ballast water, tank washings, or other residues or mixtures containing such substances, is prohibited. Any discharges of residues and mixtures containing noxious liquid substances should be to reception requirements for efficient stripping and underwater discharge arrangements in MARPOL 73/78, Annex II.

## **20.5 Personnel protection**

### **20.5.1 Decontamination showers and eyewashes**

Except in the case of pollution hazard only substances, a suitably marked decontamination shower and eyewash is to be available on deck in a convenient location. The shower and eyewash are to be operable in all ambient conditions (i.e. also below 0°C).

### **20.5.2 Protective and safety equipment**

Protective and safety equipment is to be kept on board in suitable locations as required by Section 14 or by Part 1, Volume IX, Rules for Ships Carrying Liquefied Gases in Bulk, Section 14, for products to be carried.

## **20.6 Operational requirements**

**20.6.1** Deck cargo and products covered by the provisions of this Section are not be loaded or unloaded simultaneously.

**20.6.2** Only personnel engaged in the transfer of cargo covered by the provisions of this Section shall be permitted to be in the cargo area and the adjacent open main deck during loading or unloading operations.

## 20.7 Table of permitted cargoes

**Table 20.1 Permitted cargoes**

Product	Flammability
Oil-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of these Guidelines	No
Water-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of these Guidelines	No
Drilling Brines, including:	No
Sodium Chloride Solution	No
Calcium Bromide Solution	No
Calcium Chloride Solution	No
Calcium nitrate/Magnesium nitrate/Potassium chloride solution	No
Calcium Nitrate Solution (50% or less)	No
Drilling brines (containing zinc salts)	No
Potassium Formate Solution	No
Potassium Chloride Solution	No
Ethyl Alcohol	Yes
Ethylene Glycol	No
Ethylene Glycol monoalkyl ether	Yes
Methyl Alcohol	Yes
Acetic acid	Yes
Formic acid	Yes
Hydrochloric Acid	No
Hydrochloric-hydrofluoric mixtures containing 3% or less Hydrofluoric acid	No
Sodium Silicate Solution	No
Sulphuric Acid	No
Triethylene Glycol	Yes
Toluene	Yes
Xylene	Yes
Liquid carbon dioxide	No
Liquid nitrogen	No
Noxious liquid, NF, (7) n.o.s. (trade name ..., contains ...) ST3, Cat. Y	No
Noxious liquid, F, (8) n.o.s. (trade name ..., contains ...) ST3, Cat. Y	Yes
Noxious liquid, NF, (9) n.o.s. (trade name ..., contains ...) ST3, Cat. Z	No
Noxious liquid, F, (10) n.o.s. (trade name ..., contains ...) ST3, Cat. Z	Yes
Noxious liquid, (11) n.o.s. (trade name ..., contains ...) Cat. Z	No
Non-noxious liquid, (12) n.o.s. (trade name ..., contains ...) Cat. OS	No