

**RULES
FOR THE CLASSIFICATION OF
SHIPS**

Part 27 – CHEMICAL TANKERS
January 2021

CROATIAN REGISTER OF SHIPPING

Hrvatska (Croatia) • 21000 Split • Marasovića 67 • P.O.B. 187
Tel.: (...) 385 (0)21 40 81 11
Fax.: (...) 385 (0)21 35 81 59
E-mail: tech.coord@crs.hr
web site: www.crs.hr

By the decision of the General Committee of Croatian Register of Shipping,

RULES FOR THE CLASSIFICATION OF SHIPS
Part 27 – CHEMICAL TANKERS

have been adopted on 22nd December 2020 and shall enter into force on 1st January 2021

REVIEW OF MODIFICATIONS AND ADDITIONS IN RELATION TO 2016 EDITION

RULES FOR THE CLASSIFICATION OF SHIPS ***Part 27 – Chemical tankers***

All major changes in respect to the Rules for the classification of ships, Part 27 – Chemical tankers, edition 2016, throughout the text are shaded.

The grammar and print errors, have been corrected throughout the text of the Rules and are not subject to above indication of changes.

This Part of the Rules includes the requirements of the following international organisations:

International Maritime Organization (IMO)

Conventions: International Convention for the Safety of Life at Sea, 1974 (SOLAS 74) and all subsequent amendments up to and including **MSC.436(99)**.
Protocol of 1988 relating to the International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS PROT (amended) 1988).

Resolutions: A.567(14) and A.1122(30);
MSC.35(63), MSC.62(67), MSC.235(82), MSC.325(90), MSC.340(91), MSC.369(93), MSC.440(99) and **MSC.460(101)**;
MEPC.148(54), MEPC.225(64), MEPC.250(66), MEPC.302(72) and **MEPC.318(74)**.

Codes: International Code for the Construction and Equipment of Ship's Carrying Dangerous Chemicals in Bulk resolution MSC.4(48)/MEPC.19(22) and all subsequent amendments up to and including resolution **MSC.460(101)/MEPC.318(74)**.

Circulars: MSC/Circ.314, MSC/Circ.394, MSC/Circ.406/Rev.1, MSC/Circ.553, MSC/Circ.585, MSC/Circ.670, MSC/Circ.677, MSC/Circ.731, MSC/Circ.879, MSC/Circ.879/Corr.1, MSC/Circ.929, MSC/Circ.1009, MSC/Circ.1095, MSC/Circ.1165, MSC.1/Circ.1220, MSC.1/Circ.1237, MSC.1/Circ.1241, MSC.1/Circ.1267, MSC.1/Circ.1269, MSC.1/Circ.1270, MSC.1/Circ.1270/Corr.1, MSC.1/Circ.1312, MSC.1/Circ.1312/Corr.1, MSC.1/Circ.1316, MSC.1/Circ.1317, MSC.1/Circ.1323, MSC.1/Circ.1324, MSC.1/Circ.1384, MSC.1/Circ.1385, MSC.1/Circ.1386, MSC.1/Circ.1459, MSC.1/Circ.1501 and MSC.1/Circ.1504;
MSC-MEPC.2/Circ.7, MSC-MEPC.2/Circ.14, MSC-MEPC.2/Circ.16 and MSC-MEPC.2/Circ.17;
MSC-MEPC.5/Circ.10 and MSC-MEPC.5/Circ.11;
MEPC.1/Circ.512/Rev.1, MEPC.1/Circ.856, MEPC.1/Circ.856/Corr.1 and **MEPC.1/Circ.879**;
MEPC.2/Circular;
BLG.1/Circ.25.

International Association of Classification Societies (IACS)

Unified Requirements (UR):
F20 (2015, rev.7).

Unified Interpretations (UI):
CC1 (2007, rev. 2), CC2 (2007, rev. 1), CC3 (2007, rev. 1), CC4 (2002), CC5 (2008), CC6 (2011) and CC7 (2016);
SC 201 (2006, rev. 1), SC 253(2016) and SC 290(2019).

Recommendations (Rec.):
110 (2010, rev.1)

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FOREWORD

1. The lay out of the *Rules for the Classification of Ships, Part 27 – Chemical Tankers* (hereinafter referred as: the Rules) is based on the:

- (a) International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) adopted by the IMO Maritime Safety Committee by resolution MSC.4(48) and by the Marine Environment Protection Committee by the resolution MEPC.19(22); and
- (b) subsequent amendments thereto adopted by the following resolutions:

	Resolution	Entry into force
1	MSC.10(54)	30 October 1988
2	MSC.14(57) MEPC.32(27)	13 October 1990 13 October 1990
3	MSC.28(61) MEPC.55(33)	1 July 1994 1 July 1994
4	MSC.50(66) MEPC.69(38)	1 July 1998 1 July 1998
5	MSC.58(67) MEPC.73(39)	1 July 1998 10 July 1998
6	MSC.102(73) MEPC.79(43) MEPC.90(45)	1 July 2002 1 July 2002 1 July 2002
7	MSC.176(79) MEPC.119(52)	1 January 2007 1 January 2007
8	MSC.219(82) MEPC.166(56)	1 January 2009 1 January 2009
9	MSC.340(91) MEPC.225(64)	1 June 2014 1 June 2014
10	MSC.369(93) MEPC.250(66)	1 January 2016 1 January 2016
11	MSC.440(99) MEPC.302(72)	1 January 2020 1 January 2020
12	MSC.460(101) MEPC.318(74)	1 January 2021 1 January 2021

This Part of the Rules includes requirements of IBC Code, as amended, and International Maritime Organization (IMO) Assembly Resolutions specified in the text; in reproducing the above text in this Part of the Rules applicable for the purpose of classification, the word "Administration", wherever mentioned, has been replaced by the word "*Register*".

IACS Unified Requirements are included in text of Rules.

Unified Interpretations are included in text of Rules and printed in italic text.

Additional classification requirements of the *Register*, where applicable, are stated at the end of the referred section, head or item, as applicable.

2. Under the provisions of regulation 9 and 10 of Chapter VII of the International Convention for the Safety of Life at Sea, 1974 (SOLAS 74), as amended and the provisions of regulation 11 of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), chemical tankers constructed on or after 1 July 1986 and ships converted to chemical tankers on or after 1 July 1986 must comply with the requirements of the IBC Code.

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

4. For the purposes of MARPOL 73/78, the IBC 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 and identified as such by an entry of "X", "Y" or "Z" in column **c** in the table of Section 17.

5. This Part of the Rules contains guidelines including interpretation and application criteria of the IBC Code provisions set forth by the *Register* and unified interpretations of the provisions of the IBC Code which have been agreed upon by IMO (see MSC/Circ. 406/Rev.1).

6. For guidelines for the transport and handling of limited amounts of hazardous and noxious liquid substances in bulk in offshore support vessels (see resolution MSC.235(82)) resolution A.1122(30) applies.

7. For guidelines for the transport of vegetable oils in deeptanks or in independent tanks specially designed for the carriage of such vegetable oils in existing general dry cargo ships see resolution MEPC.148(54).

8. For ships constructed on or after 1 January 2017 complying with Polar Code, the carriage of noxious liquid substances (NLS) identified in chapter 17, column e, as ship type 3 or identified as NLS in chapter 18 of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) in cargo tanks of type 3 ships, shall be subject to the approval of the *Register*. The results shall be reflected on the International Pollution Prevention Certificate for the Carriage of Noxious Liquid Substances in Bulk or Certificate of Fitness identifying the operation in polar waters, see MEPC.1/Circ.856 and MEPC.1/Circ.856/Corr.1.

When considering the approval of the carriage of NLS identified in chapter 17, column e, as ship type 3 or identified as NLS in chapter 18 of the IBC Code, the carriage conditions for voyages in polar waters may be noted in the column "Conditions of carriage" or in the general remarks related to the certificate. This applies to both the NLS Certificate and Certificate of Fitness.

1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 In general, the requirements in this Part of the Rules applies to cargo containment and cargo handling systems and to the interfaces between these systems and other parts of the ship.

1.1.2 Unless expressly provided otherwise in this Part of the Rules, the ship's hull and equipment, machinery and electrical equipment, trim and stability, safety, radio and navigational equipment, etc. shall generally comply with the requirements in the other relevant Parts of the Rules.

1.1.3 Emergency towing arrangements shall be fitted on chemical tankers of 20,000 tdw and above in accordance with the requirements specified in *Rules, Part 3 – Hull Equipment*, 5.4 (see resolution MSC.35(63)).

1.1.4 Means shall be provided to enable the crew to gain safe access to the bow even in severe weather conditions which shall be to the satisfaction of the *Register* (see resolution MSC.62(67)).

Fibre Reinforced Plastic (FRP) gratings used in lieu of steel gratings for safe access to tanker bows shall possess:

- low flame spread characteristics and shall not generate excessive quantities of smoke and toxic products as per the FTP Code; and
- adequate structural fire integrity as per recognized standards, see MSC.1/Circ.1504 and IACS UI SC 253 Rev.1, after undergoing tests in accordance with the above standards.

1.1.5 Steering gear on chemical tankers of 10,000 tdw and above shall comply with the additional requirements as specified in *Rules, Part 9 – Machines*, 6.2.

1.2 APPLICATION

1.2.1 This Part of the Rules 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 not having significant fire hazards in excess of those of petroleum products and similar flammable products;

1.2.2 Application of the requirements in this Part of the Rules is at present limited to the products listed in the Table 17.1.1-1 of 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 this Part of the Rules are found in Section 18.

1.2.3 Liquids covered by this Part of the Rules are those having a vapour pressure not exceeding 0.28 MPa absolute at a temperature of 37.8°C.

1.2.4 For the purpose of the safety of life at sea, this Part of the Rules 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**.

1.2.5 For the purposes of the marine environment pollution prevention, this Part of the Rules applies only to NLS tankers, as defined in 1.16.2 of Annex II of MARPOL 73/78, 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.

1.2.6 For a product proposed for carriage in bulk, but not listed in Sections 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 6.3 of Annex II of MARPOL 73/78 must be followed.

See also MEPC.1/Circ.857.

1.2.7 Unless expressly provided otherwise, this Part of the Rules 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.

Unless expressly provided otherwise, for the application of the present requirements to existing ships see *Rules, Part 1 - General Requirements, Chapter 1*, 1.3.

1.2.8 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 1.14 of Annex II of MARPOL 73/78.

1.2.9 Where reference is made in this Part of the Rules to a paragraph, all the provisions of the subparagraphs of that designation shall apply.

1.2.10 For the guidelines for the provisional assessment of liquid substances transported in bulk see MEPC.1/Circ.512/Rev.1.

See also MEPC.1/Circ.857.

1.2.11 For the carriage of blends of bio-fuels and Marpol Annex I cargoes see MSC-MEPC.2/Circ.17 – “2019 Guidelines for the carriage of biofuels and Marpol Annex I cargoes”.

For the carriage of energy-rich fuels and their blends see MEPC.1/Circ.879.

1.2.12 Blending of the bulk liquid cargoes and production processes during sea voyages is prohibited. It means that:

- .1 The physical blending of bulk liquid cargoes during sea voyages is prohibited. Physical blending refers to the process whereby the ship's cargo pumps and pipelines are used to

internally circulate two or more different cargoes with the intent to achieve a cargo with a new product designation. This prohibition does not preclude the master from undertaking cargo transfers for the safety of the ship or protection of the marine environment.

- .2 The prohibition in .1 does not apply to the blending of products for use in the search and exploitation of seabed mineral resources on board ships used to facilitate such operations.
- .3 Any production process on board a ship during sea voyages is prohibited. Production processes refer to any deliberate operation whereby a chemical reaction between a ship's cargo and any other substance or cargo takes place.
- .4 The prohibition in .3 does not apply to the production processes of cargoes for use in the search and exploitation of seabed mineral resources on board ships used to facilitate such operations, refer to the Code for the Transport and Handling of Hazardous and Noxious Liquid Substances in Bulk on Off-shore Support Vessels - OSV Chemical Code (resolution A.1122(30)).

1.3 HAZARDS AND CRITERIA FOR ASSIGNING CARRIAGE REQUIREMENTS FOR PRODUCTS SUBJECT TO THIS PART OF THE RULES

Hazards of products covered by this Part of the Rules include:

1.3.1 Fire hazard, defined by flashpoint, explosive/flammability limits/range and autoignition temperature of the chemical.

1.3.2 Health hazard, defined by:

- .1 corrosive effects on the skin in the liquid state; or
- .2 acute toxic effect, taking into account values of:
LD50 (oral): a dose, which is lethal to 50% of the test subjects when administered orally;
LD50 (dermal): a dose, which is lethal to 50% of the test subjects when administered to the skin;
LC50 (inhalation): the concentration which is lethal by inhalation to 50% of the test subjects; or
- .3 Other health effects such as carcinogenicity and sensitization.

1.3.3 Reactivity hazard, defined by reactivity:

- .1 with water;
- .2 with air;
- .3 with other products; or

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

1.3.4 Marine pollution hazard, as defined by:

- .1 bioaccumulation;
- .2 lack of ready biodegradability;
- .3 acute toxicity to aquatic organisms;
- .4 chronic toxicity to aquatic organisms;
- .5 long term human health effects; and
- .6 physical properties resulting in the product floating or sinking and so adversely affecting marine life.

1.3.5 For the criteria for assigning carriage requirements for products subject to this Part of the Rules see Chapter 21 of the IBC Code.

1.4 DEFINITIONS

1.4.1 Definitions and explanations relating to the general terminology of the Rules are given in *Rules, Part 1 – General Requirements, Chapter 1, Section 2*.

For other definitions and explanations see other relevant Parts of the Rules.

1.4.2 For the purpose of this Part of the Rules the following definitions apply, unless expressly provided otherwise (see additional definitions given in individual Sections):

- .1 **Accommodation spaces** - 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** - the Government of the State whose flag the ship is entitled to fly. For Administration (Port) see Port Administration.
- .3 **Anniversary date** - 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** - the temperature at which a product exhibits a vapour pressure equal to the atmospheric pressure.
- .5 **Breadth (B)** - the maximum breadth of the ship, measured amidships to the moulded line of the frame in a ship with a metal shell and to the outer surface of the hull in a ship with a shell of any other material. The breadth (B) shall be measured in metres.
- .6 **Cargo area** - 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, coffer-

- dams, 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** - a space containing pumps and their accessories for the handling of the products covered by this Part of the Rules.
- .8 **Cargo service spaces** - spaces within the cargo area used for workshops, lockers and store-rooms of more than 2 m² in area, used for cargo-handling equipment.
- .9 **Cargo tank** - the envelope designed to contain the cargo.
- .10 **Chemical tanker** - a cargo ship constructed or adapted and used for the carriage in bulk of any liquid product listed in Section 17.
- .11 **Cofferdam** - the isolating space between two adjacent steel bulkheads or decks. This space may be a void space or a ballast space.
- .12 **Control stations** - 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** - any liquid chemicals designated as presenting a safety hazard, based on the safety criteria for assigning products to Chapter 17 of the IBC Code.
- .14 **Density** - 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** - 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** - 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 **Gas-freeing** - the process where a portable or fixed ventilation system is used to introduce fresh air into a tank in order to reduce the concentration of hazardous gases or vapours to a level safe for tank entry.
- .18 **Hold space** - the space enclosed by the ship's structure in which an independent cargo tank is situated.
- .19 **Independent** - arrangement of a piping or venting system, for example, in no way connected to another system and with no provisions available for the potential connection to other systems.
- .20 **Length (L)** - means 96% of the total length on a waterline at 85% of the least moulded depth measured from the top of the keel, or the length from the foreside of the stem to the axis of the rudder stock on that waterline, if that be greater. In ships designed with a rake of keel, the waterline on which this length is measured shall be parallel to the designed waterline. The length (L) shall be measured in metres.
- .21 **Machinery spaces of category A** - 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.
- .22 **Machinery spaces** - all machinery spaces of category A and all other spaces containing propelling machinery, boilers, oil fuel units, steam and internal-combustion engines, generators and major electrical machinery, oil filling station, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces, and trunks to such spaces.
- .23 **MARPOL** - the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997, as amended.
- .24 **Noxious Liquid Substance** - 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.
- .25 **Oil fuel unit** - 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.
- .26 **Organization** - the International Maritime Organization (IMO).
- .27 **Permeability (of a space)** - the ratio of the volume within that space which is assumed to be occupied by water to the total volume of that space.
- .28 **Port administration** - the appropriate authority of the country in the port of which the ship is loading or unloading.

- .29 Products** - the collective term used to cover both Noxious Liquid Substances and Dangerous Chemicals.
- .30 Pump-room** - a space, located in the cargo area, containing pumps and their accessories for the handling of ballast and oil fuel.
- .31 Purging** - the introduction of inert gas into a tank which is already in an inert condition with the object of further reducing the oxygen content; and/or reducing the existing hydrocarbon or other flammable vapours content to a level below which combustion cannot be supported if air is subsequently introduced into the tank.
- .32 Recognized organization** - an organization authorized by an Administration in accordance with MARPOL Annex II regulation 8.2.2 and SOLAS regulation XI-1/1.
- .33 Recognized standards** - applicable international or national standards acceptable to the *Register* or standards laid down and maintained by an organization which complies with the standards adopted by the Organization which is recognized by the *Register*.
- .34 Reference temperature** - the temperature at which the vapour pressure of the cargo corresponds to the set pressure of the pressure-relief valve.
- .35 Separate** - arrangement of a cargo piping system or cargo vent system, for example, in no way connected to another cargo piping or cargo vent system.
This separation may be achieved by the use of design or operational methods. Operational methods shall not be used within a cargo tank and shall consist of one of the following types:
- .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.
- .36 Service spaces** - 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.
- .37 SOLAS** - the International Convention for the Safety of Life at Sea, 1974, as amended.
- .38 Vapour pressure** - the equilibrium pressure of the saturated vapour above a liquid expressed in Pascals (Pa) at a specified temperature.
- .39 Void space** - an enclosed space in the cargo area external to a cargo tank, other than a hold space, ballast space, oil fuel tank, cargo pump-room, pump-room, or any space in normal use by personnel.

1.5 EQUIVALENTS

1.5.1 Where this Part of the Rules 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 *Register* 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 this Part of the Rules. However, the *Register* 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 this Part of the Rules, unless such substitution is specifically allowed by this Part of the Rules.

1.6 TECHNICAL DOCUMENTATION

1.6.1 In addition to the technical documentation specified in *Rules, Part 1-General Requirements*, Chapter 2/1.2 the following technical data and documents shall be submitted to the *Register*:

- .1 drawings and strength calculations of cargo tanks and data on their location with regard to the ship's bottom and side shell;
- .2 data of the foundations and fastening of the cargo tanks where the cargo tanks are independent from the hull or positioned on the deck;
- .3 drawings and schemes of cargo piping systems, including details of expansion fittings, flange connections, stop valves and cargo transfer control systems;
- .4 drawings and description of inert gas system;
- .5 evaluation of suitability of fire extinguishing system and fire extinguishing media to be used with regard to the products intended to be carried (including calculation of the capacity of system);
- .6 schemes and calculations of mechanical ventilation in the cargo area and other spaces in which work is performed on the cargo, including data of materials used for construction of impellers and housing of ventilation fans;
- .7 schemes and calculations of cargo tanks vent system;
- .8 schemes and descriptions of all systems and devices for vapour detection, tank gauging and cargo temperature measuring;
- .9 schemes and calculations of bilge and ballast water lines within the cargo area including cofferdams, pipe tunnels, hold spaces, etc.;
- .10 evaluation of suitability of insulation materials used within cargo area, including details of production technology, mainte-

- nance, quality control and vibration and sun radiation resistance;
- .11 drawings of quick-closing devices for cargo systems;
 - .12 schemes and calculations of the cargo heating and cooling systems;
 - .13 drawings of cargo tank pressure/vacuum devices;
 - .14 schemes of cargo pressure and temperature control;
 - .15 electric circuit diagrams for measuring and signalling instruments;
 - .16 electric circuit diagrams for remote controlled valves and automatic and remote stopping of electrical machinery;
 - .17 arrangement plans of electrical equipment in cargo area;
 - .18 cable laying plans within cargo area;
 - .19 plans of electric bonding for electrical equipment, cables and piping within cargo area;
 - .20 evaluation of suitability of electrical equipment within cargo area intended to be used;
 - .21 data about preventive measures against additional stresses of independent tanks caused by the adjacent hull structure.

1.6.2 A general arrangement plan or special drawings shall be prepared showing location of:

- .1 cargo tank access hatches, tank washing machine hatches and all other cargo tank openings;
- .2 doors, hatches and all other openings in gas-dangerous spaces and areas (see *Rules, Part 12 - Electrical Equipment, 19.2*);
- .3 cargo tank vent outlets and air inlets and outlets and outlets of ventilating systems in cargo area;
- .4 entrances, doors, sidescuttles, air inlets and outlets and other openings to accommodation, service and machinery spaces and control stations in superstructure and other spaces facing the cargo area;
- .5 cargo tanks grouped, where necessary, in order to achieve segregation of mutually incompatible cargoes.

1.6.3 A list of cargoes intended to be carried shall be submitted to the *Register* for consideration. For product proposed for carriage but not listed in Section 17 and Section 18, before inclusion in the approved List of products the ship is suitable to carry, the procedure prescribed in 1.2.6 shall be complied with.

2 SHIP SURVIVAL CAPABILITY AND LOCATION OF CARGO TANKS

2.1 GENERAL

2.1.1 Ships, subject to this Part of the Rules, shall survive the normal effects of flooding following assumed hull damage caused by some external force (see 2.5). In addition, to safeguard the ship and the environment, the cargo tanks of certain types of ships (see 2.1.2) 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 (see 2.6). Both the assumed damage and the proximity of the cargo tanks to the ship's shell shall be dependent upon the degree of hazard presented by the products to be carried.

2.1.2 Ships, subject to this Part of the Rules, shall be designed to one of the following standards:

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

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

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

2.1.5 See IACS Rec. No.110 Guideline for Scope of Damage Stability Verification on new oil tankers, chemical tankers and gas carriers.

2.2 FREEBOARD AND STABILITY

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

2.2.2 The stability of the ship in all seagoing conditions shall be to a standard which is acceptable to the *Register* (see *Rules, Part 4 – Stability, 3.4*).

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 (see *Rules, Part 4 – Stability, 3.4*).

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 (see MSC Circ.406/Rev.1). In addition, the booklet shall contain sufficient information to enable the master to load and operate the ship in a safe and seaworthy manner, to the satisfaction of the *Register* (see *Rules, Part 4 – Stability, 1.5*).

2.2.6 All ships, subject to this Part of the Rules (/ IBC Code), shall be fitted with a stability instrument, capable of verifying compliance with intact and damage stability requirements, approved by the *Register* having regard to the performance standards recommended by the IMO:

- .1 ships constructed before 1 January 2016 shall comply with this requirement at the first scheduled renewal survey of the ship on or after 1 January 2016 but not later than 1 January 2021;
- .2 notwithstanding the requirements of 2.2.6.1, a stability instrument fitted on a ship constructed before 1 January 2016 need not be replaced provided it is capable of verifying compliance with intact and damage stability, to the satisfaction of the *Register*; and
- .3 for the purposes of control under regulation 16 of MARPOL Annex II, the *Register* shall issue a document of approval for the stability instrument.

For performance standards recommended by the IMO see part B, chapter 4, of the International Code on Intact Stability, 2008 (2008 IS Code), as amended; the Guidelines for the Approval of Stability Instruments (MSC.1/Circ.1229), annex, section 4, as amended; and the technical standards de-

fined in part 1 of the Guidelines for verification of damage stability requirements for tankers (MSC.1/Circ.1461).

2.2.7 The *Register* may waive the requirements of 2.2.6 for the following ships provided the procedures employed for intact and damage stability verification maintain the same degree of safety, as being loaded in accordance with the approved conditions (*refer to operational guidance provided in part 2 of the Guidelines for verification of damage stability requirements for tankers (MSC.1/Circ.1461)*).

Any such waiver shall be duly noted on the International Certificate of Fitness referred to in paragraph 1.5.4 of the IBC Code:

- .1 ships which are on a dedicated service, with a limited number of permutations of loading such that all anticipated conditions have been approved in the stability information provided to the master in accordance with the requirements of 2.2.5;
- .2 ships where stability verification is made remotely by a means approved by the *Register*;
- .3 ships which are loaded within an approved range of loading conditions; or
- .4 ships constructed before 1 January 2016 provided with approved limiting KG/GM curves covering all applicable intact and damage stability requirements.

2.2.8 No loading conditions, other than those contained in the approved Loading and Stability Information Booklet, shall be used unless previously approved by the *Register*.

Alternatively, such cases may be examined by the master or a responsible officer when a loading instrument approved in accordance with requirements specified in *Rules, Part 2 – Hull, 4.1* is installed onboard.

2.2.9 In no case shall the distance between the top of solid ballast and cargo tank bottom be less than the assumed maximum vertical extent of the bottom damage.

The solid ballast shall be of concrete block or similar materials which can be fitted securely.

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 super-structures and deck-houses on

the freeboard deck fitted with weathertight doors shall comply with the requirements of the relevant regulation of the International Convention on Load Lines in force, except that the choice of valves shall be limited to:

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

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

2.3.3 The automatic non-return valves referred to in 2.3.1.1 and 2.3.1.2 shall be fully effective in preventing admission of water into the ship, taking into account the sinkage, trim and heel in survival requirements in 2.9, and shall comply with recognized standards (see *Rules, Part 8 – Piping, 1.4* and 1.5).

2.3.4 The requirements in 2.3.1 do not apply to the overboard discharges led through the shell from within super-structures and deck-houses located above the second super-structure deck.

2.4 CONDITIONS OF LOADING

2.4.1 Damage survival capability shall be investigated on the basis of loading information submitted to the *Register* for all anticipated conditions of loading and variations in draught and trim. Ballast conditions where the chemical tanker is not carrying products covered by this Part of the Rules, 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 as prescribed in Table 2.5.1-1:

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 2.5.1-1

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

2.6 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.

2.6.3 Any cargo tank, irrespective of its location, may be used for collecting contaminated cargo pump room bilge water or tank washings, as an exception to the requirements in 2.6.1.1 and .2.

2.6.4 In general, the area of suction wells shall not be greater than that required to accommodate cargo pumps, suction pipes, valves, heating coils etc., and to ensure efficient flow and the necessary access for cleaning and maintenance.

The requirements for the total retain quantity of residue not in excess of 0.075 m³ specified in 12.3 of Annex II of MARPOL 73/78 shall also be taken into consideration.

2.7 FLOODING ASSUMPTIONS

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

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

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

*Note: 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 from a readily accessible place in case of damage 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 securely closed weathertight at final equilibrium may be permitted.

2.7.9 Tunnels, ducts, pipes, doors, bulkheads and decks which might form watertight boundaries of intact spaces in the case of assumed damage (see 2.5.1) shall have minimum strength adequate to withstand the pressure height corresponding to the deepest equilibrium waterline in damaged conditions.

2.7.10 The calculations made as required in 2.7.1 shall allow for preparing maximum permissible VCG-curves (offsets) or, alternatively, the minimum permissible metacentric heights which shall be included in the stability manual.

It is recommended to prepare individual curves (offsets) for each considered damage case, except those cases

for which can be demonstrated that will not result in a severe condition.

2.7.11 When preferred by the Owner, damage stability calculations may be performed for a limited number of loading conditions shown in the approved Loading and Stability Information Booklet. In this case the curves (offsets) prescribed in 2.7.10 are not required and the loading limitations shall be appended to the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

2.7.12 Where damage survival capability criteria (see 2.9) satisfies for conditional loading condition as specified in 2.7.13 the requirements for calculations prescribed in 2.7.10 and 2.7.11 may be dispensed with.

2.7.13 The conditional loading condition shall correspond to the loading condition with a maximum draught of the ship and maximum permissible trim (by stern or by bow, whichever gives more unfavourable results) as well as highest possible centre of gravity above base line (taking into account free surface effect) and empty damaged compartments for each considered damage case.

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 *Register*.

2.8.2 In the case of small type 2 and type 3 ships which do not comply in all respects with the appropriate requirements of 2.8.1.3 and 2.8.1.6, special dispensation may only be considered by the *Register* 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.

2.8.3 The longitudinal extent of damage to the superstructure in the case of side damage where the machinery space is regarded as one-space flooding in 2.8.1, shall generally to be the same as the longitudinal extent of the side damage to the machinery space (see Figure 2.8.3-1).

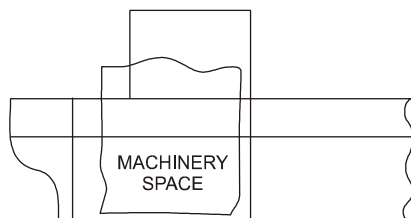


Figure 2.8.3-1
Longitudinal extent of damage to superstructure

2.8.4 If the concept of a stepped machinery space forward bulkhead is applied (see 3.2.1), for damage stability considerations in 2.8.1.3 and 5 when such a bulkhead contains a step more than 3 m in length, damage shall be treated as shown in Figure 2.8.4-1

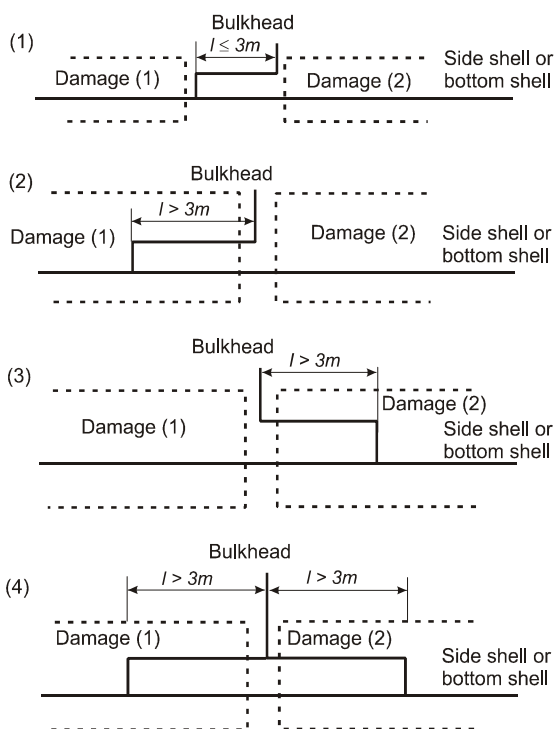


Figure 2.8.4-1
Damage to stepped machinery space forward bulkhead

2.8.5 For the type 3 ships of less than 125 m in length, but no less than 70 m, the ability to survive the flooding of the machinery space in accordance with survival requirements in 2.9 shall apply only, as a minimum.

Alternative proposals for equivalent survival ability may be considered by the *Register*.

2.8.6 In the case of type 2 and type 3 ships of less than 70 m in length special dispensation with regard to the

compliance with the appropriate requirements of 2.8.1.3 and 2.8.1.6 (see 2.8.2) shall be in accordance with the following:

- .1 Assumed extent of damage shall be in accordance with 2.5 and 2.8.1.3 and 2.8.1.6.
- .2 Downflooding point and angle of heel shall be in accordance with 2.9.2 and 2.9.3.
- .3 The area with positive sign of the righting lever curve within the range from the arbitrary point between the final stage of equilibrium after flooding and 25° (or 30° if no deck immersion occurs) to 20° shall be not less than 0.0175 m-rad.
- .4 The maximum value of GZ is not specified.

2.9 SURVIVAL REQUIREMENTS

2.9.1 Ships subject to this Part of the 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 criteria as specified in 2.9.2 and 2.9.3. See MSC-MEPC.5/Circ.11.

2.9.2 In any stage of flooding:

- .1 the waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding or downflooding may take place. Such openings shall include air pipes and openings which are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and watertight flush scuttles, small watertight cargo tank hatch covers which maintain the high integrity of the deck, remotely operated watertight sliding doors, and sidescuttles of the non-opening type;
- .2 the maximum angle of heel due to unsymmetrical flooding shall not exceed 25°, except that this angle may be increased to 30° if no deck immersion occurs;
- .3 the residual stability during intermediate stages of flooding shall be to the satisfaction of the *Register*. 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 capa-

- ble of being closed weathertight may be permitted. See IACS UI CC 7; and
- .2 the emergency source of power shall be capable of operating. See IACS UI SC 290.

2.9.4 The words “to the satisfaction of the Register” in 2.9.2.3 means as follows. In ordinary cases, the final stage of flooding is considered most severe, but the most severe condition may be encountered during intermediate stages of flooding involving replacement of sea water in the damaged space. In this connection, stability during such intermediate stages of flooding shall be considered when specifically requested by the *Register*.

2.9.5 The survival requirements at the final stage of equilibrium after flooding shall be in accordance with Figure 2.9.5-1.

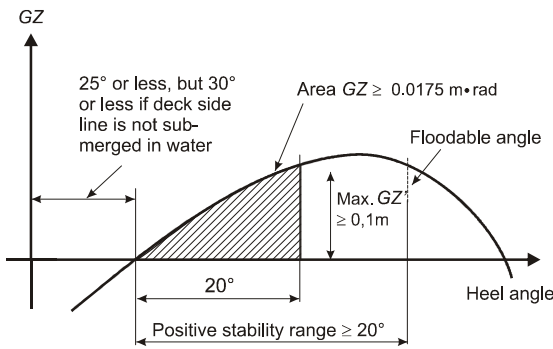


Figure 2.9.5-1
 Stability criteria at final equilibrium after flooding

Note: The initial point of calculation of the stability range at an angle of heel of 20° may be taken arbitrarily at any intermediate point between the angle of heel at the final stage of equilibrium and the maximum angle of heel.

3 SHIP ARRANGEMENTS

3.1 CARGO SEGREGATION

3.1.1 Unless expressly provided otherwise, tanks containing cargo or residues of cargo subject to this Part of the 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.

3.1.2 Cargo piping shall not pass through any accommodation, service or machinery space 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.

3.1.4 If cargo piping systems or cargo venting systems shall 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 this Part of the Rules shall not be carried in either the fore or aft peak tank.

3.1.6 For cargo tanks and slop tanks, neither linear contact nor point contacts with accommodation spaces, service spaces, machinery space, etc. shall be accepted. Further, no segregation of spaces in contact by means of slanting plates shall be accepted.

3.1.7 Cargo piping shall not pass through the spaces specified in 3.1.2 and, in addition, through spaces such as fuel oil tanks, fresh water tanks and control stations.

3.1.8 The common edge in a cruciform joint, i.e. the linear contacts and point contacts, either vertically or horizontally (see Figure 3.1.8-1) 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.

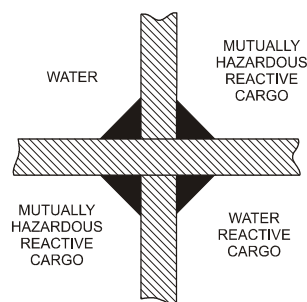


Figure 3.1.8-1

Segregation of mutually hazardous reactive cargoes and water reactive cargoes and water

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 requirements specified in *Rules, Part 17 – Fire Protection*, 4.5 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 inlets, air outlets and other openings into accommodation, service and machinery spaces and control stations in relation to cargo piping and cargo vent systems.

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

See 3.2.14.

3.2.4 When segregated by a gastight deck and well ventilated, such a space is not electrically hazardous space, and in this case, arrangement of accommodation spaces, service spaces or control stations above fuel oil tanks adjacent to

cargo tanks in the poop as given in Figure 3.2.4-1 may be accepted.

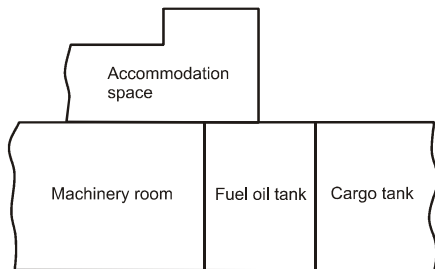


Figure 3.2.4-1

Location of accommodation spaces above fuel oil tanks

3.2.5 Store rooms where doors may be fitted within the limits mentioned in 3.2.3 are restricted to lockers containing cargo related and safety equipment and decontamination shower spaces (see 14.1 and 14.3).

3.2.6 Entrances and openings to service spaces located forward of the cargo area may not face such area. However, for ships of less than 70 m in length alternative arrangements may be specially considered by the *Register*.

3.2.7 The gastight wheelhouse doors and windows shall be fitted with packing and dog bolts. These windows, doors and clear view screens shall be hose-tested at a pressure of 0.2 N/mm². To ensure gastightness of the clear view screen, an additional window fitted with dog bolts or other means of gastight capable of tightening the window pane when the screen is not rotating shall be provided.

3.2.8 Regardless of the cargo to be carried, means shall be provided to keep deck spills not flowing along the sides of the superstructures and deck houses where entrances, air inlets and outlets and other openings as specified in 3.2.3 are located. This may be accomplished by provision of a permanent continuous coaming extending from side to side and having height of not less than 300 mm or a superstructure/deckhouse front shall be continued to the sides of the ship in the form of a sill.

3.2.9 Continuous coaming having height of not less than 150 mm above the deck and nowhere less than 50 mm above the upper edge of the shear strake shall be fitted on the ship's sides to keep any spills on deck in the cargo area.

3.2.10 Escape routes from the machinery spaces shall not terminate within the coamings or within a distance of 3 m beyond the coamings specified in 3.2.8.

3.2.11 Chain lockers shall be arranged outside the cargo area, except for cofferdams, ballast tanks, etc.

3.2.12 Paint lockers, regardless of their use, shall not be located above the cargo area (see MSC.1/Circ.1241).

3.2.13 For the voluntary structural guidelines for ships carrying liquids in bulk containing benzene see MSC/Circ.1220.

3.2.14 If, owing to the design of a ship, it is impossible in practice, or unreasonable, to fulfil the requirements relating to the location of access doors, air inlets or other openings in superstructures and/or deckhouses, the *Register* may adopt alternative provisions provided that, as a consequence

of doing so, no ignition source is located in the hazardous areas defined in publication IEC 60092-502, except for electrical installations that have the required protection and have been certified as safe under that standard.

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 floors; and
- .2 unrestricted access to all valves necessary for cargo handling for a person wearing the required personnel protective equipment and/or safety equipment.

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

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

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

3.3.5 Means shall be provided to deal with drainage and any possible leakage from cargo pumps and valves in cargo 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 shall be provided. A shore connection with a standard coupling or other facilities shall be provided for transferring contaminated liquids to onshore reception facilities.

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

3.3.7 Where machinery, such as cargo pumps and fans, 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 (see *Rules, Part 7 – Machinery Installation*, 1.12).

3.3.8 Cargo pump-rooms and pump-rooms shall be separated from adjacent spaces by means of gas-tight boundaries and may not give direct access to other spaces except as permitted in 3.4.1.

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

3.3.10 For other technical requirements relating to protection at work in cargo pump-room national requirements of the flag State the ship is entitled to fly shall be observed.

3.3.11 The requirement for discharge pressure gauges in 3.3.6 shall apply also to tank cleaning pumps, bilge pumps, etc. used for handling cargoes and liquids containing cargoes in general.

3.3.12 The shaft seals, required in 3.3.7, of a type for periodical feeding of grease shall not be accepted. Only continuous gastight sealing type is acceptable. These shaft seals shall be provided outside the cargo pump room. (See Figure 3.3.12-1).

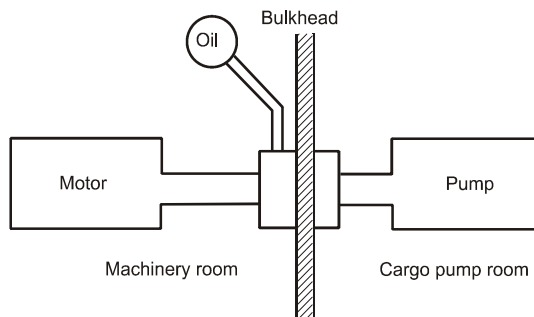


Figure 3.3.12-1

Lubrication of shaft gastight seal

3.3.13 In ships of 500 gross tonnage and over, carrying products with a flash point not exceeding 60°C, cargo pump-rooms shall additionally comply with following:

- .1 cargo pumps, ballast pumps and stripping pumps temperature shall be monitored to detect overheating due to pump failures (see 15.21);
- .2 lighting except emergency lighting, shall be interlocked with ventilation such that the ventilation shall be in operation when switching on the lighting. Failure of the ventilation system shall not cause the lighting to go out.
Also, where the lighting in the cargo pump-rooms is used as the emergency lighting the loss of the main source of electrical power shall not prevent operation of the emergency lighting (see MSC/Circ.1037);
- .3 bilge level monitoring devices shall be provided together with audible and visual alarm signal effected in the cargo control room and navigation bridge space. Bilge high-level alarms are acceptable as an alternative means for the level monitoring devices (see MSC/Circ.1037).

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.

3.4.2 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 man-holes providing passage through the length and breadth of the space, the minimum clear opening shall be not less than 600 mm by 800 mm at a height of not more than 600 mm from the bottom shell plating unless gratings or other footholds are provided.

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

3.4.5 Although fuel oil tanks are not included in the definition of “cargo area” where such tanks are adjacent to cargo tanks (see 3.1.1) the requirements of 3.4.1 shall apply.

3.4.6 To cater for restrictions in the movement of personnel and to limit the time needed for a possible emergency escape, two separate means of access shall generally be fitted in double bottom tanks and similar spaces (see 3.4.1) where obstructions impede movement. The two accesses shall be as widely separated as practicable. Only one access may be approved in special circumstances if, it being understood that the escapes have the required dimensions, the ability to readily traverse the space and to remove an injured person can be proved to the satisfaction of the Register.

3.4.7 Pipe tunnels shall be provided with not less than two separate access openings fitted on opposite ends of tunnel, at distances not exceeding 60 m, and leading to the open deck. The Register may accept pipe tunnel openings leading to the cargo pump-room, pump-room or void spaces in the cargo area provided they are fitted with means of closure approved by the Register (see Rules, Part 3 – Hull Equipment, 7.12) and shall be closed during normal ship’s service, except when entrance to pipe tunnel is necessary.

3.4.8 Dimensions and structure of pipe tunnels shall be such as to ensure their complete inspection and repair of piping and removal of an injured person.

3.4.9 For the purpose of 3.4.2 and 3.4.3 the following shall apply:

- .1 The term “minimum opening of not less than 600 mm by 600 mm” means that such openings may have corner radii up to 100 mm maximum (see Figure 3.4.9.1-1).

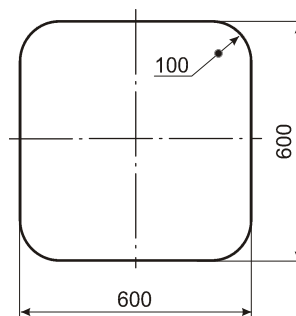


Figure 3.4.9.1-1

Shape of minimum clear opening of 600 mm by 600 mm

- .2 The term “minimum opening of not less 600 mm by 800 mm” includes also an opening as shown in Figure 3.4.9.2-1.

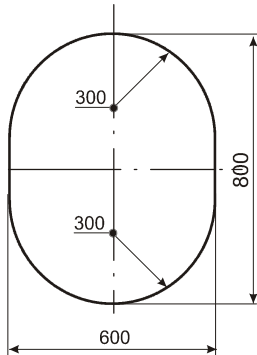


Figure 3.4.9.2-1

- .3 For the pressure tanks only, access openings may be circular openings having a diameter of not less than 600 mm.
- .4 At access openings and in the vicinity no pipes or equipment that interfere with the access route shall be arranged.

3.5 BILGE AND BALLAST ARRANGEMENTS

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

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

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

3.5.4 An eductor situated in the cargo area using water power from pumps in the machinery spaces may be accepted as a means to discharge permanent ballast from tanks and/or double bottoms adjacent to cargo tanks (see 3.5.1), provided the supply line is above deck level and a non-return valve and removable spool piece are fitted in the supply line outside the machinery space (see Figure 3.5.4-1).

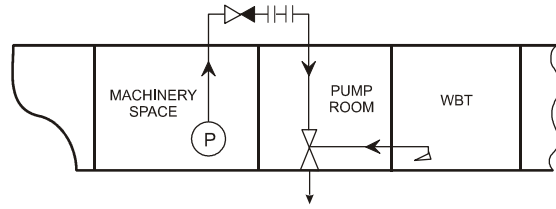


Figure 3.5.4-1
Ballast discharge arrangement

3.5.5 The ballast filling line fitted with stop valve and non-return valve, as shown in Figure 3.5.5-1 shall be exclusively used for filling and no for discharging (see 3.5.1).

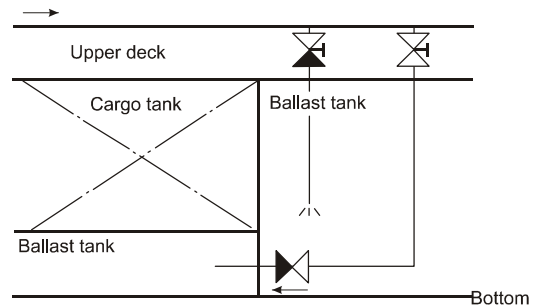


Figure 3.5.5-1
Ballast filling arrangement

3.5.6 When a filling of cargo tank with ballast is performed at a deck level by means of pumps serving permanent ballast tanks, a removable spool piece or flexible hose plus a shut-off valve, in addition to the required non-return valve, shall be fitted on the inlet to the cargo tank (see 3.5.2).

In this case the filling pipe shall be extended as close to the bottom of the tank as practicable, to minimise generation of the static electricity (see Figure 3.5.6-1).

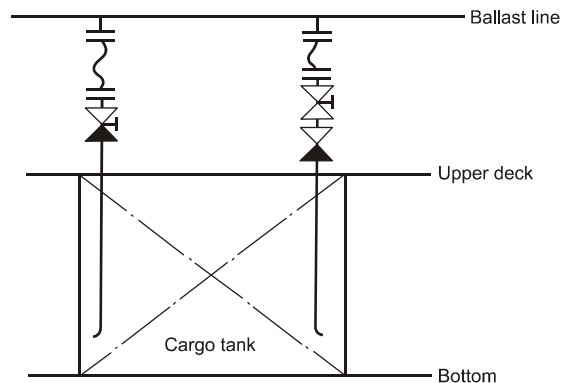


Figure 3.5.6-1
Ballast filling arrangements

3.5.7 The relaxation relevant to the bilge system for spaces which are separated from cargo tanks by a double bulkhead (see 3.5.3) shall be understood as limited to spaces not enclosing piping which may contain cargo or cargo residues.

3.5.8 The use of cargo pumps as bilge pumps is subject to the following:

- .1 Cargo pumps may also be used as bilge pumps provided they are connected to the bilge piping through a shut-off valve and a non-return valve arranged in series.
- .2 In the case of carriage of corrosive liquids, one of the cargo pumps may be used for bilge service provided it is connected to the bilge piping through two shut-off valves plus a non-return valve arranged in series.

3.6 PUMP AND PIPELINE IDENTIFICATION

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

3.6.2 The peel-resistant tapes or paint coat shall be used to clearly identify respective pipes.

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 *Register*.

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 shut-off valve at its connection to the cargo piping system within the cargo area. At this location, it shall also be capable of being separated by means of a removable spool-piece and blank flanges when not in use.
- .2 The shore connection shall be fitted with a shut-off 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 *Register*.
- .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 shut-off valve and blank flange.

3.7.4 Entrances, air inlets, air outlets and other openings to accommodation, service and machinery spaces and control stations shall not face the cargo shore-connection location of bow or stern loading and unloading arrangements. They shall be located on the outboard side of the superstructure or deck-house at a distance of at least 4% of the length of the ship but not less than 3 m from the end of the house facing the cargo shore-connection location of the bow or stern loading and unloading arrangements. This distance, however, need not exceed 5 m. Sidescuttles facing the shore-connection location and on the sides of the superstructure or deck-house within the distance mentioned above shall be of the fixed (non-opening) type. In addition, during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deck-house side shall be kept closed. Where, in the case of small ships, compliance with 3.2.3 and this paragraph is not possible, the *Register* may approve relaxation from the above requirements.

See 3.2.14.

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 in 3.7.7 or within a distance of 3 m beyond the coamings.

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

3.7.8 Electrical equipment within the coamings required in 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.

3.7.11 The height of the continuous coamings required in 3.7.7 shall be not less than 150 mm above the deck and nowhere less than 50 mm above the upper edge of the shear strake.

3.7.12 On ships engaged in the carriage of products with flashpoint not exceeding 60°C the anchor windlass and openings of chain pipes leading into the chain locker shall not be permitted within the coamings or within a distance of 3 m beyond the coamings required in 3.7.7.

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

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

4.3 GENERAL

4.3.1 Independent cargo tanks shall be built and installed so as to eliminate, whenever possible, (or in any event to minimize) its stressing as result of stressing or motion of the adjacent hull structure. The reaction forces in way of tank supports shall be transmitted as directly as possible to the hull primary supporting members, minimizing stress concentrations.

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

4.3.3 Gravity tanks intended for carriage of products having vapour pressure greater than 0.07 MPa shall be provided with mechanical refrigeration system to keep the vapour pressure of the cargo below the design pressure of the cargo tank.

4.4 SCANTLING AND TESTING

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

4.4.1 For ships with inserted and permanently fitted tanks with plane walls, not forming part of the ship's main structure, the requirements in *Rules, Part 2 – Hull*, section 1 to 16 and *Part 3 – Hull Equipment* shall apply unless otherwise mentioned in the following. Where the tank is extended from board to board a longitudinal bulkhead shall be provided.

4.4.2 The scantlings of tank structure elements shall be determined by the formulae given in *Rules, Part 2 – Hull*, section 11.2.

Ships with tanks independent of the shell plating forming part of the ship's main structure

4.4.3 For ships with tanks independent of the shell plating, which form, however, part of the ship's main structure, the requirements in *Rules, Part 2 – Hull*, section 18 shall apply.

Thickness of solid stainless steel and clad steel plating and of lined plating

4.4.4 Where solid stainless steel plating, clad steel plating or plating lined with rubber or synthetic material is used, the thickness of plating and stiffeners determined in accordance with requirements in *Rules, Part 2 – Hull*, section 11 and/or section 18, may be reduced for the values as shown in Table 4.4.4-1.

Table 4.4.4-1

Arrangement of cargo or water ballast	Solid stainless steel plating or plating both sides lined [mm]	Steel plating one side clad or plating one side lined [mm]
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

4.4.5 The suitability of the use of stainless steel and rubber or synthetic material lining shall be proved to the *Register* unless already verified in service. See also 6.7.

4.4.6 Gravity tanks shall be tested in accordance with the requirements given in *Rules, Part 2 – Hull*, 18.1. All cargo tanks bulkheads shall be water tested from at least one side.

4.4.7 For the details of dimensioning and testing of the pressure tanks the requirements in *Rules, Part 10 – Boilers, Heat Exchangers and Pressure Vessels*, Section 6, shall apply.

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 be not less than:

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

where:

t_o = theoretical thickness

t = $PD/(2Ke+P)$, [mm]

with

P = design pressure, [MPa] referred to in 5.1.2

D = outside diameter, [mm]

K = allowable stress, [N/mm^2] referred to in 5.1.5

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

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

$$b = \frac{D t_o}{2.5 r}, \quad [\text{mm}]$$

with

r = mean radius of the bend, [mm]

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

a = negative manufacturing tolerance for thickness, (%).

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

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

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

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

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

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

where:

R_m = specified minimum tensile strength at ambient temperature, [N/mm^2]

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

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

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

5.1.7 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to weight of pipes and content and to superimposed loads from supports, ship deflection or other causes, the wall thickness shall be increased over that required by 5.1.1 or, if this is impracticable or would cause excessive local stresses, these loads shall be reduced, protected against or eliminated by other design methods.

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

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

5.1.10 Unless otherwise stated in this Section, cargo pipes, cargo piping and associated accessories shall be in compliance with the requirements specified in *Rules, Part 8 – Piping*, Section 1.

5.1.11 For the purpose of this Part of the Rules and in accordance with *Rules, Part 8 – Piping*, 1.2 cargo pipes, cargo piping and associated accessories shall be considered as:

- .1 class I when the design pressure is above 1.5 MPa, or the pipe is intended for toxic substances;
- .2 class II when the design pressure is equal to or less than 1.5 MPa;
- .3 class III when they are open ended or placed inside cargo tanks.

5.1.12 For piping subjected to green seas, the design pressure P , in MPa, in the formula in 5.1.1 shall be replaced by an equivalent pressure P' given by the following formula:

$$P' = \frac{1}{2} \left(P + \sqrt{P^2 + 0,006R \cdot K \frac{D_C}{D}} \right), \quad [\text{MPa}]$$

where:

D_C - external diameter of the pipe taking into account the thickness insulation, in [mm], whose shall be taken at least equal to:

40 mm if $D \leq 50$ mm;

80 mm if $D \geq 150$ mm.

Intermediate values shall determined by interpolation.

R' - Drag corresponding to the effect of green seas, [N/mm²], such as given in Table 5.1.6.7-1 as a function of the location of the pipes and of their height H , [m], above the deepest loadline. Intermediate values shall be determined by interpolation.

Table 5.1.6.7-1

External diameter of pipe (1)	Aft of the quarter of the ship's length			Forward of the quarter of the ship's length		
	$H \leq 8$	$H = 13$	$H \geq 18$	$H \leq 8$	$H = 13$	$H \geq 18$
≤ 25	1500	250	150	2200	350	150
50	1400	250	150	2000	350	150
75	1100	250	150	1600	350	150
100	700	250	150	700	350	150
≥ 150	500	250	150	700	350	150

(1) D_C , if the pipe is insulated, otherwise D .

5.1.13 The value for c (added corrosion thickness) for the formula in 5.1.1 shall normally be equal to at least 3 mm. The *Register* may accept a lesser value for pipes made of austenitic or austenitic-ferritic stainless steel, pipes with internal lining or, if applicable, pipes with acceptable external protective lining or painting.

5.2 PIPING FABRICATION AND JOINING DETAILS

5.2.1 The requirements of this section apply to piping inside and outside the cargo tanks. However, relaxation 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 shut-off valves and expansion joints; and
- .2 for other exceptional cases specifically approved by the Register.

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

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

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

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

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

5.2.6 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.

5.2.7 The use of bellows shall not be permitted for corrosive and polymerising products, except if provision is made to prevent stagnation of liquids, such as cargo drains trapped in the corrugated parts of the joints.

5.3 FLANGE CONNECTIONS

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

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

5.4 TEST REQUIREMENTS FOR PIPING

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

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

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

5.4.4 With regard to the non-destruction testing of welded pipes and accessories the following shall apply:

- .1 Butt welded pipes and accessories shall be X-rayed at random and entirely checked by means of a dye-penetrant test or an equivalent method.
- .2 X-rays shall cover at least 10% of the connections and may be extended, at the request of the *Register* depending on the results of the inspection.
- .3 Relaxation of the above requirements may be considered by the *Register* on a case-by-case basis for pipes welded at workshops. However, this only applies to ships exclusively intended to carry cargoes with minor fire risk.

5.5 PIPING ARRANGEMENTS

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

5.5.2 Cargo piping located below the main deck may run from the tank it serves and penetrate tank bulkheads or boundaries common to longitudinally or transversally adjacent cargo tanks, ballast tanks, empty tanks, 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;
- .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 (see 2.6); and
- .5 operable from the weather deck.

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

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

weather deck and cargo pump-room or pump-room (see 3.4.7).

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.

5.5.6 The intent of the requirement in 5.5.2 is to preclude the hazard of cargo leaking pass a shut-off valve gland into the space where the valve is located.

5.5.7 The ends of cargo tank filling pipes shall be located as near as possible to the tank bottom in order to reduce the risk of generating static electricity.

5.5.8 Shields shall be provided on flange connections to prevent the projection of liquids in case of leakage if pipes are intended to carry cargoes involving serious risks of skin toxicity.

5.5.9 In chemical tankers intended for the transport of products having a flash point not exceeding 60°C aluminium pipes may be permitted in ballast tanks, in inerted cargo tanks and, provided the pipes are protected from accidental impact, in hazardous areas on open deck.

5.5.10 Pumps, piping and associated fittings shall constitute a permanently fitted system; in general, removable parts shall not be allowed, except for specific cases for which it can be proved, to the satisfaction of the *Register*, that no effective alternative solutions are available. In such circumstances, the safety measures deemed necessary will be considered by the Register on a case-by-case basis.

5.6 CARGO-TRANSFER CONTROL SYSTEMS

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

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

5.6.2 The controls necessary during transfer or transport of cargoes covered by this Part of the Rules other than in cargo pump-rooms which have been dealt with elsewhere in this Part 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.

5.6.4 The stop valve required in 5.6.1.1 may be omitted for cargo pipes in cargo tanks fitted with stop valve located near the open end and operable from the weather deck (see 5.5.2).

5.6.5 One blank flange shall be provided in addition to the stop valve required in 5.6.1.2 at each cargo hose connection.

5.6.6 The stop valve required in 5.6.1.2 shall be provided also for the hose connection used for the transfer of cargo vapour.

5.6.7 The cargo pumps control shall be fitted in a position which is readily accessible, even in the event that the cargo piping or hoses break. This position shall be clearly indicated.

5.6.8 Where a cargo control room is provided, the following controls, monitoring and alarms shall be connected to this room:

- .1 cargo pump control;
- .2 control of loading/unloading valves;
- .3 level gauges;
- .4 temperature indicators;
- .5 high level alarms,
- .6 very high level alarms;
- .7 high/low temperature alarms;
- .8 high/low pressure alarms;
- .9 fixed gas detecting system alarms.

In general, high/low temperature alarms shall also be transduced to the navigating bridge.

5.6.9 The cargo control room shall be located above the weather deck and may be considered as a dangerous space or a safe space, depending on its location and on the possible presence of a product or of its vapours. If it is considered a dangerous space, it shall be provided with a ventilation system capable of supplying at least 20 air changes per hour; it shall not be located in the accommodation area and only safe type electrical equipment shall be allowed.

5.6.10 A cargo control room without cargo pump and valve control is defined as a "cargo control station".

5.7 SHIP'S CARGO HOSES

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

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

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

testing, its specified maximum working pressure and, if used in services other than the ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure shall not be less than 1 MPa gauge.

Cargo hoses shall be marked with the name of product for which the hose is intended, where applicable.

5.7.4 The requirements in 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.

5.8 PROTECTION AGAINST AN INCENTIVE DISCHARGE OF STATIC ELECTRICITY

5.8.1 For the requirements regarding protection of piping systems and equipment against an incentive discharge of static electricity see Section 10.

5.9 CERTIFICATION, INSPECTION AND TESTING

5.9.1 The requirements in this section for the certification, inspection and testing are related to cargo piping and other equipment fitted in the cargo area. These requirements supplement the requirements given in *Rules, Part 8 – Piping*, for piping systems.

5.9.2 Where required in Table 5.9.9-1, materials used for pipes, valves and fittings shall be subjected to the test specified in *Rules, Part 8 – Piping*, 1.3.

5.9.3 Where required in Table 5.9.9-1, welded joints shall be subjected to the examinations specified in 5.4.4 and examinations specified in *Rules, Part 8 – Piping*, 1.3, for class I and class II pipes, as applicable.

5.9.4 Where required in Table 5.9.9-1, cargo pipes valves, fittings and pump casings shall be subjected to hydrostatic tests in accordance with the relevant requirements in *Rules, Part 8 – Piping*, 16.1 and 16.2.

5.9.5 Each expansion joint shall be subjected to hydrostatic test under a pressure of not less than twice maximum service pressure, and in any case not less than 1 MPa.

During the test expansion joint shall be repeatedly deformed from its geometrical axis.

5.9.6 For testing of ship's cargo hoses see 5.7.

5.9.7 Where fitted, bellow pieces of gas-tight penetration seals shall be pressure tested.

5.9.8 Tightness of the gas-tight penetration seal shall be checked. This test may be carried in the workshop or on board.

5.9.10 After installation on board, the cargo piping system shall be checked for leakage under operational conditions (see 5.4.3).

5.9.9 Inspection and tests required for cargo piping and other equipment fitted in the cargo area are summarised in Table 5.9.9-1.

Table 5.9.9-1
Inspection and testing at works

No	Item	Tests for materials		Inspections and tests for the products			References to the Rules
		Y/N (1)	Type of material certificate (2)	during manufacturing (1)	after completion (1)(3)	Type of product certificate (2)	
1	seamless or stainless steel cargo pipes	Y	• C where $ND > 25\text{mm}$ • W where $ND \leq 25\text{mm}$	Y (4)	Y	C	1.3, Part 8 and Part 25
2	pipes of class II, cargo valves and fittings	Y	• C where $ND > 25\text{mm}$ • W where $ND \leq 100\text{mm}$	Y (4)	Y	C	1.3 and 1.4, Part 8, Part 25 and Part 26
3	expansion joints and cargo hoses	Y (5)	W	N	Y	C	1.4, Part 8 and Part 24
4	cargo pumps	Y	C	Y (6)	Y	C	1.9, Part 8, Part 25 and Part 26, see note (6)
5	gastight penetration seals	N	-	N	Y	C	1.3, Part 8
6	cargo tank P/V-valves	Y	C	Y	Y	C	1.3, 5.1 and 5.2, Part 8
7	flame arresters	N	-	N	Y	C	5.2, Part 8, see note (3)

(1) Y = required, N = not required.
(2) C = class certificate, W = works' certificate.
(3) includes the checking of the rule characteristics according to the drawings approved by the Register.
(4) only in the case of welded construction.
(5) if metallic.
(6) inspection during manufacturing shall be carried out according to a program approved by the Register.

6 MATERIALS OF CONSTRUCTION, PROTECTIVE LININGS AND COATINGS

6.1 GENERAL

6.1.1 Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, shall be suitable at the temperature and pressure for the cargo to be carried in accordance with recognized standards (see *Rules, Part 25 – Metallic Materials*). Steel is assumed to be the normal material of construction.

6.1.2 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.

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

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

6.1.4 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.

6.1.5 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 form shall provide information on the required materials of construction. These requirements shall be 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.

6.1.6 Selection of materials and coating systems coming into contact with cargo liquid or vapour is the responsibility of the shipyard and/or owner. It shall 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 manufactures.

6.1.7 The requirements for selecting the material in 6.3.2 and .3 need not apply to cargo pump room casings and equipment and fittings, excluding electrical installations, which are considered to come in contact solely with vapours emitted from cargo pump room bilges. However, the requirements apply to the cargo pump room bottom plating and casing to a suitable height from the bottom plating which are con-

sidered to come in contact with the cargo. For electrical installations the requirements in 10.1 shall apply.

6.1.8 In addition to the requirements in 6.1.3.2 and .3 materials of constructions having a melting point below 925°C, e.g. aluminium and its alloys, shall not be used for external piping involved in cargo handling operations on ships intended for the carriage of products with flashpoints not exceeding 60°C. Short lengths of external pipes connected to cargo tanks may be permitted if they are provided with fire-resistant insulation.

6.1.9 The fixed tank cleaning equipment installed within cargo tanks shall comply with the requirements in 6.1.3.2 and .3.

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

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

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

shall be not less than 30.

6.1.11 The use of aluminium coating is prohibited in the cargo tanks, cargo tank deck area, cargo pump-rooms, pump rooms, cofferdams or any other area where cargo vapours may accumulate.

7 CARGO TEMPERATURE CONTROL

7.1 GENERAL

7.1.1 When provided, any cargo heating or cooling systems shall be constructed, fitted and tested to the satisfaction of the *Register*. 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;
- .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.

7.1.7 The capacity of a ship to maintain specific cargoes under heated conditions is the responsibility of the shipyard and/or the owner.

7.1.8 Except for ships intended for restricted voyages, any cargo with a melting point equal to 20°C, or above, shall be capable of being maintained under heated conditions.

Attention is drawn to the fact that, for safety reasons, certain cargoes shall not be heated above a specific temperature (see 7.1.18).

7.1.9 When a ship is fitted with a heating system capable of maintaining the liquid temperature above 45°C, the ship's structure and materials shall be checked for this temperature and the maximum permissible temperature shall be stated on the ship's certificate.

7.1.10 Wherever a particular temperature (higher or lower than the ambient temperature) is required to be maintained for the preservation of the cargo, one of the following systems shall be adopted:

- .1 thermally insulated tanks capable of maintaining the temperature of the cargo within acceptable limits for the time of the voyage;
- .2 a heating or cooling plant or refrigerating plant;
- .3 a combination of .1 and .2 above.

7.1.11 No heating/cooling media shall be used which reacts in a hazardous manner with cargo. Manifolds for the delivery and backflow of heating/cooling media shall be fitted on the weather deck; connections to cargo tanks for inlet and outlet shall be in way of the cargo tank top.

7.1.12 Where the heat exchanger room is located in the accommodation area and considered as gas-safe, it shall be treated as a machinery space (other than a category A) and provided with independent mechanical extraction ventilation as well as with scuppers discharging directly into the machinery space.

7.1.13 Wherever the cargo temperature is maintained by a heating or refrigerating plant, unless otherwise indicated in the contract specification, the system shall be designed taking into account the reference temperatures indicated in Table 7.1.13-1.

Table 7.1.13-1

Reference temperature, [°C]		
Sea	0	32
Air	5	45

7.1.14 Wherever the heating or cooling system is essential for the preservation of the cargo, the following components shall be duplicated:

- .1 coils and ducts in cargo tanks;
- .2 heating or cooling sources;
- .3 circulating pumps for cargo and heating/cooling medium; if suitable for the use, cargo pumps may be employed for the circulation of the heating or cooling medium;
- .4 refrigeration plant.

7.1.15 Depending on the electrical apparatus class temperature required for the cargoes being carried, the maximum surface temperature of the heating system, within enclosed spaces inside the cargo area shall not exceed the values indicated in Table 7.1.15-1.

Table 7.1.15-1

Class temperature	Maximum surface temperature of the heating system
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

7.1.16 Cargo heating or cooling systems shall be fitted with the necessary connections to purge, by inert gas or compressed air, the heating or cooling circuit of each cargo tank and to perform the pressure testing of the system.

7.1.17 For water reactive products (see 15.16) spool pieces shall be provided in addition to the valves required in 7.1.3.

7.1.18 The alarm system required in 7.1.5.4 shall be provided:

- .1 for those products which are carried in a heated condition (see 15.13.7) and for which, in column **o** of the table in Section 17 reference is made to the requirements in 15.13;
- .2 for products mentioned in .1 above, in a case where adjacent cargo tanks or fuel oil tanks are heated or cooled to the extent that overheating or overcooling could result in a dangerous conditions;
- .3 for those products for which a carrying temperature not greater than certain limits is required by Section 15 such as elementary phosphorus and molten sulphur; and
- .4 giving a visual and audible alarm signal on the navigating bridge and in the cargo control station, if fitted.

7.1.19 The temperature sensing ends of alarm system shall be provided at no less than two locations, on the liquid surface and on the bottom of the tank.

7.1.20 If the sampling equipment mentioned in 7.1.6.3 consists of an observation tank for drains, this tank shall comply with the following requirements:

- .1 it shall be located in the cargo area and provided with an air pipe with the end fitted with a flame screen and arranged at not less than 3 m from openings of accommodation spaces and from sources of ignition; and
- .2 it shall be fitted with a connection for discharge into the slop tanks with associated shut-off valves and sight glass and quipped with a sampling cock for backflowing medium analysis.

7.2 ADDITIONAL REQUIREMENTS

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

8 CARGO TANK VENTING AND GAS-FREEING ARRANGEMENTS

8.1 APPLICATION

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

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

8.1.3 For the purpose of this regulation, the term “ship constructed” is as defined in *Rules, Part 1 – General Requirements*, Chapter 1, 2.25.

8.1.4 Ships constructed on or after 1 July 1986 but before 1 January 1994 which fully comply with the requirements of this Part of the Rules applicable at that time may be regarded as complying with the requirements for cargo tanks venting, purging and gas-freeing (see *Rules, Part 8 – Piping*, 5.2) and with the requirements for ventilation and gas measurement of double hull and double bottom spaces and portable instruments (see *Rules, Part 17 – Fire Protection*, 4.5 and Table 25.1 item 15).

8.1.5 For ships to which this Part of the Rules applies, the requirements of this Section shall apply in lieu of the requirements specified in *Rules, Part 17 – Fire protection*, 4.5.3, 4.5.6 and 16.3.2.

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

8.2 CARGO TANK VENTING

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

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

8.2.3 Provision shall be made to ensure that the liquid head in any tank does not exceed the design head of the tank. Suitable high-level alarms, overflow control systems or spill valves, together with gauging and tank filling procedures, may

be accepted for this purpose. Where the means of limiting cargo tank overpressure includes an automatic closing valve, the valve shall comply with the appropriate provisions of 15.19.

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

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

8.2.7 Self-draining back to the cargo tanks shall be by natural gravity.

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 shall be provided.

8.2.8 The system which protects against the liquid level exceeding the design head of the cargo tank, referred to in 8.2.3, shall be independent of the cargo tank gauging devices.

8.2.9 When designing cargo tank venting arrangements revised factors contained in MSC/Circ.731 shall be taken into consideration.

8.2.10 High level alarms and overflow control systems specified in 8.2.3 shall be type approved by the *Register*.

8.3 TYPES OF TANK VENTING SYSTEM

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

8.3.2 A controlled tank venting system is a system in which pressure- and vacuum-relief valves or pressure/vacuum valves are fitted to each tank to limit the pressure or vacuum in the tank. A controlled venting system may consist of individual vents from each tank or such individual vents on the pressure side only as may be combined into a common header or headers, with due regard to cargo segregation. In no case shall shut-off valves be fitted either above or below pressure-

or vacuum-relief valves or pressure/vacuum valves. Provision may be made for bypassing a pressure- or vacuum-relief valve or pressure/vacuum valve under certain operating conditions provided that the requirement of 8.3.6 is maintained and that there is suitable indication to show whether or not the valve is bypassed. By-passing of P/V valves is allowed during cargo operations for cargoes which do not require a vapour return system, provided that the vent-line outlet is fitted with flame arresters and is located at the required height above the deck level. However, by-passing of high-velocity valves is not permitted.

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

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

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

See 3.2.14.

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

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

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

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

8.3.9 The term “with due regard to cargo segregation” referred to in 8.3.1 for open tank venting system means the design that restricts the ingress of the cargo of a cargo tank into other cargo tanks through vent lines even at times of heavy weather as given in Figure 8.3.9-1. In consideration of possible degrading of product quality due to coming to contact with different dangerous chemicals or their vapours, however, the open type venting system shall be of independent design as far as practicable.

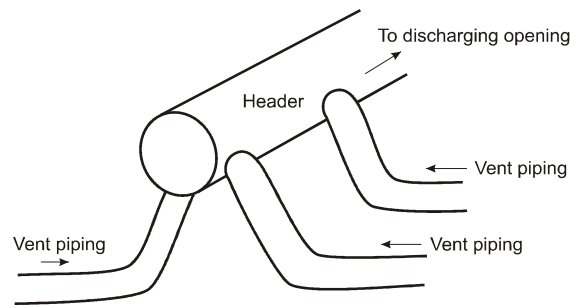


Figure 8.3.9-1
Cargo segregation in open tank venting system

8.3.10 In case where the controlled venting systems of the cargo tanks carrying the cargoes different from each other, except those which react in a dangerous manner, or the same cargoes are led to a common pipe header, the pressure relief valves and vacuum regulating valves shall be separate from each other, and any other arrangement than that given in Figure 8.3.10-1 is unacceptable. Vacuum regulating valves may be of the arrangement either 1 or 2.

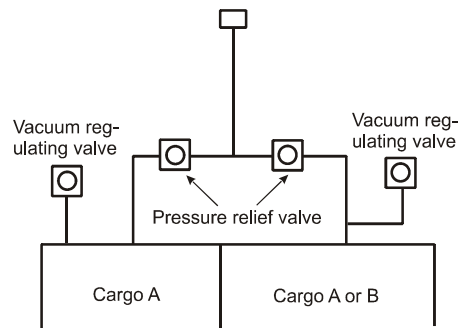


Figure 8.3.10-1
Acceptable arrangements for the combined controlled tank venting system

8.3.11 When pressure/vacuum valves, i.e. valves whose pressure side and vacuum side are led to the common pipe, are used for the controlled venting system of the cargo tanks intended to carry cargoes different from each other, any arrangement other than the venting system independent for each tank or group of tanks, as applicable, is unacceptable.

8.3.12 As the countermeasures against the blockage by “freezing of cargo vapour or icing up in adverse weather conditions” referred to in 8.3.7, ships operated in cold zone shall be provided with heating systems, etc. for the prevention thereof. In ships not provided with special heating systems, proper maintenance and inspection work procedures shall be established.

8.3.13 For a tank equipped with closed or restricted gauging, the venting system shall be sized allowing for flame screens, if fitted, to permit loading at the design rate without overpressurizing the tank. Specifically, under conditions in which a saturated cargo vapour is discharged through the venting system at the maximum anticipated loading rate, the pressure differential between the cargo tank vapour space and the atmosphere shall not exceed 0.02 MPa or, for independent cargo tanks, the maximum working pressure of the tank.

8.3.14 Vent outlets of cargo tanks intended for the carriage of flammable or toxic products shall be arranged at a distance of not less than 3 m from air outlets and as far as possible from air inlets to pump rooms and cargo pump rooms.

8.3.15 Pressure relief valves and vacuum regulating valves (pressure/vacuum valves) shall be type approved by the *Register*. The pressure setting, installation tests and marking shall comply with ISO standard 15364:2000 “Ships and marine technology – Pressure/vacuum valves for cargo tanks” (see MSC/Circ.1009).

8.3.16 Devices to prevent the passage of flame (including high velocity valves) referred to in 8.3.6 shall be type approved by the *Register*.

The design, testing, marking and locating shall comply with the MSC/Circ.677 – Revised standards for design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers, as amended with MSC/Circ.1009 and MSC.1/Circ.1324.

8.3.17 Ships constructed before 1 January 2013 shall comply with 8.3.16 not later than the first scheduled dry-docking carried out on or after 1 January 2013.

8.4 VENTING REQUIREMENTS FOR INDIVIDUAL PRODUCTS

8.4.1 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 PURGING

8.5.1 When the application of inert gas is required by 11.1.1, before gas-freeing, the cargo tanks shall be purged with inert gas through outlet pipes with cross-sectional area such that an exit velocity of at least 20 m/s can be maintained when any three tanks are being simultaneously supplied with inert gas.

The outlets shall extend not less than 2 m above the deck level.

Purging shall continue until the concentration of hydrocarbon or other flammable vapours in the cargo tanks has been reduced to less than 2% by volume.

8.6 CARGO TANK GAS-FREEING

8.6.1 The arrangements for gas-freeing of 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. Ac-

cordingly, 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.

See 3.2.14.

8.6.2 The outlets referred to in 8.6.1.2 and 8.6.1.3 may be fixed or portable pipes.

8.6.3 In designing a gas-freeing system in conformity with 8.6.1, particularly in order to achieve the required exit velocities of 8.6.1.2 and 8.6.1.3, 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.

8.6.4 When designing a gas-freeing system revised factors contained in MSC/Circ.731 shall be taken into consideration.

8.6.5 The method and instruction for cargo tank gas-freeing shall be described in the Cargo Operation Manual, in detail.

8.6.6 The outlets referred to in 8.6.1.2 and 8.6.1.3 shall be arranged as far as practicable at distances specified in 8.3.4 and 15.12, as applicable.

8.6.7 The fans used for cargo tank gas freeing, either fixed or portable type, located in hazardous locations shall be of nonsparking construction (see *Rules, Part 9 – Machinery*, 5.3).

9 ENVIRONMENTAL CONTROL

9.1 GENERAL

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

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

- .1 Inerting: by filling the cargo tank and associated piping systems and, where specified in 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 dewpoint of -40°C or below at atmospheric pressure, and maintaining that condition.
- .4 Ventilation: forced or natural.

9.1.3 Where inerting or padding of cargo tanks is required by this Part of the Rules in column **h** in the table of Section 17:

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

9.1.4 Where drying is used and dry nitrogen is used as the medium, similar arrangements for supply of the drying agent shall be made to those required in 9.1.3. Where drying agents are used as the drying medium on all air inlets to the

tank, sufficient medium shall be carried for the duration of the voyage, taking into consideration the diurnal temperature range and the expected humidity.

9.2 ENVIRONMENTAL CONTROL REQUIREMENTS FOR INDIVIDUAL PRODUCTS

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

9.3 APPLICATION

9.3.1 Notwithstanding the requirements specified in column **h** in the Table 17.1.1-1, (see 9.2.1), chemical tankers of 8,000 tonnes deadweight and over, if intended for the carriage of products with a flash point not exceeding 60°C , listed in the Table 17.1.1-1 and Table 18.1.1-1, and having:

- .1 individual cargo tanks exceeding 3,000 m^3 ; or
- .2 cargo tanks fitted with washing machines with the individual nozzle capacity exceeding $17.5 \text{ m}^3/\text{h}$; or
- .3 a total combined throughput from the number of washing machines in use in a cargo tank, at any one time, in excess of $110 \text{ m}^3/\text{h}$,

shall be fitted with an inert gas system complying as specified in 9.4.1 to 9.4.3.

9.3.2 In addition to the requirements specified in 9.3.1 chemical tankers of 8,000 tonnes deadweight and over, intended to carry oil cargoes (see *Rules, Part 1 – General Requirements*, Chapter 1, 2.16) with a flashpoint not exceeding 60°C , or other liquid products having a similar fire hazard (see Section 18) shall be equipped with an inert gas system complying with the requirements as specified in 9.4.1 to 9.4.3.

See *Rules, Part 17 – Fire protection*, 4.5.5.

9.4 ARRANGEMENT AND DESIGN OF INERT GAS SYSTEMS

9.4.1 For arrangement and design of inert gas systems see *Rules, Part 17 - Fire protection*, 24.15.

IACS UR F20 Rev.7 shall be applied.

For ships carrying products requiring oxygen-dependent inhibitors see also MSC.1/Circ.1501.

9.4.2 As an alternative to the water seal in the inert gas line on deck, an arrangement consisting of two shut-off valves in series with a venting valve in between (double block and bleed) may be accepted by the *Register*. The following conditions shall apply:

- .1 operation of the valve shall be automatically executed. Signals for opening/closing shall be taken from the process directly, e.g. inert gas flow or differential pressure;
- .2 alarm for faulty operation of the valves shall be provided, e.g. the operation status

of “Blower stop” and “Supply valve open” is an alarm condition.

- .3 second non return device shall be a screw-down type check valve or shall consist of a check valve and shut-off valve fitted downstream of the water seal.

9.4.3 It shall be possible to isolate cargo tanks from the inert gas system by removing spool pieces and blanking pipe ends or by double blanks with an intermediate vent and provisions for detection of leakage.

The connections to the inert gas supply main which serve for purging and gas-freeing of cargo piping system components shall consist of removable spool pieces. At the connection to the cargo piping system a stop valve with a blank flange shall be provided.

9.4.4 In ships carrying toxic substance the inert gas generator shall be located in the separate room intended for that purpose solely and located aft of the cargo area. Such a space shall be separated from the machinery spaces at least by a gastight steel boundaries having no doors or other openings leading to machinery spaces and from accommodation and service spaces by open decks, cofferdams or similar spaces. The ventilation shall be of the pressure type and air inlets shall be located on the open deck outside the cargo area. Access doors shall be located on the transverse bulkhead not facing the cargo area or on the outboard side of the superstructure or deckhouse at a distance not less than that specified in 3.2.3.

The inert gas supply main shall not be located in, or have any connection with systems located in machinery spaces, accommodation and service spaces.

9.4.5 The *Register* may accept system using inert gas from other hydrocarbons production sources provided that an equivalent standard of safety is achieved.

9.4.6 An inert gas system based on production of inert gas by means other than combustion of hydrocarbons may be accepted upon special considerations by the *Register* and provided that an equivalent standard of safety, as required in 9.4.1 to 9.4.3, is achieved.

9.5 INERT GAS STORAGE SYSTEM

9.5.1 As an alternative to the inert gas systems required in 9.4 an inert gas storage systems may also be provided for inerting the spaces surrounding cargo tanks and for blanketing the cargo in the tanks, subject to special consideration by the *Register* in each particular case. The stored quantity of gas shall be sufficient to allow for losses of inert gas during the voyage.

9.5.2 The inert gas may be stored in pressure vessels or cylinders. Pressure vessels shall be located in the cargo area on the open deck or in separate spaces. Pressure vessels and cylinders shall comply with the requirements specified in *Rules, Part 10 – Boilers, Heat Exchangers and Pressure Vessels*, Section 6.

The requirements of section 3.1.3 and 3.8.2 shall apply wherever relevant to the installation of pressure vessels and cylinders in closed spaces

9.5.3 A pressure reducing valve backed up by a safety valve shall be fitted to pressure vessels and batteries of cylinders. The downstream piping system shall comply as follows:

- .1 In the inert gas main within the cargo area two non-return devices shall be fitted in series. If the fixed connections to the cargo tanks are provided, the design of the non-return devices shall comply with 9.4. Otherwise, removable spool pieces shall be fitted at all connections to cargo tanks, spaces surrounding tanks and cargo and process pipelines.
- .2 Shut-off devices shall be fitted upstream and down-stream of these spool pieces. Pressure reducing valves shall be backed up by safety valves.

9.5.4 Cargo tanks and the spaces surrounding cargo tanks which shall be inerted shall be equipped with means for measuring the pressure and with connections for checking the tank atmosphere as well as with suitable safety devices to prevent excessive pressure or vacuum.

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 relevant requirements specified in, *Rules, Part 12 – Electrical Equipment*.

10.1.2.1 Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products (reference is made to recommendations IEC 60079-1-1:2002).

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

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

10.1.4 Electrical equipment, cables and wiring shall not be installed in the hazardous locations unless it conforms with the standards not inferior to those acceptable to the *Register* (see 10.1.2.1). 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 *Register*, to ensure that an equivalent level of safety is assured.

10.1.5 Where electrical equipment is installed in hazardous locations, as permitted in this Section, it shall be to the satisfaction of the *Register* and certified by the relevant authorities recognized by the *Register* 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, “Yes” 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.

10.1.7 Unless otherwise required in this Section the requirements for electrical installations specified in *Rules, Part 12 – Electrical Equipment*, 19.2 shall be complied with.

10.1.8 The materials in electrical apparatus, such as copper, aluminium and insulation, shall, as far as practicable, be protected, e.g. by encapsulation, to prevent contact with vapours of products referred to in 10.1.2.2.

10.1.9 Absence of information on temperature class and apparatus group in column **i** in the table of Section 17 means that data are not currently available, and this shall not be confused with the non-flammable, “NF”, notation describing some products.

10.2 BONDING

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

10.2.2 The devices intended to continuously monitor the insulation level of all distribution systems shall also monitor all circuits, other than intrinsically safe circuits, connected to apparatus in hazardous areas or passing through such areas. An audible and visual alarm shall be given, at a manned position, in the event of an abnormally low level of insulation.

10.2.3 To avoid the hazard of an incentive discharge due to the build-up of static electricity resulting from the flow of the liquid/gases/vapours, the resistance between any point on the surface of the cargo and slop tanks, piping systems and equipment, and the hull of the ship shall be not greater than $10^6 \Omega$.

10.2.4 Where bonding straps are required, they shall be:

- .1 clearly visible so that any shortcoming can be clearly detected;
- .2 designed and sited so that they are protected against mechanical damage and are not affected by high resistivity contamination, e.g. corrosive products or paint; and
- .3 easy to install and replace.

10.3 ELECTRICAL REQUIREMENTS FOR INDIVIDUAL PRODUCTS

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

10.4 HAZARDOUS LOCATIONS AND TYPE OF ELECTRICAL EQUIPMENT AND WIRING

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

10.4.2 CARGOES WITH A FLASHPOINT EXCEEDING 60°C (CLOSED CUP TEST)

.1 Cargo tanks, cargo piping and cargo pump-rooms are the only hazardous location (Zone 2) for such cargoes which have “Yes” notation in column **i** in the table of Section 17.

When electrical equipment, adequate for the space concerned, is used the following shall be observed:

.1.1 Submerged cargo pump motors and their associated cables may be permitted by the Register, due consideration being given to the chemical and physical characteristics of the

individual products or clearly indicated group of products, as applicable. Arrangements shall be made to prevent the energizing of motors and cables in flammable gas-air mixtures and to de-energize the motors and cables in the event of low liquid level. Such a shutdown shall be indicated by an alarm at the cargo control station.

- .1.2 Where electrical equipment is located in a cargo pump-room, due consideration shall be given to the use of types of apparatus which ensure the absence of arcs or sparks and hot spots during normal operation, or which are of a certified safe type.
- .2 Where the cargo is heated to within 15°C of its flashpoint value, the requirements of 10.4.3 shall apply.

10.4.3 For cargoes with a flashpoint not exceeding 60°C (closed cup test), with “No” qualification in column **i** in the table of Section 17, the hazardous locations are given below. In addition to intrinsically safe systems and circuits (Ex)i, the only electrical installations permitted in hazardous locations are the following:

- .1 Cargo tanks and cargo piping (Zone 0):
 - .1.1 No additional electrical equipment is permitted.
- .2 Void spaces adjacent to above or below integral tanks (Zone 1):
 - .2.1 Thorough runs of cables. Such cables shall be installed in heavy gauge steel pipes with gastight joints. Expansion bends shall not be fitted in such spaces.
 - .2.2 Electrical depth sounding or log devices and impressed current cathodic protection system anodes or electrodes. These devices shall be housed in gastight enclosures; associated cables shall be protected as referred to in 10.4.3.2.1.
- .3 Hold spaces containing independent cargo tanks (Zone 1):
 - .3.1 Through runs of cable without any additional protection.
 - .3.2 Lighting fittings with pressurized enclosure (Ex)p or of the flameproof type (Ex)d.
The lighting system shall be divided between at least two branch circuits. All switches and protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
 - .3.3 Electrical depth sounding or log devices and impressed current cathodic protection system anodes or electrodes. These devices shall be housed in gastight enclosures.
- .4 Cofferdams and permanent (for example segregated) ballast tanks adjacent to cargo tanks (Zone 1):

- .4.1 See .3;
- .4.2 Corrosion-resistant pipes, providing adequate mechanical protection shall be used in compartments which may be filled with sea water (e.g. permanent ballast tanks).
- .5 Cargo pump-rooms and pump-rooms in the cargo area (Zone 1):
 - .5.1 Lighting fittings with pressurized enclosures (Ex)p or of the flameproof type (Ex)d. The lighting system shall be divided between at least two branch circuits. All switches and all protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
 - .5.2 Electrical motors for driving cargo pumps and any associated auxiliary pumps shall be separated from these spaces by a gastight bulkhead or deck. Flexible couplings, or other means of maintaining alignment, shall be fitted to the shafts between the driven equipment and its motors, and in addition, glands shall be provided in accordance with recognized standards where the shafts pass through the bulkhead or deck. Such electrical motors shall be located in a compartment having positive pressure ventilation.
 - .5.3 Flameproof general alarm, fire-extinguishing system visual and/or audible indicators (Ex)d.
 - .5.4 Safe type sensors for the gas detection systems.
- .6 Spaces on open deck, or semi-enclosed spaces on open deck, within 3 m of any cargo tank outlet, gas or vapour outlet, cargo pipe flange, cargo valve or entrance and ventilation opening to cargo pump-rooms; cargo area on open deck over all cargo tanks and cargo tank holds to the full width of the ship, plus 3 m fore and aft and up to a height of 2,4 m above the deck. Spaces on open deck within the coamings or within a distance of 3 m beyond the coamings fitted in accordance with 3.2.8 and 3.7.7 (Zone 1).
 - .6.1 Equipment of a certified safe type, adequate for open deck use;
 - .6.2 Through runs of cables;
 - .6.3 Expansion bends shall not be fitted within 3 m of any cargo tank outlet, gas or vapour outlet, cargo pipe flange, cargo valve or entrance and ventilation opening to cargo pump-rooms.
- .7 Enclosed or semi-enclosed spaces in which pipes containing cargoes are located; enclosed or semi-enclosed spaces immediately above cargo tanks (e.g. between decks) or having bulkheads above and in line with cargo tank bulkheads, enclosed or semi-

enclosed spaces immediately above cargo pump-rooms or above vertical cofferdams adjoining cargo tanks, unless separated by a gastight deck and suitably ventilated; and compartments for cargo hoses (Zone 1):

- .7.1 Lighting fittings of a certified safe type. The lighting system shall be divided between at least two branch circuits. All switches and protective devices shall interrupt all poles or phases and shall be located in a non-hazardous location.
- .7.2 Through runs of cables.
- .8 Enclosed or semi-enclosed spaces having a direct opening into any hazardous location referred to above shall have electrical installations complying with the requirements for the space or zone into which the opening leads.

10.4.4 For the purpose of 10.4.3.6 the length of the cargo area on an open deck shall be measured between the forward bulkhead of the foremost cargo tank and the after bulkhead of the aftermost cargo tank or when independent tanks are fitted between the forward bulkhead of the foremost hold space and the after bulkhead of the aftermost hold space.

11 FIRE PROTECTION AND FIRE EXTINCTION

11.1 APPLICATION

11.1.1 The requirements for tankers ($\leq 60^{\circ}\text{C}$) specified in *Rules, Part 17 – Fire Protection* shall apply to ships covered by this Part of the Rules, irrespective of tonnage, including ships of less than 500 gross tonnage (see MSC.1/Circ.1323), except that:

- .1 requirements specified in 10.8 and 10.9 shall not apply;
- .2 requirements as specified in 4.5.1.2 (i.e. the requirements for location of the main cargo control station) need not apply;
- .3 requirements specified in 10.2, and Annex 5, Table 1-1, items 7 and 8 (i.e. the requirements for the water fire main system and fixed fire-extinguishing system in machinery spaces) shall apply to chemical tankers (regardless of size) as they would apply to cargo ships of 2,000 gross tonnage and over;
- .4 requirements specified in Annex 5, Table 1-1, item 7 note 8 (i.e. the requirements for fixed local application fire-extinguishing system) shall apply to chemical tankers of 2,000 gross tonnage and over;
- .5 the provisions of 11.3, hereunder, shall apply in lieu of the requirements in Annex 5, Table 1-1, item 4;
- .6 the provisions of 11.2, hereunder, shall apply in lieu of the requirements in Annex 5, Table 1-1, item 11;
- .7 requirements specified in 4.5.10.1.3 shall apply to ships of 500 gross tonnage and over, replacing “hydrocarbon gases” by “flammable vapours” in regulation; and
- .8 requirements specified in Table 25.1, item 18, 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 of minimum requirements) need not comply with requirements for tankers ($\leq 60^{\circ}\text{C}$) specified in *Rules, Part 17 – Fire Protection*, Sections 4 and 9, provided that they comply with the requirements for cargo ships specified in Section 9 of that Part, except that requirements as specified in Annex 5, Table 1-1, item 5 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 exceeding 60°C (entry “Yes” in column **i** of the table of minimum requirements), the requirements specified in *Rules, Part 17 – Fire Protection*, 9.8 for tankers ($> 60^{\circ}\text{C}$) may apply, in lieu of the provisions of this Section.

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 *Rules, Part 17 – Fire Protection*, 24.5. 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 *Rules, Part 17 – Fire Protection*, 24.5 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.

11.2.2 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 *Register*.

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 spraying or high-expansion foam system (see *Rules, Part 17 – Fire Protection*, 24.6 and 24.7). The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall reflect this conditional requirement.

11.2.4 For the media and systems equivalent to the carbon dioxide fire-extinguishing system see MSC.1/Circ.1317 and MSC.1/Circ.1267 (gas fire-extinguishing systems) and MSC.1/Circ.1270 (aerosol fire-extinguishing systems). See also MSC.1/Circ.1316.

11.2.5 For the systems equivalent to the pressure-water spraying or high-expansion foam system referred to in 11.2.3, see MSC/Circ.1165, MSC.1/Circ.1385, MSC.1/Circ.1386, MSC.1/Circ.1237 and MSC.1/Circ.1269 (water-based fire-extinguishing systems) and MSC.1/Circ.1384 (fixed high-expansion foam system).

11.2.6 Foam concentrate stored onboard shall be periodically controlled. The tests as specified in MSC/Circ.670 shall be performed and carried out at recognized laboratories.

11.2.7 A record of the age of the foam concentrate and of subsequent controls shall be kept onboard.

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 *Register* shall be provided. Regular protein foam shall not be used.

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

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

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

- .1 2 l/min per square metre of the cargo tanks deck area, where cargo tanks deck area means the maximum breadth of the ship times the total longitudinal extent of the cargo tank spaces;
- .2 20 l/min per square metre of the horizontal sectional area of the single tank having the largest such area;
- .3 10 l/min per square metre of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1,250 l/min. For ships less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the *Register*.

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 l/min of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of the monitor. Such capacity shall be not less than 1,250 l/min. For ships less than 4,000 tonnes deadweight, the minimum capacity of the monitor shall be to the satisfaction of the *Register*.

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

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

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

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

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

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

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

11.3.15 Where flammable cargoes are to be carried, all sources of ignition shall be excluded from hazardous locations unless such sources conform with 10.1.4.

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.

11.3.17 For the part of cargoes for which foam is not effective or is incompatible, an alternative system provided shall be just as effective for the products concerned as the deck foam system required for the generality of flammable cargoes.

Where the alternative provisions, as referred to in 11.3.13, is a dry powder system, it shall comply with the requirements specified in *Rules, Part 17 – Fire Protection*, 24.19.

11.3.18 The term “regular protein foam” referred to in 11.3.2 means the foam without either any agents or anti-frozen agents added to bring the liquid point to level not higher than 0°C.

11.3.19 For ships of less than 4,000 tonnes deadweight (see 11.3.7) the minimum capacity of the monitor shall be 1,000 l/min and the application rate shall be at least 10 l/min/m² of the area to be protected.

11.3.20 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 on deck over the full length of the ship, and in the accommodation and service spaces, control stations and machinery spaces.

11.3.21 At least two portable fire-extinguishers shall be provided for each cargo manifold. These fire-extinguishers shall be stored at suitable places, except for the time of cargo operation.

11.3.22 For the purpose of the requirements in 11.3.15 internal combustion engines shall not be installed in cargo pump rooms, in pump rooms and in other spaces adjacent to or located above cargo tanks. However, reciprocating steam engines with a working temperature lower than the maximum surface temperature stated in 7.1.15 may be installed in the above mentioned rooms and spaces.

The maximum temperature of the steam and heating media in the cargo area shall be adjusted to comply with maximum surface temperature. See also 3.7.12.

11.3.23 Foam concentrate stored onboard shall be periodically controlled. The tests as specified in MSC.1/Circ.1312

and MSC.1/Circ.1312/Corr.1 shall be performed and carried out at recognized laboratories.

A record of the age of the foam concentrate and of subsequent controls shall be kept onboard.

11.3.24 In applying the requirements for extinguishing media in this section, MSC/Circ.314 may be used which provides guidance for calculating the capacity of the fixed deck foam systems for chemical tankers.

11.4 ADDITIONAL REQUIREMENTS

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

11.4.2 Where several fire-extinguishing media including foam are determined effective for each product, foam fire-extinguishing system shall be provided.

12 MECHANICAL VENTILATION IN THE CARGO AREA

For ships to which this Part of the Rules applies, the requirements of this Section replace the requirements specified in *Rules, Part 8 – Piping, 7.4*.

However, for products addressed under paragraphs 11.1.2 and 11.1.3, except acids and products for which paragraph 15.17 applies, the requirements specified in *Rules, Part 8 – Piping, 7.4* 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.

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

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

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

- .1 impellers or housing of non-metallic construction, due regard being paid to the elimination of static electricity;
- .2 impellers and housing of non-ferrous materials;
- .3 impellers and housing of austenitic stainless steel; and
- .4 ferrous impellers and housing with not less than 13 mm design tip clearance.

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

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

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

12.1.11 Pump-rooms intended solely for ballast transfer need not comply with the requirements in 12.1.1. The requirements of 12.1.1 are only applicable to the pump-rooms where pumps for cargo, such as cargo pumps, stripping pumps, pumps for slop tanks, pumps for COW or similar pumps are provided.

12.1.12 Spaces referred to in 12.1.1 shall be ventilated for a period of at least of 15 minutes prior to entering into compartment and operating the equipment and ventilation system shall be kept in operation all the time the persons are present and the equipment is operated.

A warning notice requiring the use of such ventilation shall be placed at the entrance to the compartment concerned.

12.1.13 For the requirements about interconnection of operation of lighting and ventilation in the cargo pump-rooms in ships carrying products with a flash point not exceeding 60°C see 3.3.13.2.

12.1.14 Ventilation systems controls required in 12.1.1 shall include the ventilation ducts dampers for inlet and outlet openings and shall be placed in an easily accessible position above the weather deck.

12.1.15 The height of the ventilation systems outlets shall be not 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.

12.1.16 The ventilation inlets shall be fitted in locations at least 3 m in the horizontal direction from ventilation inlets and openings to accommodation spaces, service spaces, control stations, machinery spaces and other spaces outside the cargo area. The height of ventilation inlets shall be not less than 3 m above the weatherdeck.

12.1.17 For the purpose of the requirements in 12.1.9, one spare impeller shall be provided for each type of fan.

12.2 PUMP-ROOMS AND OTHER ENCLOSED SPACES NORMALLY ENTERED

12.2.1 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.

12.2.2 The term "other enclosed spaces normally entered" shall include the special lockers and storage rooms required in 14.1.2 and suitable clearly marked locker required in 14.2.5 which are easily accessible to personnel.

12.2.3 The provisions of 12.2.1 shall apply irrespective whether the controls for pumps and valves in the pump room are provided outside the pump room or not.

12.2.4 The distance of the ventilation system outlets and inlets from ventilation inlets, ventilation outlets and other openings to the spaces referred to in 12.1.16 shall be not less than 3 m in the horizontal direction.

The height of the ventilation inlets shall be not less than 3 m above the weatherdeck.

12.3 SPACES NOT NORMALLY ENTERED

12.3.1 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.

12.3.2 Portable fans driven by electric or internal combustion motors are not acceptable.

12.3.3 For the recommendations for ventilation of the double hull spaces see MSC/Circ.730.

13 INSTRUMENTATION

13.1 GAUGING

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

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

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

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

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

13.1.4 The types of gauging devices for individual products are shown in column **j** in the table of Section 17.

13.1.5 A restricted gauging device may consist of a sounding pipe with an inside diameter not greater than 200 mm, fitted with a vapour-tight cover. The pipe shall be provided with holes located inside the cargo tank in the proximity of the tank top in order to make its internal pressure equal to that of the tank.

13.1.6 Where in addition to the closed gauging device, for a certain products, an overflow-control system and high level alarm are also required, the requirements for independency of systems as specified in 15.19.10 to 15.19.14 shall be complied with.

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 *Register* may exempt the ship from the requirement, provided an appropriate entry is made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk. When granting such an exemption, the *Register* shall recognize the necessity for additional breathing-air supply and an entry shall be made on the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk drawing attention to the provisions of 14.2.4 and 16.4.2.2.

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

13.2.5 Vapour-detection instruments, either fixed or portable, shall be of a type recognised suitable by the *Register* for the products to be carried. The spaces which shall be monitored are:

- .1 cargo pump-rooms and pump-rooms located in the cargo area;
- .2 spaces containing motors driving cargo pumps, except for the machinery space;
- .3 enclosed spaces containing cargo piping and equipment connected with cargo handling, cofferdams, enclosed spaces and double bottoms and double hull spaces adjacent to cargo tanks;
- .4 pipe tunnels in the cargo area;
- .5 other spaces, deemed necessary by the *Register*, depending on the ship arrangement.

Where a fixed system is installed, it shall serve at least the spaces among those listed above which are normally entered by the crew (see 12.1 and 12.2).

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

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

14.1.4 The number of work clothes and protective equipment shall be sufficient for those working in the cargo area, on deck and in cargo pump room, and in any case not less than three complete sets shall be provided.

14.1.5 Where one type of the work clothes and protective equipment is not suitable for all products the ship is certified to carry, the necessary number of sets for respective types of cargo shall be provided.

14.1.6 The lockers for used work cloths and protective equipment which have not undergone a thorough cleaning process, located within accommodation spaces, shall comply with requirements in 3.2.5.

14.1.7 For the minimum safety standards for ships carrying liquids in bulk containing benzene see MSC/Circ.1095 and MSC.1/Circ.1220.

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 for tankers ($\leq 60^{\circ}\text{C}$) in *Rules, Part 17 – Fire Protection*, Table 25.1, item 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 for tankers ($\leq 60^{\circ}\text{C}$) as specified in *Rules, Part 17 – Fire Protection*, Table 25.1, item 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.

14.2.5 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.

14.2.7 The equivalent quantity of spare bottled air permitting personnel to perform work for at least 20 min, as required in 14.2.1, shall be not less than 800 l of the free air volume, for each set.

14.2.8 The equivalent quantity of spare bottled air referred to in 14.2.4.2 shall be not less than 4,800 l under atmospheric pressure.

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

ble 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 (see Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG)).

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 shall be available on deck in convenient locations. The showers and eyewash shall be operable in all ambient conditions.

14.3.5 Medical first-aid equipment shall be kept in a special clearly marked locker, located within accommodation spaces.

14.3.6 The decontamination showers and eye wash shall be provided on the main deck at both sides in way of the loading/unloading manifold and at the front of superstructures or deck houses.

In order for the showers and eye wash to be operable in all ambient conditions, the water pipes shall be fitted with a heating system or other suitable installation so as to avoid any ice formation in the piping.

15 SPECIAL REQUIREMENTS

15.1 GENERAL

15.1.1 The requirements 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 Section 1 to Section 14.

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 *Register*, 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 *Register*.

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

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

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

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

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

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

15.2.10 For the purpose of injecting ammonia the cargo may be circulated by means of the cargo pump. Gaseous ammonia shall be injected into the circulating cargo.

15.2.11 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.

15.3 CARBON DISULPHIDE

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

Carriage under water pad

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

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

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

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

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

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

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

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

15.3.9 Safety relief valves shall be of stainless steel construction.

15.3.10 Because of its low ignition temperature and close clearances required to arrest its flame propagation, only intrinsically safe systems and circuits are permitted in the hazardous locations (see 10.4.3).

Carriage under suitable inert gas pad

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

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

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

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

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

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

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

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

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

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

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

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

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

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

where:

V_L = volume of the tank

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

ρ_L = density of cargo at the loading temperature

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

15.3.25 Zones on weather deck, or semi-enclosed spaces on weather deck within three metres of a tank outlet, gas or vapour outlet, cargo pipe flange or cargo valve of a tank certified to carry carbon disulphide, shall comply with the electrical equipment requirements specified for carbon disulphide in column i, in the table of 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 *Register*. Cargo handling plans shall show the entire cargo piping system. A copy of the approved cargo handling plan shall be available on board. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be endorsed to include reference to the approved cargo handling plan.

15.4 DIETHYL ETHER

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

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

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

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

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

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

15.5 HYDROGEN PEROXIDE SOLUTIONS

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

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

15.5.1.2 Cargo tanks and associated equipment shall be either pure aluminium (99.5%) or solid stainless steel (304L, 316, 316L or 316Ti), and passivated in accordance with approved procedures. Aluminium shall not be used for piping on deck. All 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 shall not be used for seawater ballast.

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

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

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

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

15.5.1.10 A fixed water-spray system shall be provided for diluting and washing away any concentrated hydrogen peroxide solution spilled on deck. The areas covered by the water-

spray shall include the manifold/hose connections and the tank tops of those tanks designated for carrying hydrogen peroxide solutions. The minimum application rate shall satisfy the following criteria:

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

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

15.5.1.12 Protective clothing that is resistant to hydrogen peroxide solutions shall be provided for each crew member involved in cargo-transfer operations. Protective clothing shall include 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 MSC/Circ.394 (see 15.5.3). A certificate shall be on board the vessel indicating that the procedures in the circular have been followed. The passivation requirement may be waived by an Administration for domestic shipments of short duration. Particular care in this respect is essential to ensure the safe carriage of hydrogen peroxide:

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

15.5.2.3 Cargo tanks and associated equipment shall be either pure aluminium (99.5%) or solid stainless steel of types suitable for use with hydrogen peroxide (e.g. 304, 304L, 316, 316L, 316Ti). Aluminium shall not be used for piping on deck. All non-metallic materials of construction for the con-

tainment system shall neither be attacked by hydrogen peroxide nor contribute to its decomposition.

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

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

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

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

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

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

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

15.5.2.10 Only those hydrogen peroxide solutions which have a maximum decomposition rate of 1% per year at 25°C shall be carried. Certification from the shipper that the product meets this standard shall be presented to the master and kept on board. A technical representative of the manufacturer

shall be on board to monitor the transfer operations and have the capability to test the stability of the hydrogen peroxide. He shall certify to the master that the cargo has been loaded in a stable condition.

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

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

15.5.3 Procedures for inspection, cleaning, passivation and loading of tanks for the carriage of hydrogen peroxide solutions 8-60%, which have contained other cargoes, or for the carriage of other cargoes after the carriage of hydrogen peroxide (MSC/Circ.394)

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

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

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

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

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

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

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

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

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

- .1 New welds and other repaired parts shall be cleaned and finished using stainless steel wire brush, chisel, sandpaper or buff. Rough surfaces shall be given a smooth finish. A final polishing is necessary.
- .2 Fatty and oily residues shall be removed by the use of appropriate organic solvents or detergent solutions in water. The use of chlorine-containing compounds shall be avoided as they can seriously interfere with passivation.
- .3 The residues of the degreasing agent shall be removed, followed by a washing with water.
- .4 In the next step, scale and rust shall be removed by the application of acid (e.g. a mixture of nitric and hydrofluoric acids), followed again by a washing with clean water.
- .5 All the metal surfaces which can come into contact with hydrogen peroxide shall be passivated by the application of nitric acid of a concentration between 10 and 35% by mass. The nitric acid must be free from heavy metals, other oxidizing agents or hydrogen fluoride. The passivation process shall continue for 8 to 24 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 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 min 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 to 0.5% sodium hydroxide). To prevent excessive corrosion at the bottom of the tank when treating with more concentrated solutions of sodium hydroxide, water shall be added continuously to dilute the sodium hydroxide solution which collects there.
- .3 The tank shall be thoroughly washed with clean, filtered water. As soon as possible after washing, the surface shall be passivated by the application of nitric acid of a concentration between 30 and 35% by mass. The passivation process shall continue for 16 to 24 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 shall be repeated until the effluent water has the same pH value as the incoming water.
- .5 A visual inspection shall be made to ensure that all surfaces have been treated. It is recommended that an additional flushing is carried out for a minimum of 24 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 is loaded under intermittent visual supervision of the interior of the tank from an appropriate opening.

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

15.5.3.14 The concentration and stability of the hydrogen peroxide solution shall be determined again. If the same values are obtained within the limits of error as in paragraph 15.5.2.10, the tank is considered to be properly passivated and the cargo ready for shipment.

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

15.5.3.16 The following procedure shall be applied when tanks having contained hydrogen peroxide solution are to be used for other products (unless otherwise specified, all steps

apply to the tanks and to all associated equipment having been in contact with hydrogen peroxide):

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

Steps .1 to .3, in 15.5.3.16, shall be carried out under the supervision of the master or the shipper.

Step .3 in paragraph 15.5.3.16 shall be carried out by a person familiar with the safety-relevant properties of the chemical to be transported and of hydrogen peroxide.

Special cautions

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

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

- .1 name and amount of stabilizer added;
- .2 date stabilizer was added and duration of effectiveness;
- .3 any temperature limitations qualifying the stabilizer's effective lifetime;
- .4 the action to be taken should the length of voyage exceed the effective lifetime of the stabilizer.

15.6 MOTOR FUEL ANTI-KNOCK COMPOUNDS (CONTAINING LEAD ALKYLs)

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

15.6.2 If a cargo 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 *Register*.

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

15.7 PHOSPHORUS, YELLOW OR WHITE

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

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

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

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

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

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

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

15.7.8 A water drench system acceptable to the *Register* 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 *Register*.

15.8 PROPYLENE OXIDE OR ETHYLENE OXIDE/PROPYLENE MIXTURES WITH AN ETHYLENE OXIDE CONTENT OF 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. benzenesulphonic);
- .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 service for these products, such inspections shall be performed at intervals of not more than two years.

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

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

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

15.8.9 Gaskets shall be constructed of materials which do not react with, dissolve in, or lower the autoignition temperature of these products and which are fire-resistant and possess adequate mechanical behaviour. The surface presented to the cargo shall be polytetrafluoroethylene (PTFE), or mate-

rials giving a similar degree of safety by their inertness. Spirally wound stainless steel, with a filler of PTFE or similar fluorinated polymer, may be accepted.

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

Gaskets of other type and/or other materials shall be type approved by the *Register*.

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 *Register*:

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

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

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

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

15.8.14.2 The products shall be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapourreturn system connected to a containment system for the product shall be independent of all other containment systems (see MSC/Circ.585).

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

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

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

15.8.17 Cargo hoses used for transfer of these products shall be marked: "FOR ALKYLENE OXIDE TRANSFER ONLY".

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

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

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

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

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

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 *Register* for ships operating in restricted areas or on voyages of restricted duration, and account may be taken in such cases of any insulation of the tanks. The area and times of year for which such carriage would be permitted shall be included in the conditions of carriage of the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

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

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

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

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

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

15.8.25.1 The piping system for tanks to be loaded with these products shall be separated (as defined in 3.1.4) from piping systems for all other tanks, including empty tanks. If the piping system for the tanks to be loaded is not independent (as defined in 1.4.2.19), the required piping separation shall be accomplished by the removal of spool-pieces, valves, or other pipe section and the installation of blank flanges at these loca-

tions. 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 *Register*. Each intended loading arrangement shall be shown on a separate cargo-handling plan. Cargo-handling plans shall show the entire cargo piping system and the locations for installation of blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo-handling plan shall be maintained on board the ship. The International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk shall be endorsed to include reference to the approved cargo-handling plans.

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

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

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

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

where

V_L = maximum volume to which the tank may be loaded
 V = volume of the tank
 ρ_R = density of cargo at the reference temperature
 ρ_L = density of cargo at the loading temperature and pressure

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

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

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

15.8.29 A water-spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with

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

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

15.9 SODIUM CHLORATE SOLUTION (50% OR LESS BY MASS)

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

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

15.10 SULPHUR (MOLTEN)

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

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

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

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

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

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

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

15.11 ACIDS

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

15.11.2 Materials of construction used for cargo tanks shall comply with the requirements specified in Section 6. Proposals for lining steel tanks and related piping systems with corrosion-resistant materials may be considered by the *Register*.

Lining is an acid-resistant material that is applied to the tank or piping system in a solid state with a defined elasticity property.

The elasticity of the lining shall not be less than that of the supporting boundary plating.

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

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

15.11.5 Because of the danger of evolution of hydrogen when these substances are being carried, the electrical arrangements shall comply with 10.1.4. 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 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.

15.11.9 The shields and drip trays referred to in 15.11.4 shall be of the corrosion-resistant material.

15.11.10 For the purpose of the requirements in 15.11.6, in segregating cargo tanks carrying cargo or cargo residues from oil fuel tanks none of facial contacts, linear contacts and point contacts are accepted.

15.11.11 For the purpose of detecting leakage of cargo into adjacent spaces, the pH meter and hydrogen detector shall be provided. These apparatus may be of the portable type. As an alternative the litmus papers may also be used.

15.11.12 Drip trays shall be provided underneath the cargo pumps and associated flange joints to collect and led drains to bilge wells, and shall be of the corrosion-resistant materials, or applied with effective coatings.

Where the bottom of the cargo pump room and its casing walls to a height of 1 m from the bottom are made corrosion-resistant, this requirements may be dispensed with.

15.12 TOXIC PRODUCTS

15.12.1 Exhaust openings of tank vent systems shall be located:

- 1 at a height of B/3 or 6 m, whichever is greater, above the weather deck or, in the case of a deck tank, the access gangway;
- 2 not less than 6 m above the fore-and-aft gangway, if fitted within 6 m of the gangway;

- .3 15 m from any opening or air intake to any accommodation and service spaces; and
- .4 the vent height may be reduced to 3 m above the deck or fore-and-aft gangway, as applicable, provided high-velocity vent valves of an approved type, directing the vapour/air mixture upwards in an unimpeded jet with an exit velocity of at least 30 m/s, are fitted.

15.12.2 Tank venting systems shall be provided with a connection for a vapour-return line to the shore installation (see MSC/Circ. 585).

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 3.7.2).

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

15.12.5 In application of the 15.12.2 connections on the tank venting systems shall be provided with the stop valve.

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 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, refer to MSC-MEPC.2/Circ.14 on Products requiring oxygen-dependent inhibitors;
- .3 date additive was put in the product and duration of effectiveness;
- .4 any temperature limitations qualifying the additives' effective lifetime; and
- .5 the action to be taken shall the length of voyage exceed the effective lifetime of the additives.

For example of a certificate see MSC-MEPC.2/Circ.16.

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 When a product containing an oxygen-dependent inhibitor is to be carried:

- .1 in a ship for which inerting is required under SOLAS regulation II-2/4.5.5, as amended, the application of inert gas shall not take place before loading or during the voyage, but shall be applied before commencement of unloading, refer to MSC-MEPC.2/Circ.14 on Products requiring oxygen-dependent inhibitors;
- .2 in a ship to which SOLAS regulation II-2/4.5.5, as amended, does not apply, the product may be carried without inertion (in tanks of a size not greater than 3,000 m³). If inertion is to be applied on such a ship, then the application of inert gas shall not take place before loading or during the voyage, but shall be applied before commencement of unloading, refer to MSC-MEPC.2/Circ.14 on Products requiring oxygen-dependent inhibitors.

See also MSC-MEPC.5/Circ.10.

For equivalency arrangements for the carriage of styrene monomer, see MSC/Circ.879 and 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

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

15.14 CARGOES WITH A VAPOUR PRESSURE GREATER THAN 0.1013 MPa ABSOLUTE AT 37.8°C

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

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

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

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

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

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

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

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

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

where

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

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

15.14.8 In application of the 15.14.4 connections on the tank venting systems shall be provided with the stop valve.

15.15 HYDROGEN SULPHIDE (H₂S) DETECTION EQUIPMENT FOR BULK LIQUIDS

15.15.1 Hydrogen sulphide (H₂S) detection equipment shall be provided on board ships carrying bulk liquids prone to H₂S formation. It should be noted that scavengers and biocides, when used, may not be 100% effective in controlling the formation of H₂S. Toxic vapour detection instruments complying with the requirement in 13.2.1 for testing for H₂S may be used to satisfy this requirement.

15.16 CARGO CONTAMINATION

15.16.1 Deleted.

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

- .1 Air inlets to pressure/vacuum-relief valves of tanks containing the cargo shall be situated at least 2 m above the weather deck.

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

15.16.3 In application of the requirements in 15.16.2.3 the following shall be complied with.

- .1 permanent ballast or water tanks shall be maintained in dry condition i.e. the tank casings, frames etc. shall be free from attachments of water droplets or from moistened condition;
- .2 the tanks shall be fitted with spool pieces, outside the tank, being removed after discharging ballast and/or water.

15.16.4 In the case of the linear and point contacts divided into the cross welding as shown in Figure 15.16.4-1 the requirements in 15.16.2.3 need not apply.

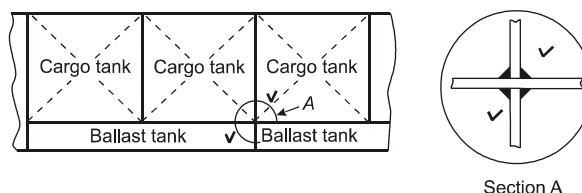


Figure 15.16.4-1
Separation of cargo tank from permanent ballast or water tanks

15.17 INCREASED VENTILATION REQUIREMENTS

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

15.17.2 The term "work areas and similar spaces" in 15.17.1 includes the service spaces, cargo control rooms and similar spaces but does not include cargo manifolds where cargo operation is carried.

15.18 SPECIAL CARGO PUMP-ROOM REQUIREMENTS

15.18.1 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 *Register* may give special consideration to cargo pump-rooms below deck.

15.18.2 No cargo pump-room shall be arranged below deck, under any circumstances; i.e. either submerged cargo pumps shall be provided or cargo pump-rooms shall be provided on open deck.

15.19 OVERFLOW CONTROL

15.19.1 The provisions of this section are applicable where specific reference is made in column o in the table of Section 17, and are in addition to the requirements for gauging devices in 13.1.

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

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

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

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

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

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

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

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

$$LR = \frac{3600 U}{t}, [m^3/h]$$

where:

U = ullage volume, [m³], at operating signal level;

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

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

15.19.9 The function of the level alarms, see 15.19.4, shall be capable of being tested by actual operation of level gauges. When verification by actual operation is impracticable, suitable means to verify that the alarm circuits are in normal condition, as shown in Figure 15.19.9-1, shall be provided.

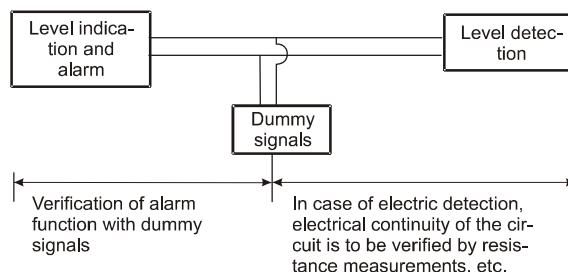


Figure 15.19.9-1
Testing of level alarms

Independency of systems

15.19.10 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.

15.19.11 Electronic, pneumatic and hydraulic circuits required for sensors in 15.19.10.1 to .3 shall be independent of each other such that a fault on any one will not render either of the others inoperative.

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

15.19.13 Where a cargo control room or a navigation bridge space containing a modular unit is envisaged, separate level indication and visual alarms must be provided for each of the functions in 15.19.10.1 to .3. An audible alarm must also be provided but since this is not directional it need not be separate. An audible alarm must also be arranged in the cargo

area. Where there is no cargo control room an audible and visual alarm shall be arranged at the cargo control station.

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

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

15.21 TEMPERATURE SENSORS

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

15.21.2 Cargo pumps and stripping pumps, installed in cargo pump-rooms and driven by shafts passing through pump-room bulkheads shall be fitted with temperature sensing devices for bulkhead shaft glands, bearings and pump casings.

15.21.3 A continuous audible and visual alarm signal shall be initiated in the cargo control room or at the pump control station.

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

15.21.5 The provisions of this section shall also apply where specific reference is made in column **o** in the table of Section 17 (see 3.3.13.1).

16 OPERATIONAL REQUIREMENTS

16.1 MAXIMUM ALLOWABLE QUANTITY OF CARGO PER TANK

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

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

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

16.1.4 The minimum volume of the cargo tank shall be determined with regard to the maximum allowable quantity of cargo specified in 16.1.1 and 16.1.2, as applicable, and in consideration of the thermal expansion of the cargo at temperature of 45°C. Care shall be taken so as to ensure that the open ends of the venting system in the tank may not submerge in the cargo but in the gaseous phase under any trim condition of the ship at sea.

16.1.5 Where the cargo tank temperature will possibly exceed 45°C being affected by cargo heating system, the minimum volume of the cargo tank shall be determined on the basis of such temperature.

16.1.6 For the additional requirements regarding normal liquid-full condition of the cargo tank see 15.3.22, 15.8.26.1, 15.14.7.1 and 15.19.6.

16.2 CARGO INFORMATION

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

16.2.2 Any cargo offered for bulk shipment shall be indicated in the shipping documents by the product name, under which it is listed in Section 17 or 18 of this Part of the Rules or the latest edition of MEPC.2/Circular or under which it has been provisionally assessed (see BLG.1/Circ.25). 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 Register.

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

- .1 a full description of the physical and chemical properties, including reactivity, necessary for the safe containment of the cargo;
- .2 action to be taken in the event of spills or leaks;

- .3 countermeasures against accidental personal contact;
- .4 fire-fighting procedures and fire-fighting media;
- .5 procedures for cargo transfer, tank cleaning, gas-freeing and ballasting; and
- .6 for those cargoes required to be stabilized or inhibited, the cargo shall be refused if the certificate required by these paragraphs is not supplied.

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

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

16.2.6 Where column **o** in the table of 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 (see MSC-MEPC.2/Circ.7).

16.2.7 Where column **o** in the table 17.1.1-1 refers to this item, the cargo is subject to the prewash requirements in regulation 13.7.1.4 of Annex II of MARPOL.

16.2.8 Deleted.

16.2.9 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 (see MSC-MEPC.2/Circ.7).

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 (see Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG)) and a sufficient number of them shall be instructed and trained in essential first aid for cargoes carried (see the STCW Code, parts A and B).

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 *Register*. (see *Rules, Part 17 – Fire Protection, Annex 5, Table 1-1, item 3.*

16.5.2 The stowage space shall be:

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

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

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

16.5.5 When the stowage space is provided in the cargo area, it shall not be located below the open deck. Access to the space shall be from the weather deck. Ventilation of the space shall comply with the requirements in 12.2.

16.6 CARGOES NOT TO BE EXPOSED TO EXCESSIVE HEAT

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

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

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

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

17 SUMMARY OF MINIMUM REQUIREMENTS

17.1 GENERAL

17.1.1 The summary of general, special and operational requirements, “minimum requirements”, for the individual products to which the ships subject to this Part of the Rules shall comply are shown in the Table 17.1.1-1.

17.1.2 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 Part of the Rules applicable to the appropriate position of the entry in this Section for Noxious Liquid Substances, not otherwise specified (n.o.s.).

17.2 EXPLANATORY NOTES TO THE TABLE 17.1.1-1

- .1 **Product name** (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 (for explanation see Chapter 19 of the IBC Code). In some cases, the product names are not identical with the names given in previous issues of the Code.
- .2 **UN number** (column b):
Deleted
- .3 **Pollution Category** (column c):
The letter X, Y, Z means the Pollution Category assigned to each product under MARPOL Annex II.
- .4 **Hazards** (column d):
“S” means that the product is included in this Part of the Rules because of its safety hazards;
P” means that the product is included in this Part of the Rules because of its pollution hazards; and
S/P” means that the product is included in this Part of the Rules because of both its safety and pollution hazards.
- .5 **Ship type** (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)
- .6 **Tank type** (column f):
1 independent tank (4.1.1)
2 integral tank (4.1.2)
G gravity tank (4.1.3)
P pressure tank (4.1.4)
- .7 **Tank vents** (column g):
Cont.: controlled venting
Open: open venting
- .8 **Tank environmental control** (column h):
Inert: inerting (9.1.2.1)
Pad: liquid or gas padding (9.1.2.2)
Dry: drying (9.1.2.3)
Vent: natural or forced ventilation (9.1.2.4)
No: no special requirements under this Part of the Rules (inerting may be required under *Rules, Part 17- Fire protection*)
- .9 **Electrical equipment** (column i)
Temperature classes (i’) T1 to T6
“-” indicates no requirements
blank indicates no information
Apparatus group (i’’) IIA, IIB or IIC:
“-” indicates no requirements
blank indicates no information
Flash point (i’’)’
Yes: flashpoint exceeding 60°C (10.1.6)
No: flashpoint not exceeding 60°C (10.1.6)
NF: non-flammable product (10.1.6)
- .10 **Gauging** (column j)
O: open gauging (13.1.1.1)
R: restricted gauging (13.1.1.2)
C: closed gauging (13.1.1.3)
- .11 **Vapour detection** (column k):
F: flammable vapours (13.2)
T: toxic vapours (13.2)
No: indicates no special requirements under this Part of the Rules
- .12 **Fire protection** (column l):
A: alcohol-resistant foam or multi-purpose foam
B: regular foam; encompasses all foams that are not of an alcohol-resistant type, including fluoro-protein and aqueous-film-forming foam (AFFF)
C: water-spray
D: dry chemical
No: no special requirements under this Part of the Rules
- .13 **Materials of construction** (column m):
Deleted
- .14 **Emergency equipment** (column n)
Yes: see 14.3.1
No: no special requirements under this Part of the Rules
- .15 **Special and operational requirements** (column o):
When specific reference is made to Sections 15 and/or 16, these requirements shall be additional to the requirements in any other column.

Table 17.1.1-1

(updated in accordance with 2019 amendments (resolutions MSC.460(101) / MEPC.318(74))

a	c	d	e	f	g	h	i'	i''	i'''	j	k	l	n	o
Acetic acid	Z	S/P	3	2G	Cont	No	T1	IIA	No	C	F	AC	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.17, 15.19, 16.2.9
Acetic anhydride	Z	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	AC	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, 15.19.6
Acetochlor	X	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.9
Acetone cyanohydrin	Y	S/P	1	1G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.13, 15.17, 15.19, 16.6.1, 16.6.2, 16.6.3
Acetonitrile	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Acetonitrile (Low purity grade)	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Acid oil mixture from soya bean, corn (maize) and sunflower oil refining	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Acrylamide solution (50% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	No	15.12, 15.13, 15.17, 15.19, 16.2.9, 16.6.1
Acrylic acid	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	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, 15.19, 16.2.9, 16.6.1
Acrylic acid/ethenesulphonic acid copolymer with phosphonate groups, sodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
Acrylonitrile	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	FT	AC	Yes	15.12, 15.13, 15.17, 15.19
Acrylonitrile-Styrene copolymer dispersion in polyether polyol	Y	P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Adiponitrile	Z	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Alachlor technical (90% or more)	X	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6, 16.2.9
Alcohol (C9-C11) poly (2.5-9) ethoxylate	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Alcohol (C6-C17) (secondary) poly(3-6) ethoxylates	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Alcohol (C6-C17) (secondary) poly(7-12) ethoxylates	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Alcohol (C10-C18) poly(7) ethoxylate	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Alcohol (C12-C16) poly(1-6) ethoxylates	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Alcohol (C12-C16) poly(20+) ethoxylates	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Alcohol (C12-C16) poly(7-19) ethoxylates	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Alcohols (C13+)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9

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Alcohols (C12+), primary, linear	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	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	ABC	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	ABC	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	ABC	No	15.19.6, 16.2.6
Alkanes (C6-C9)	X	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
Iso- and cyclo-alkanes (C10-C11)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Iso- and cyclo-alkanes (C12+)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
n-Alkanes (C9-C11)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
n-Alkanes (C10 – C20)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Alkaryl polyethers (C9-C20)	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6
Alkenoic acid, polyhydroxy ester borated	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Alkenyl (C11+) amide	X	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Alkenyl (C16-C20) succinic anhydride	Z	S/P	3	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Alkyl acrylate/vinylpyridine copolymer in toluene	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	FT	ABC	No	15.12, 15.17, 15.19.6, 16.2.9
Alkylaryl phosphate mixtures (more than 40% Diphenyl tolyl phosphate, less than 0.02% ortho-isomers)	X	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Alkylated (C4-C9) hindered phenols	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Alkylbenzene, alkylindane, alkylindene mixture (each C12-C17)	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Alkyl benzene distillation bottoms	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	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	FT	ABC	No	15.12, 15.17, 15.19.6
Alkylbenzenes mixtures (containing naphthalene)	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Alkyl (C3-C4) benzenes	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C5-C8) benzenes	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C9+) benzenes	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Alkyl (C11-C17) benzene sulphonic acid	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Alkylbenzene sulphonic acid, sodium salt solution	Y	S/P	2	2G	Cont	No	-	-	NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Alkyl/cyclo (C4-C5) alcohols	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C10-C15, C12 rich) phenol poly (4-12) ethoxylate	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Alkyl (C12+) dimethylamine	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19

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Alkyl dithiocarbamate (C19-C35)	Y	P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Alkyldithiothiadiazole (C6-C24)	Y	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.6
Alkyl ester copolymer (C4-C20)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Alkyl (C7-C9) nitrates	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 15.20, 16.6.1, 16.6.2, 16.6.3
Alkyl (C8-C10)/(C12-C14):(40% or less/60% or more) polyglucoside solution (55% or less)	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Alkyl (C8-C10)/(C12-C14):(60% or more/40% or less) polyglucoside solution(55% or less)	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Alkyl (C7-C11) phenol poly(4-12) ethoxylate	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C8-C40) phenol sulphide	Z	S/P	3	2G	Open	No			Yes	O	No	ABC	No	
Alkyl (C8-C9) phenylamine in aromatic solvents	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C9-C15) phenyl propoxylate	Z	S/P	3	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Alkyl (C8-C10) polyglucoside solution (65% or less)	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Alkyl (C8-C10)/(C12-C14):(50%/50%) polyglucoside solution (55% or less)	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Alkyl (C12-C14) polyglucoside solution (55% or less)	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Alkyl (C12-C16) propoxyamine ethoxylate	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	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	ABC	No	15.19.6, 16.2.9
Alkyl sulphonic acid ester of phenol	Y	P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Alkyl (C18+) toluenes	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9
Alkyl (C18-C28) toluenesulphonic acid	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	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, 16.2.6, 16.2.9
Alkyl (C18-C28) toluenesulphonic acid, calcium salts, borated	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Alkyl (C18-C28) toluenesulphonic acid, calcium salts, low overbase	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Alkyl (C18-C28) toluenesulphonic acid, calcium salts, high overbase	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Allyl alcohol	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Allyl chloride	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19
Aluminium chloride/Hydrogen chloride solution	Y	S/P	2	2G	Cont	No	-	-	NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19

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Aluminium hydroxide, sodium hydroxide, sodium carbonate solution (40% or less)	Y	S/P	2	2G	Cont	No	-	-	NF	C	T	No	Yes	15.12, 15.17, 15.19
Aluminium sulphate solution	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19
2-(2-Aminoethoxy) ethanol	Z	S/P	3	2G	Cont	No			Yes	C	T	AD	Yes	15.12, 15.17, 15.19
Aminoethyldiethanolamine/Aminoethylethanolamine solution	Z	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Aminoethyl ethanolamine	Z	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
N-Aminoethylpiperazine	Z	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
2-Amino-2-methyl-1-propanol	Z	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Ammonia aqueous (28% or less)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19
Ammonium chloride solution (less than 25%) (*)	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	AC	No	
Ammonium lignosulphonate solutions	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Ammonium nitrate solution (93% or less) (*)	Z	S/P	2	1G	Cont	No			NF	R	T	No	No	15.2, 15.11.4, 15.11.6, 15.12.3, 15.12.4, 15.18, 15.19.6, 16.2.9
Ammonium polyphosphate solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
Ammonium sulphate solution	Z	P	3	2G	Open	No			NF	O	No	No	No	
Ammonium sulphide solution (45% or less) (*)	Y	S/P	2	2G	Cont	Inert	T4	IIB	No	C	FT	AC	No	15.12, 15.17, 15.19, 16.6.1, 16.6.2, 16.6.3
Ammonium thiosulphate solution (60% or less)	Z	S/P	3	2G	Open	No			NF	O	No	No	No	
Amyl acetate (all isomers)	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
n-Amyl alcohol	Z	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	ABC	Yes	15.12, 15.17, 15.19
Amyl alcohol, primary	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
sec-Amyl alcohol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
tert-Amyl alcohol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
tert-Amyl ethyl ether	Z	P	3	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
tert-Amyl methyl ether	X	S/P	2	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Aniline	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Aryl polyolefins (C11-C50)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Aviation alkylates (C8 paraffins and isoparaffins BPT 95 - 120°C)	X	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
Barium long chain (C11-C50) alkaryl sulphate	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 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	FT	ABC	No	15.12, 15.17, 15.19.6, 16.2.9
Benzene sulphonyl chloride	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Benzenetricarboxylic acid, trioctyl ester	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Benzyl acetate	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Benzyl alcohol	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6

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Benzyl chloride	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	FT	ABC	Yes	15.12, 15.13, 15.17, 15.19
Bio-fuel blends of Diesel/gas oil and FAME (>25% but <99% by volume)	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Bio-fuel blends of Diesel/gas oil and vegetable oil (>25% but <99% by volume)	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Bio-fuel blends of Gasoline and Ethyl alcohol (>25% but <99% by volume)	X	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	AC	No	15.12, 15.17, 15.19.6
Bis (2-ethylhexyl) terephthalate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
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	AC	No	
Bromochloromethane	Z	P	3	2G	Open	No			NF	O	No	No	No	
Butene oligomer	X	P	2	2G	Cont	No	T4	IIB	No	R	F	ABC	No	15.19.6
2-Butoxyethanol (58%)/Hyperbranched polyesteramide (42%) (mixture)	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	No	15.12.3, 15.12.4, 15.19
Butyl acetate (all isomers)	Y	P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Butyl acrylate (all isomers)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
tert-Butyl alcohol	Z	P	3	2G	Cont	No	T1	IIA	No	R	F	AC	No	15.19.6
Butylamine (all isomers)	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Butylbenzene (all isomers)	X	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Butyl benzyl phthalate	X	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Butyl butyrate (all isomers)	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
Butyl/Decyl/Cetyl/Eicosyl methacrylate mixture	Y	S/P	2	2G	Open	No	T3	IIA	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
Butylene glycol	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	
1,2-Butylene oxide	Y	S/P	3	2G	Cont	Inert	T2	IIB	No	C	FT	AC	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, 15.12, 15.17, 15.19.6
n-Butyl ether	Y	S/P	3	2G	Cont	Inert	T4	IIB	No	R	F	AC	No	15.4.6, 15.19
Butyl methacrylate	Z	S/P	3	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
n-Butyl propionate	Y	P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Butyraldehyde (all isomers)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Butyric acid	Y	S/P	3	2G	Cont	No			Yes	O	No	AC	No	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.19.6
gamma-Butyrolactone	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6

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Calcium alkaryl sulphate (C11-C50)	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
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	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Calcium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19.6
Calcium hypochlorite solution (more than 15%)	X	S/P	1	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19
Calcium lignosulphonate solutions	Z	P	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Calcium long-chain alkyl (C5-C10) phenate	Y	P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6
Calcium long-chain alkyl (C11-C40) phenate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Calcium long-chain alkyl phenate sulphide (C8-C40)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Calcium long-chain alkyl salicylate (C13+)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Calcium long-chain alkyl (C18-C28) salicylate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Calcium nitrate/Magnesium nitrate/Potassium chloride solution	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Calcium nitrate solution (50% or less)	Z	S	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Camelina oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7
epsilon-Caprolactam (molten or aqueous solutions)	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Carbolic oil	Y	S/P	2	2G	Cont	No			Yes	C	FT	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Carbon disulphide	Y	S/P	1	1G	Cont	Pad + inert	T6	IIC	No	C	FT	C	Yes	15.3, 15.12, 15.17, 15.18, 15.19
Carbon tetrachloride	Y	S/P	2	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19.6
Cashew nut shell oil (untreated)	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.7, 16.2.9
Castor oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Cesium formate solution (*)	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	ABC	No	15.13, 15.19.6, 16.2.9, 16.6.1, 16.6.2
Chlorinated paraffins (C10-C13)	X	S/P	1	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19, 16.2.6
Chlorinated paraffins (C14-C17) (with 50% chlorine or more, and less than 1% C13 or shorter chains)	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	AC	No	15.12, 15.17, 15.19
Chloroacetic acid (80% or less)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12, 15.17, 15.18, 15.19, 16.2.9
Chlorobenzene	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6

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Chloroform	Y	S/P	3	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19.6
Chlorohydrins (crude)	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
4-Chloro-2-methylphenoxyacetic acid, dimethylamine salt solution	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
o-Chloronitrobenzene	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12.3, 15.12.4, 15.19, 16.2.6, 16.2.9
1-(4-Chlorophenyl)-4,4- dimethyl-pentan-3-one	Y	S/P	2	2G	Open	No			Yes	O	No	ABD	No	15.19.6, 16.2.6, 16.2.9
2- or 3-Chloropropionic acid	Z	S/P	2	2G	Cont	No			Yes	C	T	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, 16.2.9
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, 15.17, 15.18, 15.19
m-Chlorotoluene	Y	S/P	2	2G	Cont	No	T4	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19
o-Chlorotoluene	Y	P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
p-Chlorotoluene	Y	P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6, 16.2.9
Chlorotoluenes (mixed isomers)	Y	P	2	2G	Cont	No	T4	IIA	No	R	F	ABC	No	15.19.6
Choline chloride solutions	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Citric acid (70% or less)	Z	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Coal tar	X	S/P	2	2G	Cont	No	T2	IIA	Yes	C	T	BD	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Coal tar naphtha solvent	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6, 16.2.9
Coal tar pitch (molten) (*)	X	S/P	2	1G	Cont	No	T2	IIA	Yes	C	T	ABC D	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Cocoa butter	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Coconut oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Coconut oil fatty acid	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Coconut oil fatty acid methyl ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Copper salt of long chain (C17+) alkanolic acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Corn Oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Cotton seed oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Creosote (coal tar)	X	S/P	1	2G	Cont	No	T2	IIA	Yes	C	T	AD	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9

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Cresols (all isomers)	Y	S/P	1	2G	Cont	No	T1	IIA	Yes	C	T	ABC	Yes	15.12, 15.18, 15.19, 16.2.9
Cresol/Phenol/Xylenol mixture	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Cresylic acid, dephenolized	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Cresylic acid, sodium salt solution	Y	S/P	2	2G	Cont	No	T4	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Crotonaldehyde	X	S/P	1	1G	Cont	No	T3	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.18, 15.19
1,5,9-Cyclododecatriene	X	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.13, 15.19.6, 16.6.1, 16.6.2
Cycloheptane	X	S/P	2	2G	Cont	No	T4	IIA	No	R	F	AC	No	15.19.6
Cyclohexane	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6, 16.2.9
Cyclohexane-1,2-dicarboxylic acid, diisononyl ester	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Cyclohexane oxidation products, sodium salts solution	Z	P	3	2G	Open	No	-	-	NF	O	No	No	No	
Cyclohexanol	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Cyclohexanone	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Cyclohexanone, Cyclohexanol mixture	Y	S/P	3	2G	Cont	No			Yes	R	F	AC	No	15.19.6
Cyclohexyl acetate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Cyclohexylamine	Y	S/P	3	2G	Cont	No	T3	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
1,3-Cyclopentadiene dimer (molten)	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19, 16.2.6, 16.2.9
Cyclopentane	Y	P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Cyclopentene	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
p-Cymene	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Decahydronaphthalene	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Decanoic acid	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Decene	X	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Decyl acrylate	X	S/P	1	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.13, 15.19, 16.6.1, 16.6.2
Decyl alcohol (all isomers)	Y	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9(e)
Decyl/Dodecyl/Tetradecyl alcohol mixture	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Decyloxytetrahydrothiophene dioxide	X	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Diacetone alcohol	Z	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Dialkyl (C8-C9) diphenylamines	Z	P	3	2G	Open	No			Yes	O	No	ABC	No	
Dialkyl (C7-C13) phthalates	X	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6
Dialkyl (C9-C10) phthalates	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Dialkyl thiophosphates sodium salts solution	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
2,6-Diaminohexanoic acid phosphonate mixed salts solution	Z	S/P	3	2G	Cont	No	-	-	NF	R	No	No	No	15.11, 15.17, 15.19.6
Dibromomethane	Y	S/P	2	2G	Open	No			NF	O	No	No	No	15.19.6

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Dibutylamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	ABC	Yes	15.12, 15.17, 15.19
Dibutyl hydrogen phosphonate	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
2,6-Di-tert-butylphenol	X	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9
Dibutyl phthalate	X	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Dibutyl terephthalate	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9
Dichlorobenzene (all isomers)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	ABD	No	15.12, 15.17, 15.19.6
3,4-Dichloro-1-butene	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
1,1-Dichloroethane	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Dichloroethyl ether	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.18, 15.19
1,6-Dichlorohexane	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
2,2'-Dichloroisopropyl ether	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19
Dichloromethane	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6
2,4-Dichlorophenol	Y	S/P	2	2G	Cont	Dry			Yes	C	T	AD	Yes	15.12, 15.16.2, 15.17, 15.19, 16.2.6, 16.2.9
2,4-Dichlorophenoxyacetic acid, diethanolamine salt solution	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.9
2,4-Dichlorophenoxyacetic acid, dimethylamine salt solution (70% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.9
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt solution	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
1,1-Dichloropropane	Y	S/P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
1,2-Dichloropropane	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
1,3-Dichloropropene	X	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	ABC	Yes	15.12, 15.17, 15.19
Dichloropropene/Dichloropropane mixtures	X	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	ABD	No	15.12, 15.17, 15.19
2,2-Dichloropropionic acid	Y	S/P	2	2G	Cont	Dry			Yes	C	T	AD	Yes	15.11.2, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12, 15.16.2, 15.17, 15.19, 16.2.9
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	Cont	No	T1	IIA	Yes	C	T	AC	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Diethylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Diethylaminoethanol	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
2,6-Diethylaniline	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Diethylbenzene	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Diethylene glycol	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Diethylene glycol dibutyl ether	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
Diethylene glycol diethyl ether	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Diethylene glycol phthalate	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Diethylenetriamine	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19

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Diethylenetriaminepentaacetic acid, pentasodium salt solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
Diethyl ether (*)	Z	S/P	2	1G	Cont	Inert	T4	IIB	No	R	F	AC	No	15.4, 15.14, 15.19
Di-(2-ethylhexyl) adipate	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Di-(2-ethylhexyl) phosphoric acid	Y	S/P	2	2G	Cont	No			Yes	R	T	AD	No	15.12.3, 15.12.4, 15.19.6
Diethyl phthalate	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6
Diethyl sulphate	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Diglycidyl ether of bisphenol A	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Diglycidyl ether of bisphenol F	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6, 16.2.6
Diheptyl phthalate	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Di-n-hexyl adipate	X	S/P	1	2G	Open	No			Yes	O	No	AC	No	15.19
Dihexyl phthalate	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Diisobutylamine	Y	S/P	2	2G	Cont	No	T4	IIB	No	C	FT	ABC	No	15.12.3, 15.12.4, 15.19
Diisobutylene	Y	P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Diisobutyl ketone	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Diisobutyl phthalate	X	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Diisononyl adipate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
Diisooctyl phthalate	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Diisopropanolamine	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Diisopropylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.17, 15.19.6
Diisopropylbenzene (all isomers)	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Diisopropylnaphthalene	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
N,N-Dimethylacetamide	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
N,N-Dimethylacetamide solution (40% or less)	Z	S/P	3	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19.6
Dimethyl adipate	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Dimethylamine solution (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19
Dimethylamine solution (greater than 45% but not greater than 55%)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19
Dimethylamine solution (greater than 55% but not greater than 65%)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.14, 15.19
N,N-Dimethylcyclohexylamine	Y	S/P	2	2G	Cont	No	T3	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Dimethyl disulphide	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
N,N-Dimethyldodecylamine	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Dimethylethanolamine	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Dimethylformamide	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
Dimethyl glutarate	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Dimethyl hydrogen phosphite	Y	S/P	3	2G	Cont	No	T4	IIB	No	R	F	AC	No	15.19.6
Dimethyl octanoic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9

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Dimethyl phthalate	Y	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Dimethylpolysiloxane	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
2,2-Dimethylpropane-1,3-diol (molten or solution)	Z	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	16.2.9
Dimethyl succinate	Y	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Dinitrotoluene (molten)	X	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19, 15.21, 16.2.6, 16.2.9, 16.6.4
Dinonyl phthalate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
Diocetyl phthalate	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
1,4-Dioxane	Y	S/P	3	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12, 15.17, 15.19.6, 16.2.9
Dipentene	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Diphenyl	X	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Diphenylamine (molten)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Diphenylamine, reaction product with 2,2,4-Trimethylpentene	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19, 16.2.6
Diphenylamines, alkylated	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19, 16.2.6, 16.2.9
Diphenyl/Diphenyl ether mixtures	X	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Diphenyl ether	X	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Diphenyl ether/Diphenyl phenyl ether mixture	X	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Diphenylmethane diisocyanate	Y	S/P	2	2G	Cont	Dry	-	-	Yes(a)	C	T(a)	AB(b) D	Yes	15.12, 15.16.2, 15.17, 15.19, 16.2.6, 16.2.9
Diphenylol propane-epichlorohydrin resins	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Di-n-propylamine	Y	S/P	2	2G	Cont	No	T3	IIB	No	C	FT	AC	Yes	15.12.3, 15.12.4, 15.17, 15.19.6
Dipropylene glycol	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Dithiocarbamate ester (C7-C35)	X	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Ditridecyl adipate	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Ditridecyl phthalate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
Diundecyl phthalate	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Dodecane (all isomers)	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
tert-Dodecanethiol	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
1-Dodecene	Y	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Dodecene (all isomers)	X	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Dodecyl alcohol	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
n-Dodecyl mercaptan	X	S/P	1	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Dodecylamine/Tetradecylamine mixture	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Dodecylbenzene	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Dodecyl diphenyl ether disulphonate solution	X	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.6

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Dodecyl hydroxypropyl sulphide	X	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6
Dodecyl methacrylate	Y	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.13, 15.19.6
Dodecyl/Octadecyl methacrylate mixture	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	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	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
Dodecyl phenol	X	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6
Dodecyl Xylene	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Drilling brines (containing zinc chloride)	X	S/P	2	2G	Open	No	-	-	NF	O	No	No	Yes	15.19.6
Drilling brines (containing calcium bromide)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6
Epichlorohydrin	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Ethanolamine	Y	S/P	3	2G	Cont	No	T2	IIA	Yes	C	FT	AC	Yes	15.12, 15.17, 15.19, 16.2.9
2-Ethoxyethyl acetate	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
Ethoxylated long chain (C16+) alkyloxy-alkylamine	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Ethoxylated tallow amine (>95%)	X	S/P	2	2G	Cont	Inert	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Ethyl acetate	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Ethyl acetoacetate	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	
Ethyl acrylate	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12, 15.13, 15.17, 15.19, 16.6.1, 16.6.2
Ethylamine (*)	Y	S/P	2	1G	Cont	No	T2	IIA	No	C	F	AC	No	15.12.3.2, 15.14, 15.19
Ethylamine solutions (72% or less)	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	F	AC	No	15.12.3.2, 15.14, 15.19
Ethyl amyl ketone	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Ethylbenzene	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
Ethyl tert-butyl ether	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Ethyl butyrate	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Ethylcyclohexane	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
N-Ethylcyclohexylamine	Y	S/P	2	2G	Cont	No	T3	IIB	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19
S-Ethyl dipropylthiocarbamate	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6, 16.2.9
Ethylene carbonate	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Ethylene chlorohydrin	Y	S/P	1	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.18, 15.19
Ethylene cyanohydrin	Y	S/P	2	2G	Cont	No		IIB	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Ethylenediamine	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Ethylenediaminetetraacetic acid, tetrasodium salt solution	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Ethylene dibromide	Y	S/P	2	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19, 16.2.9
Ethylene dichloride	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19
Ethylene glycol	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6
Ethylene glycol acetate	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Ethylene glycol butyl ether acetate	Y	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6

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Ethylene glycol diacetate	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6
Ethylene glycol methyl ether acetate	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Ethylene glycol monoalkyl ethers	Y	S/P	3	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19, 16.2.9
Ethylene glycol phenyl ether	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Ethylene glycol phenyl ether/Diethylene glycol phenyl ether mixture	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Ethylene glycol (>75%)/sodium alkyl carboxylates/borax mixture	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Ethylene glycol (>85%)/sodium alkyl carboxylates mixture	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
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	FT	AC	Yes	15.8, 15.12, 15.14, 15.17, 15.19
Ethylene-vinyl acetate copolymer (emulsion)	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Ethyl-3-ethoxypropionate	Y	P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
2-Ethylhexanoic acid	Y	S/P	3	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
2-Ethylhexyl acrylate	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.13, 15.19.6, 16.6.1, 16.6.2
2-Ethylhexylamine	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19.6
2-Ethyl-2-(hydroxymethyl) propane-1,3-diol (C8-C10) ester	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Ethylidene norbornene	Y	S/P	2	2G	Cont	No	T3	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Ethyl methacrylate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
N-Ethylmethylallylamine	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19
Ethyl propionate	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
2-Ethyl-3-propylacrolein	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6, 16.2.9
Ethyl toluene	Y	P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
Fatty acid (saturated C13+)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Fatty acid methyl esters (m)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	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	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Fatty acids, (C12+)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Fatty acids, (C16+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Fatty acids, essentially linear (C6-C18) 2-ethylhexyl ester	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Ferric chloride solutions	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19, 16.2.9
Ferric nitrate/Nitric acid solution	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19

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Fish oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Fish silage protein concentrate (containing 4% or less formic acid)	Y	P	2	2G	Open	No	-	-	NF	O	No	No	No	15.19.6, 16.2.6
Fish protein concentrate (containing 4% or less formic acid)	Z	P	3	2G	Open	No	-	-	NF	O	No	No	No	
Fluorosilicic acid solution (20-30%)	Y	S/P	3	2G	Cont	No	-	-	NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19
Formaldehyde solutions (45% or less)	Y	S/P	3	2G	Cont	No	T2	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Formamide	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6, 16.2.9
Formic acid (85% or less acid)	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T(g)	AC	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, 15.17, 15.19, 16.2.9
Formic acid (over 85%)	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT(g)	AC	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, 15.17, 15.19, 16.2.9
Formic acid mixture (containing up to 18% propionic acid and up to 25% sodium formate)	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	C	FT	AC	Yes	15.12, 15.17, 15.19
Furfuryl alcohol	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Glucitol/glycerol blend propoxylated (containing less than 10% amines)	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Glucitol/glycerol blend propoxylated (containing 10% or more amines)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Glutaraldehyde solutions (50% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19
Glycerine	Z	S	3	2G	Open	No			Yes	O	No	AC	No	16.2.9
Glycerol monooleate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.9
Glycerol propoxylated	Z	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Glycerol, propoxylated and ethoxylated	Z	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
Glycerol/sucrose blend propoxylated and ethoxylated	Z	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
Glyceryl triacetate	Z	S/P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Glycidyl ester of C10 trialkylacetic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Glycine, sodium salt solution	Z	S/P	3	2G	Open	No			NF	O	No	No	No	
Glycolic acid solution (70% or less)	Z	S/P	3	2G	Cont	No	-	-	NF	C	T	No	Yes	15.12.3, 15.12.4, 15.17, 15.19, 16.2.9
Glyoxal solution (40% or less)	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9

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Glyoxylic acid solution (50% or less)	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	ACD	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, 16.2.9, 16.6.1, 16.6.2, 16.6.3
Glyphosate solution (not containing surfactant)	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Grape Seed Oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7
Groundnut oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Heptane (all isomers)	X	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
n-Heptanoic acid	Z	S/P	3	2G	Cont	No			Yes	R	No	ABC	No	15.19.6, 15.17
Heptanol (all isomers) (d)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Heptene (all isomers)	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
Heptyl acetate	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
1-Hexadecylnaphthalene / 1,4-bis(hexadecyl)naphthalene mixture	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Hexamethylenediamine (molten)	Y	S/P	3	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Hexamethylenediamine adipate (50% in water)	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Hexamethylenediamine solution	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Hexamethylene diisocyanate	Y	S/P	2	2G	Cont	Dry	T1	IIB	Yes	C	T	AC(b) D	Yes	15.12, 15.16.2, 15.17, 15.18, 15.19
Hexamethylene glycol	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	
Hexamethyleneimine	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19
Hexamethylenetetramine solutions	Z	S	3	2G	Open	No			Yes	O	No	AC	No	15.19.6
Hexane (all isomers)	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
1,6-Hexanediol, distillation overheads	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Hexanoic acid	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Hexanol	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Hexene (all isomers)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Hexyl acetate	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
Hexylene glycol	Z	S	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Hydrocarbon wax	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Hydrochloric acid (*)	Z	S/P	3	1G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19
Hydrogen peroxide solutions (over 60% but not over 70% by mass)	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.5.1, 15.12.3, 15.12.4, 15.19.6
Hydrogen peroxide solutions (over 8% but not over 60% by mass)	Y	S/P	3	2G	Cont	No			NF	R	T	No	No	15.5.2, 15.18, 15.12.3, 15.12.4, 15.19.6
2-Hydroxyethyl acrylate	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.13, 15.17, 15.19, 16.6.1, 16.6.2

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N-(Hydroxyethyl)ethylenediaminetriacetic acid, trisodium salt solution	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
2-Hydroxy-4-(methylthio)butanoic acid	Z	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Illipe oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Isoamyl alcohol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Isobutyl alcohol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Isobutyl formate	Z	P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Isobutyl methacrylate	Z	S/P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2
Isophorone	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Isophoronediamine	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Isophorone diisocyanate	Y	S/P	2	2G	Cont	Dry			Yes	C	T	ABD	Yes	15.12, 15.16.2, 15.17, 15.19
Isoprene	Y	S/P	2	2G	Cont	No	T3	IIB	No	C	FT	ABC	No	15.12, 15.13, 15.14, 15.17, 15.19.6, 16.6.1, 16.6.2
Isopropanolamine	Y	S/P	3	2G	Cont	No	T2	IIA	Yes	R	No	AC	No	15.19.6, 16.2.6, 16.2.9
Isopropyl acetate	Z	P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
Isopropylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12.3.2, 15.14, 15.19
Isopropylamine (70% or less) solution	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12.3.2, 15.19
Isopropylcyclohexane	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6, 16.2.9
Isopropyl ether	Y	S/P	3	2G	Cont	Inert	T2	IIA	No	R	F	AC	No	15.4.6, 15.13, 15.19.6, 16.6.1, 16.6.2
Jatropha oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7
Lactic acid	Z	S/P	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Lactonitrile solution (80% or less)	Y	S/P	1	1G	Cont	No			NF	C	T	No	Yes	15.12, 15.13, 15.17, 15.18, 15.19, 16.6.1, 16.6.2, 16.6.3
Lard	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Latex, ammonia (1% or less)- inhibited	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.9
Latex: Carboxylated styrene-Butadiene copolymer; Styrene-Butadiene rubber	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Lauric acid	X	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
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	AC	No	16.2.9
Linseed oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Liquid chemical wastes	X	S/P	2	2G	Cont	No			No	C	FT	AC	No	15.12, 15.17, 15.19, 20.5.1, 20.7
Long-chain alkaryl polyether (C11-C20)	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Long-chain alkaryl sulphonic acid (C16-C60)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9

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Long-chain alkylphenate/Phenol sulphide mixture	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Long-chain alkylphenol (C14-C18)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Long-chain alkylphenol (C18-C30)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
L-Lysine solution (60% or less)	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Magnesium chloride solution	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Magnesium hydroxide slurry	Z	S	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Magnesium long-chain alkaryl sulphonate (C11-C50)	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Magnesium long-chain alkyl salicylate (C11+)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Maleic anhydride	Y	S/P	3	2G	Cont	No			Yes	C	T	AC(f)	Yes	15.12, 15.17, 15.19, 16.2.9
Maleic anhydride-sodium allylsulphonate copolymer solution	Z	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
Mango kernel oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 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
Mesityl oxide	Z	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Metam sodium solution	X	S/P	2	2G	Cont	No	-	-	NF	C	T	No	No	15.12.3, 15.12.4, 15.19
Methacrylic acid	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.13, 15.12.3, 15.12.4, 15.19, 16.2.9, 16.6.1
Methacrylic acid - alkoxy poly (alkylene oxide) methacrylate copolymer, sodium salt aqueous solution (45% or less)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Methacrylic resin in ethylene dichloride	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19, 16.2.9
Methacrylonitrile	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	FT	AC	Yes	15.12, 15.13, 15.17, 15.19
3-Methoxy-1-butanol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.19.6
3-Methoxybutyl acetate	Y	S/P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6
N-(2-Methoxy-1-methyl ethyl)-2-ethyl-6-methyl chloroacetanilide	X	S/P	1	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19, 16.2.6
Methyl acetate	Z	P	3	2G	Cont	No	T1	IIA	No	R	F	AC	No	15.19.6
Methyl acetoacetate	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Methyl acrylate	Y	S/P	3	2G	Cont	No	T1	IIB	No	C	FT	AC	No	15.12, 15.17, 15.13, 15.19
Methyl alcohol (*)	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	AC	No	15.12.1, 15.12.2, 15.12.3.2, 15.12.3.3, 15.12.4, 15.17, 15.19
Methylamine solutions (42% or less)	Y	S/P	2	2G	Cont	No	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Methylamyl acetate	Y	P	2	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Methylamyl alcohol	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Methyl amyl ketone	Z	S/P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
N-Methylaniline	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6

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alpha-Methylbenzyl alcohol with acetophenone (15% or less)	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	S/P	3	2G	Cont	No	T4	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Methyl tert-butyl ether	Z	P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
Methyl butyl ketone	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6
Methylbutynol	Z	S/P	3	2G	Cont	No	T4	IIB	No	R	F	AC	No	15.19.6
Methyl butyrate	Y	S/P	3	2G	Cont	No	T4	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Methylcyclohexane	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Methylcyclopentadiene dimer	Y	S/P	2	2G	Cont	No	T4	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Methylcyclopentadienyl manganese tricarbonyl	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.18, 15.19, 16.2.9
Methyl diethanolamine	Y	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
2-Methyl-6-ethyl aniline	Y	S/P	3	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Methyl ethyl ketone	Z	S/P	3	2G	Cont	No	T1	IIA	No	R	F	AC	No	15.19.6
2-Methyl-5-ethyl pyridine	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Methyl formate	Z	S/P	2	2G	Cont	No	T1	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.14, 15.19.6
2-Methylglutaronitrile with 2-Ethylsuccinonitrile (12% or less)	Z	S/P	3	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
2-Methyl-2-hydroxy-3-butyne	Z	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6, 16.2.9
Methyl isobutyl ketone	Z	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Methyl methacrylate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.13, 15.19.6
3-Methyl-3-methoxybutanol	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Methyl naphthalene (molten)	X	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
N-Methylglucamine solution (70% or less)	Z	S	3	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
2-Methyl-1,3-propanediol	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
2-Methylpyridine	Z	S/P	3	2G	Cont	No	T1	IIA	No	C	F	AC	No	15.12.3.2, 15.19
3-Methylpyridine	Z	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19
4-Methylpyridine	Z	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19, 16.2.9
N-Methyl-2-pyrrolidone	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Methyl propyl ketone	Z	S	3	2G	Cont	No	T1	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Methyl salicylate	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
alpha-Methylstyrene	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	FT	AD(j)	No	15.12, 15.13, 15.17, 15.19.6, 16.6.1, 16.6.2
3-(methylthio)propionaldehyde	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12, 15.17, 15.19.6
Molybdenum polysulphide long chain alkyl dithiocarbamide complex	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Morpholine	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12.3, 15.12.4, 15.19
Motor fuel anti-knock compound (containing lead alkyls)	X	S/P	1	1G	Cont	Inert	T4	IIA	No	C	FT	AC	Yes	15.6, 15.12, 15.17, 15.18, 15.19

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Myrcene	X	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Naphthalene (molten)	X	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.9
Naphthalene crude (molten)	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Naphthalenesulphonic acid-Formaldehyde copolymer, sodium salt solution	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Neodecanoic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Nitrating acid (mixture of sulphuric and nitric acids)	Y	S/P	1	1G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.16.2, 15.17, 15.18, 15.19
Nitric acid (70% and over)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.16.2, 15.17, 15.19
Nitric acid (less than 70%)	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.17, 15.19
Nitrilotriacetic acid, trisodium salt solution	Y	S/P	3	2G	Cont	No			Yes	C	T	AC	No	15.12, 15.17, 15.19.6
Nitrobenzene	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19, 16.2.9
Nitroethane	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	ABC(f)	No	15.12.3, 15.12.4, 15.19.6, 16.6.1, 16.6.2, 16.6.4
Nitroethane (80%)/ Nitropropane(20%)	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	ABC(f)	No	15.12.3, 15.12.4, 15.19.6, 16.6.1, 16.6.2, 16.6.3
Nitroethane, 1-Nitropropane (each 15% or more) mixture	Y	S/P	3	2G	Cont	No	T2	IIB	No	R	FT	ABC(f)	No	15.12.3, 15.12.4, 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	T4	IIB	No	R	F	ABC	No	15.19.6, 16.2.6, 16.2.9
1- or 2-Nitropropane	Y	S/P	3	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12, 15.17, 15.19
Nitropropane (60%)/Nitroethane (40%) mixture	Y	S/P	2	2G	Cont	No	T2	IIB	No	C	FT	ABC(f)	No	15.12, 15.17, 15.19.6
o- or p-Nitrotoluenes	Y	S/P	2	2G	Cont	No		IIB	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6
Nonane (all isomers)	X	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
Nonanoic acid (all isomers)	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Non-edible industrial grade palm oil	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.7, 16.2.9
Nonene (all isomers)	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Nonyl alcohol (all isomers)	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Nonyl methacrylate monomer	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Nonylphenol	X	S/P	1	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Nonylphenol poly(4+)ethoxylate	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6
Noxious liquid, NF, (1) n.o.s. (trade name, contains) ST1, Cat. X	X	P	1	2G	Open	No	-	-	Yes	O	No	AC	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	AC	No	15.19, 16.2.6

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Noxious liquid, NF, (3) n.o.s. (trade name, contains) ST2, Cat. X	X	P	2	2G	Open	No	-		Yes	O	No	AC	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	AC	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	AC	No	15.19, 16.2.6, 16.2.9(l)
Noxious liquid, F, (6) n.o.s. (trade name, contains) ST2, Cat. Y	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19, 16.2.6, 16.2.9(l)
Noxious liquid, NF, (7) n.o.s. (trade name, contains) ST3, Cat. Y	Y	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	15.19, 16.2.6, 16.2.9(l)
Noxious liquid, F, (8) n.o.s. (trade name, contains) ST3, Cat. Y	Y	P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19, 16.2.6, 16.2.9(l)
Noxious liquid, NF, (9) n.o.s. (trade name, contains) ST3, Cat. Z	Z	P	3	2G	Open	No	-		Yes	O	No	AC	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	AC	No	15.19.6
Octamethylcyclotetrasiloxane	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	T3	IIA	No	R	F	AC	No	15.19.6
Octanoic acid (all isomers)	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Octanol (all isomers)	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Octene (all isomers)	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
n-Octyl acetate	Y	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Octyl aldehydes	Y	S/P	2	2G	Cont	No	T4	IIB	No	R	F	AC	No	15.19.6, 16.2.9
Octyl decyl adipate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.9
n-Octyl mercaptan	X	S/P	1	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19
Offshore contaminated bulk liquid P (o)	X	P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6
Offshore contaminated bulk liquid S (o)	X	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	AC	Yes	15.12, 15.15, 15.17, 15.19
Olefin-Alkyl ester copolymer (molecular weight 2000+)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Olefin Mixture (C7-C9) C8 rich, stabilized	X	P	2	2G	Cont	No	T3	IIB	No	R	F	ABC	No	15.13, 15.19.6
Olefin mixtures (C5-C7)	Y	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Olefin mixtures (C5-C15)	X	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Olefins (C13+, all isomers)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
alpha-Olefins (C6-C18) mixtures	X	S/P	2	2G	Cont	No	T4	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Oleic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Oleum	Y	S/P	2	2G	Cont	Dry	-	-	NF	C	T	No	Yes	15.11.2 to 15.11.8, 15.12, 15.16.2, 15.17, 15.19, 16.2.6
Oleylamine	X	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Olive oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9

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Oxygenated aliphatic hydrocarbon mixture	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
Palm acid oil	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm fatty acid distillate	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm kernel acid oil	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm kernel fatty acid distillate	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm kernel oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm kernel olein	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm kernel stearin	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm mid-fraction	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm oil fatty acid methyl ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.9
Palm olein	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Palm stearin	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Paraffin wax, highly-refined	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Paraffin wax, semi-refined	X	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6, 16.2.9
Paraldehyde	Z	S/P	3	2G	Cont	No	T3	IIB	No	R	F	AC	No	15.19.6, 16.2.9
Paraldehyde-ammonia reaction product	Y	S/P	2	2G	Cont	No	T1	IIB	No	C	FT	ABC	Yes	15.12, 15.17, 15.19
Pentachloroethane	Y	S/P	2	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19.6
1,3-Pentadiene	Y	P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.13, 15.19.6, 16.6.1, 16.6.2, 16.6.3
1,3-Pentadiene (greater than 50%), cyclopentene and isomers, mixtures	Y	S/P	2	2G	Cont	Inert	T3	IIB	No	C	FT	ABC	Yes	15.12, 15.13, 15.17, 15.19
Pentaethylenehexamine	X	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Pentane (all isomers)	Y	P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	15.14, 15.19.6
Pentanoic acid	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
n-Pentanoic acid (64%)/2-Methyl butyric acid (36%) mixture	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	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
Pentene (all isomers)	Y	P	2	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.14, 15.19.6
n-Pentyl propionate	Y	S/P	3	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6

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Perchloroethylene	Y	S/P	2	2G	Cont	No			NF	C	T	No	No	15.12, 15.17, 15.19.6
Phenol	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
1-Phenyl-1-xylyl ethane	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Phosphate esters, alkyl (C12-C14) amine	Y	S/P	2	2G	Cont	No	T4	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Phosphoric acid	Z	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.11.1, 15.11.2, 15.11.3, 15.11.4, 15.11.6, 15.11.7, 15.11.8, 15.12, 15.17, 15.19, 16.2.9
Phosphorus, yellow or white (*)	X	S/P	1	1G	Cont	Pad+(vent or inert)			No(c)	C	No	ABC	No	15.7, 15.19, 16.2.9
Phthalic anhydride (molten)	Y	S/P	2	2G	Cont	No	T1	IIA	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
alpha-Pinene	X	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
beta-Pinene	X	S/P	2	2G	Cont	No	T1	IIB	No	R	F	ABC	No	15.19.6
Pine oil	X	S/P	2	2G	Open	No			Yes	O		ABC	No	15.19.6, 16.2.6, 16.2.9
Piperazine, 68% solution	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Polyacrylic acid solution (40% or less)	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
Polyalkyl (C18-C22) acrylate in xylene	Y	S/P	2	2G	Cont	No	T1	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Polyalkylalkenaminesuccinimide, molybdenum oxysulphide	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	AC	No	
Poly(2-8)alkylene glycol monoalkyl (C1-C6) ether acetate	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Polyalkyl (C10-C20) methacrylate	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyalkyl (C10-C18) methacrylate/ethylene-propylene copolymer mixture	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyaluminium chloride solution	Z	S	3	2G	Open	No			NF	O	No	No	No	
Polybutene	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Polybutenyl succinimide	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Poly(2+)cyclic aromatics	X	S/P	1	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Polyether (molecular weight 1350+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Polyethylene glycol	Z	P	3	2G	Open	No			Yes	O	No	AC	No	

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Polyethylene glycol dimethyl ether	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	
Poly(ethylene glycol) methylbutenyl ether (MW>1000)	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Polyethylene polyamines	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.6, 16.2.9
Polyethylene polyamines (more than 50% C5 -C20 paraffin oil)	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Polyferric sulphate solution	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19
Poly(iminoethylene)-graft-N-poly(ethyleneoxy) solution (90% or less)	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Polyisobutenamine in aliphatic (C10-C14) solvent	Y	S/P	2	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
(Polyisobutene) amino products in aliphatic hydrocarbons	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Polyisobutenyl anhydride adduct	Z	S/P	3	2G	Open	No			Yes	O	No	ABC	No	
Poly(4+)isobutylene (MW>224)	X	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyisobutylene (MW≤224)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9
Polyglycerin, sodium salt solution (containing less than 3% sodium hydroxide)	Z	S	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Polymethylene polyphenyl isocyanate	Y	S/P	3	2G	Cont	Dry			Yes(a)	C	T(a)	AD	Yes	15.12, 15.16.2, 15.17, 15.19.6, 16.2.9
Polyolefin (molecular weight 300+)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefin amide alkeneamine (C17+)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Polyolefin amide alkeneamine borate (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefin amide alkeneamine polyol	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefinamine (C28-C250)	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Polyolefinamine in alkyl (C2-C4) benzenes	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Polyolefinamine in aromatic solvent	Y	S/P	2	2G	Cont	No	T2	IIB	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Polyolefin aminoester salts (molecular weight 2000+)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefin anhydride	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Polyolefin ester (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefin phenolic amine (C28-C250)	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Polyolefin phosphorusulphide, barium derivative (C28-C250)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Poly(20)oxyethylene sorbitan monooleate	Y	P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.9
Poly(5+)propylene	Y	P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9
Polypropylene glycol	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6

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Polysiloxane	Y	P	2	2G	Cont	No	T2	IIB	No	R	F	ABC	No	15.19.6, 16.2.9
Potassium chloride solution	Z	P	3	2G	Open	No	-	-	NF	O	No	No	No	16.2.9
Potassium hydroxide solution (*)	Y	S/P	3	2G	Open	No			NF	C	No	No	No	15.12.3.2, 15.19
Potassium formate solutions (*)	Z	S	3	2G	Open	No			NF	R	No	No	No	15.19.6
Potassium oleate	Y	S/P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.9
Potassium thiosulphate (50% or less)	Y	S/P	3	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
n-Propanolamine	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
2-Propene-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride, homopolymer solution	Y	P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6
beta-Propiolactone	Y	S/P	1	2G	Cont	No		IIA	Yes	C	T	AC	Yes	15.12, 15.17, 15.18, 15.19
Propionaldehyde	Y	S/P	3	2G	Cont	Inert	T4	IIB	No	R	F	AC	No	15.19.6
Propionic acid	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	AC	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
Propionic anhydride	Y	S/P	2	2G	Cont	No	T2	IIA	Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Propionitrile	Y	S/P	1	1G	Cont	No	T1	IIB	No	C	FT	AC	Yes	15.12, 15.17, 15.18, 15.19
n-Propyl acetate	Y	P	3	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
n-Propyl alcohol	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
n-Propylamine	Z	S/P	2	2G	Cont	Inert	T2	IIA	No	C	FT	AC	Yes	15.12, 15.17, 15.19
Propylbenzene (all isomers)	Y	P	3	2G	Cont	No	T2	IIA	No	R	F	ABC	No	15.19.6
Propylene carbonate	Z	S	3	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.19
Propylene glycol methyl ether acetate	Z	P	3	2G	Cont	No	T2	IIA	No	R	F	AC	No	
Propylene glycol monoalkyl ether	Z	S/P	3	2G	Cont	No	T3	IIA	No	R	F	AC	No	15.19.6
Propylene glycol phenyl ether	Z	S/P	3	2G	Open	No			Yes	O	No	ABC	No	
Propylene oxide	Y	S/P	2	2G	Cont	Inert	T2	IIB	No	C	FT	AC	No	15.8, 15.12, 15.14, 15.17, 15.19
Propylene tetramer	X	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
Propylene trimer	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	F	ABC	No	15.19.6
Pyridine	Y	S/P	3	2G	Cont	No	T1	IIA	No	R	FT	AC	No	15.12.3, 15.12.4, 15.19.6
Pyrolysis gasoline (containing benzene)	Y	S/P	2	2G	Cont	No	T3	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6
Rapeseed oil	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Rapeseed oil (low erucic acid containing less than 4% free fatty acids)	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Rape seed oil fatty acid methyl esters	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Resin oil, distilled	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	FT	ABC	No	15.12, 15.17, 15.19.6
Rice bran oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Rosin	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9

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Safflower oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Shea butter	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Sodium alkyl (C14-C17) sulphonates (60-65% solution)	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Sodium aluminosilicate slurry	Z	P	3	2G	Open	No			NF	O	No	No	No	16.2.9
Sodium benzoate	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	16.2.9
Sodium borohydride (15% or less)/Sodium hydroxide solution (*)	Y	S/P	3	2G	Open	No			NF	C	No	No	No	15.19, 16.2.6, 16.2.9
Sodium bromide solution (less than 50%) (*)	Y	S/P	3	2G	Open	No	-	-	NF	R	No	No	No	15.19.6
Sodium carbonate solution (*)	Z	S/P	3	2G	Open	No			NF	R	No	No	No	15.19.6
Sodium chlorate solution (50% or less) (*)	Z	S/P	3	2G	Open	No			NF	R	No	No	No	15.9, 15.12, 15.19, 16.2.9
Sodium dichromate solution (70% or less)	Y	S/P	1	1G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.18, 15.19
Sodium hydrogen sulphide (6% or less)/Sodium carbonate (3% or less) solution	Z	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9
Sodium hydrogen sulphite solution (45% or less)	Z	P	3	2G	Open	No			NF	O	No	No	No	16.2.9
Sodium hydrosulphide/Ammonium sulphide solution (*)	Y	S/P	2	2G	Cont	No	T4	IIB	No	C	FT	AC	Yes	15.12, 15.15, 15.17, 15.19, 16.6.1, 16.6.2, 16.6.3
Sodium hydrosulphide solution (45% or less) (*)	Z	S/P	3	2G	Cont	Vent or pad (gas)			NF	R	T	No	Yes	15.12, 15.15, 15.19.6, 16.2.9
Sodium hydroxide solution (*)	Y	S/P	3	2G	Open	No			NF	C	No	No	No	15.19, 16.2.6, 16.2.9
Sodium hypochlorite solution (15% or less)	Y	S/P	2	2G	Cont	No	-	-	NF	R	No	No	No	15.17, 15.19.6
Sodium methylate 21-30% in methyl alcohol	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	3	2G	Cont	No			NF	C	T	No	No	15.12.3, 15.12.4, 15.19, 16.2.6, 16.2.9
Sodium petroleum sulphonate	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	Yes	15.12.3, 15.12.4, 15.19.6, 16.2.6
Sodium poly(4+)acrylate solutions	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	AC	No	16.2.9
Sodium silicate solution	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.9
Sodium sulphate solutions	Z	S	3	2G	Open	No			NF	O	No	No	No	16.2.9
Sodium sulphide solution (15% or less)	Y	S/P	3	2G	Cont	No			NF	C	T	No	Yes	15.12, 15.17, 15.19, 16.2.9
Sodium sulphite solution (25% or less)	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9
Sodium thiocyanate solution (56% or less)	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6, 16.2.9
Soyabean oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Soybean Oil Fatty Acid Methyl Ester	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.9

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Styrene monomer	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	ABC	No	15.12, 15.13, 15.17, 15.19.6, 16.6.1, 16.6.2
Sulphohydrocarbon (C3-C88)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Sulpholane	Y	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Sulphur (molten) (*)	Z	S	3	1G	Open				Yes	O	FT	No	No	15.10, 16.2.9
						Vent or pad (gas)	T3							
Sulphuric acid	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.16.2, 15.17, 15.19, 16.2.9
Sulphuric acid, spent	Y	S/P	2	2G	Cont	No			NF	C	T	No	Yes	15.11, 15.12, 15.16.2, 15.17, 15.19
Sulphurized fat (C14-C20)	Z	S/P	3	2G	Open	No			Yes	O	No	ABC	No	
Sulphurized polyolefinamide alkene (C28-C250) amine	Z	P	3	2G	Open	No	-	-	Yes	O	No	AC	No	
Sunflower seed oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Tall oil, crude	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Tall oil, distilled	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6
Tall oil fatty acid (resin acids less than 20%)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6
Tall oil pitch	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Tall oil soap, crude	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.6
Tallow	Y	P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Tallow fatty acid	Y	P	2	2G	Open	No	-	-	Yes	O	No	AC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Tetrachloroethane	Y	S/P	2	2G	Cont	No			NF	R	T	No	No	15.12.3, 15.12.4, 15.19
Tetraethylene glycol	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Tetraethylene pentamine	Y	S/P	2	2G	Cont	No			Yes	C	T	AC	Yes	15.12, 15.17, 15.19
Tetrahydrofuran	Z	S	3	2G	Cont	No	T3	IIB	No	R	F	AC	No	15.19.6
Tetrahydronaphthalene	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Tetramethylbenzene (all isomers)	X	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.9
Titanium dioxide slurry	Z	P	3	2G	Open	No			NF	O	No	No	No	
Toluene	Y	S/P	3	2G	Cont	No	T1	IIA	No	C	FT	AC	No	15.12, 15.17, 15.19.6
Toluenediamine	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.17, 15.18, 15.19, 16.2.6, 16.2.9
Toluene diisocyanate	Y	S/P	2	2G	Cont	Dry	-	-	Yes	C	T	ABC(b)D	Yes	15.12, 15.16.2, 15.17, 15.18, 15.19, 16.2.9
o-Toluidine	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19
Tributyl phosphate	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	No	15.12.3, 15.12.4, 15.19.6
1,2,3-Trichlorobenzene (molten)	X	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9

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1,2,4-Trichlorobenzene	X	S/P	1	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19, 16.2.9
1,1,1-Trichloroethane	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
1,1,2-Trichloroethane	Y	S/P	3	2G	Open	No			NF	O	No	No	No	15.19.6
Trichloroethylene	Y	S/P	2	2G	Cont	No	-	-	NF	C	T	No	No	15.12, 15.17, 15.19.6
1,2,3-Trichloropropane	Y	S/P	3	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19
1,1,2-Trichloro-1,2,2-Trifluoroethane	Y	P	2	2G	Open	No			NF	O	No	No	No	15.19.6
Tricresyl phosphate (containing 1% or more ortho-isomer)	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	ABC	No	15.12, 15.17, 15.19, 16.2.6
Tricresyl phosphate (containing less than 1% ortho-isomer)	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6
Tridecane	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Tridecanoic acid	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Tridecyl acetate	Y	S/P	3	2G	Cont	No	-	-	Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Triethanolamine	Z	S/P	3	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Triethylamine	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	ABC	No	15.12.3, 15.12.4, 15.19
Triethylbenzene	X	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6
Triethylenetetramine	Y	S/P	2	2G	Cont	No	-	-	Yes	C	T	AC	Yes	15.12, 15.17, 15.19, 16.2.9
Triethyl phosphate	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6
Triethyl phosphite	Z	S/P	3	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Triisopropanolamine	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.9
Triisopropylated phenyl phosphates	X	P	2	2G	Open	No			Yes	O	No	AC	No	15.19.6, 16.2.6
Trimethylacetic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.11, 15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9
Trimethylamine solution (30% or less)	Z	S/P	2	2G	Cont	No	T3	IIB	No	R	FT	AC	No	15.12.3, 15.12.4, 15.14, 15.19.6
Trimethylbenzene (all isomers)	X	S/P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6
Trimethylol propane propoxylated	Z	S/P	3	2G	Open	No	-	-	Yes	O	No	ABC	No	
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate	Y	S/P	3	2G	Open	No			Yes	O	No	ABC	No	15.19.6
2,2,4-Trimethyl-1,3-pentanediol-1-isobutyrate	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
1,3,5-Trioxane	Y	S/P	3	2G	Cont	No	T2	IIB	No	C	FT	AC	No	15.12, 15.17, 15.19.6, 16.2.9
Tripropylene glycol	Z	P	3	2G	Open	No			Yes	O	No	AC	No	
Trixylyl phosphate	X	S/P	1	2G	Cont	No			Yes	C	T	ABC	No	15.12, 15.17, 15.19.6, 16.2.6
Tung oil	Y	S/P	2(k)	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Turpentine	X	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	AC	No	15.19.6
Undecanoic acid	Y	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.6, 16.2.9

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1-Undecene	X	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6
Undecyl alcohol	X	S/P	2	2G	Cont	No			Yes	R	T	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Urea/Ammonium nitrate solution	Y	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	15.19.6
Urea/Ammonium phosphate solution	Y	S/P	2	2G	Cont	No			Yes	R	T	AC	No	15.12.3, 15.12.4, 15.19.6
Urea solution	Z	S/P	3	2G	Open	No			Yes	O	No	AC	No	16.2.9
Used cooking oil (m)	X	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Used cooking oil (Triglycerides, C16-C18 and C18 unsaturated) (m) (n)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Valeraldehyde (all isomers)	Y	S/P	3	2G	Cont	Inert	T3	IIB	No	R	F	ABC	No	15.4.6, 15.13, 15.19.6, 16.6.1, 16.6.2
Vegetable acid oils (m)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Vegetable fatty acid distillates (m)	Y	P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Vegetable oil mixtures, containing less than 15% free fatty acid (m)	Y	S/P	2	2G	Open	No	-	-	Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.7, 16.2.9
Vinyl acetate	Y	S/P	3	2G	Cont	No	T2	IIA	No	C	FT	ABC	No	15.12, 15.13, 15.17, 15.19.6, 16.6.1, 16.6.2
Vinyl ethyl ether	Z	S/P	2	2G	Cont	Inert	T3	IIB	No	R	F	ABC	No	15.4, 15.13, 15.14, 15.19.6, 16.6.1, 16.6.2
Vinylidene chloride	Y	S/P	2	2G	Cont	Inert	T2	IIA	No	C	FT	ABC	No	15.12, 15.13, 15.14, 15.17, 15.19, 16.6.1, 16.6.2
Vinyl neodecanoate	Y	S/P	2	2G	Cont	No			Yes	C	T	ABC	Yes	15.12, 15.13, 15.17, 15.19, 16.6.1, 16.6.2
Vinyltoluene	Y	S/P	2	2G	Cont	No	T1	IIA	No	C	FT	ABC	No	15.12, 15.13, 15.17, 15.19.6, 16.6.1, 16.6.2
White spirit, low (15-20%) aromatic	Y	S/P	2	2G	Cont	No	T3	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6, 16.2.9
Wood lignin with sodium acetate/oxalate	Z	S/P	3	2G	Open	No	-	-	NF	O	No	No	No	
Xylenes	Y	P	2	2G	Cont	No	T1	IIA	No	R	F	ABC	No	15.19.6, 16.2.9 (h)
Xylenes/ethylbenzene (10% or more) mixture	Y	S/P	2	2G	Cont	No	T2	IIA	No	R	FT	ABC	No	15.12.3, 15.12.4, 15.19.6
Xylenol	Y	S/P	2	2G	Cont	No	-	IIA	Yes	C	T	ABC	Yes	15.12, 15.17, 15.19, 16.2.9
Zinc alkaryl dithiophosphate (C7-C16)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6, 16.2.9
Zinc alkenyl carboxamide	Y	S/P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6
Zinc alkyl dithiophosphate (C3-C14)	Y	P	2	2G	Open	No			Yes	O	No	ABC	No	15.19.6, 16.2.6

17.3 FOOTNOTES TO PRODUCTS IN TABLE 17.1.1-1

Some entries in Section 17 contain footnotes, as either letters or symbols in parentheses following the name of the product, in column a of the table 17.1.1-1. These provide additional information about the carriage requirements for the product. The definitions of these footnotes are included below.

- (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.
- (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 Section 17.

n Confirmation that the product is composed of Triglycerides, C16-C18 and C18 unsaturated shall be required in order for the entry to be used. Otherwise, the more generic entry "Used cooking oil (m)" must be used.

o Indicates that the entries are to be used solely for backloading of contaminated bulk liquids

from offshore installations used in the search and exploitation of seabed mineral resources.

- * Indicates that with reference to chapter 21 of the IBC Code (paragraph 21.1.3), deviations from the normal assignment criteria used for some carriage requirements have been implemented.

18 LIST OF PRODUCTS TO WHICH THIS PART OF THE RULES DOES NOT APPLY

18.1 GENERAL

18.1.1 The following are products (see Table 18.1.1-1), 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 this Part of the Rules.

18.1.2 Although the products listed in this Section fall outside the scope of this Part of the Rules, the attention is drawn to the fact that some safety precautions may be needed for their safe transportation.

Accordingly, the *Register* shall prescribe appropriate safety requirements (see column **c**) in table 18.1.1-1.

18.1.3 Some liquid substances are identified as falling into Pollution Category Z and, therefore, subject to certain requirements of MARPOL Annex II.

18.1.4 Liquid mixtures which are assessed or provisionally assessed under regulation 6.3 of MARPOL 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.)".

18.2 EXPLANATORY NOTES TO THE TABLE 18.1.1-1

- .1 Product name (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 (for explanation see Chapter 19 of the IBC Code). In some cases, the product names are not identical with the names given in previous issues of the Code.
- .2 Pollution Category (column **b**)
The letter Z means the Pollution Category assigned to each product under Annex II of MARPOL. OS means the product was evaluated and found to fall outside Categories X, Y, or Z.
- .3 Fire protection (column **c**)
 - A alcohol resistant foam or multipurpose 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;
 - NO no special medium recommended
 The information given for fire extinguishing medium is only for guidance and does not constitute any mandatory requirement (see MSC/Circ. 553).
 NF non flammable
 - indicates no information

Table 18.1.1-1

(updated in accordance with 2019 amendments (resolutions MSC.460(101) / MEPC.318(74))

Product name a	Pollution Category b	Fire protection c
Acetone	Z	A
Alcoholic beverages, n.o.s.	Z	A
Apple juice	OS	NF
n-Butyl alcohol	Z	A
sec-Butyl alcohol	Z	A
Calcium carbonate slurry	OS	-
Clay slurry	OS	NF
Coal slurry	OS	NF
Ethyl alcohol	Z	A
Glucose solution	OS	NF
Glycerol ethoxylated	OS	-
Hydrogenated starch hydrolysate	OS	-
Isopropyl alcohol	Z	A
Kaolin slurry	OS	NF
Lecithin	OS	-
Maltitol solution	OS	-
Microsilica slurry	OS	-

Product name	Pollution Category	Fire protection
a	b	c
Molasses	OS	A
Noxious liquid, (11) n.o.s. (trade name, contains) Cat. Z	Z	NO
Non noxious liquid, (12) n.o.s. (trade name, contains) Cat. OS	OS	NO
Orange juice (concentrated)	OS	-
Orange juice (not concentrated)	OS	-
Potassium chloride solution (less than 26%)	OS	-
Propylene glycol	OS	A
Sodium acetate solutions	Z	-
Sodium bicarbonate solution (less than 10%)	OS	-
Sorbitol solution	OS	NF
Sulphonated polyacrylate solution	Z	-
Tetraethyl silicate monomer/oligomer (20% in ethanol)	Z	-
Triethylene glycol	OS	A
Vegetable protein solution (hydrolysed)	OS	NF
Water	OS	NF

19 INDEX OF PRODUCTS CARRIED IN BULK

19.1 GENERAL

19.1.1 This Section is void, as there are no additional or alternative requirements to those indicated in Chapter 19 of the IBC Code.

20 TRANSPORT OF LIQUID CHEMICAL WASTES

20.1 PREAMBLE

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

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

20.2 DEFINITIONS

For the purpose of this Section:

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

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

20.3 APPLICABILITY

20.3.1 The requirements of this 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 this Part of the Rules.

20.3.2 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.

20.4 PERMITTED SHIPMENTS

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

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

sent of the country of final destination stating that the wastes will be safely incinerated or treated by other methods of disposal, has given authorization to the movement.

20.5 DOCUMENTATION

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

20.6 CLASSIFICATION OF LIQUID CHEMICAL WASTES

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

20.7 CARRIAGE AND HANDLING OF LIQUID CHEMICAL WASTES

20.7.1 Liquid chemical wastes shall be carried in ships and cargo tanks in accordance with the minimum requirements for liquid chemical wastes specified in 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 Part of the Rules applicable to the substance or, in case the of a mixture, its constituent presenting the predominant hazard.

21 CRITERIA FOR ASSIGNING CARRIAGE REQUIREMENTS FOR PRODUCTS SUBJECT TO THE IBC CODE

21.1 GENERAL

21.1.1 This Section is void, as there are no additional or alternative requirements to those indicated in Chapter 21 of the IBC Code.