

**PART II RULES FOR THE CONSTRUCTION
AND CLASSIFICATION OF SHIPS
IDENTIFIED BY THEIR MISSION**

TITLE 34 LIQUEFIED GAS CARRIERS

**INTERNATIONAL CODE FOR THE
CONSTRUCTION AND EQUIPMENT OF SHIPS
CARRYING LIQUEFIED GASES IN BULK, 2006, AS
AMENDED**

ANNEX 1 SPECIAL REQUIREMENTS

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**CHAPTER A
SPECIAL REQUIREMENTS – EQUIPMENT AND
SYSTEMS**

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A.1 SPECIAL REQUIREMENTS –EQUIPMENT AND
SYSTEMS

A.2 SPECIAL REQUIREMENTS – PROTECTIONS

**A1. 17 SPECIAL REQUIREMENTS –
EQUIPMENT AND SYSTEMS**

100. 17.1 General

101. The provisions of this chapter are applicable where reference is made in column "i" in the table of chapter 19. These are requirements additional to the general requirements of the Code.

200. 17.2 Materials of construction

201. Materials which may be exposed to cargo during normal operations should be resistant to the corrosive action of the gases. In addition, the following materials of construction for cargo tanks, and associated pipelines, valves, fittings and other items of equipment should not be used for certain products as specified in column "i" in the table of chapter 19:

- a. 1 mercury, copper and copper-bearing alloys, and zinc;
- b. 2 copper, silver, mercury, magnesium and other acetylide-forming metals;
- c. 3 aluminium and aluminium-bearing alloys;
- d. 4 copper, copper alloys, zinc and galvanized steel;
- e. 5 aluminium, copper and alloys of either;
- f. 6 copper and copper-bearing alloys with greater than 1% copper.

300. 17.3 Independent tanks

301. 17.3.1 Products should be carried in independent tanks only.

302. 17.3.2 Products should be carried in type C independent tanks and the provisions of 7.1.3 apply. The design pressure of the cargo tank should take into account any padding pressure or vapour discharge unloading pressure.

400. 17.4 Refrigeration systems

401. 17.4.1 Only the indirect system described in 7.2.4.2 should be used.

402. 17.4.2 For a ship engaged in the carriage of products which readily form dangerous peroxides, recondensed cargo should not be allowed to form stagnant pockets of uninhibited liquid. This may be achieved either by:

- a. 1 using the indirect system described in 7.2.4.2 with the condenser inside the cargo tank; or
- b. 2 using the direct system or combined system described in 7.2.4.1 and
- c. 3 respectively, or the indirect system described in 7.2.4.2 with the condenser outside the cargo tank, and designing the condensate system to avoid any places in which liquid could collect and be retained. Where this is impossible inhibited liquid should be added upstream of such a place.

403. 17.4.3 If the ship is to carry consecutively products as specified in 17.4.2 with a ballast passage between, all uninhibited liquid should be removed prior to the ballast voyage. If a second cargo is to be carried between such consecutive cargoes, the reliquefaction system should be thoroughly drained and purged before loading the second cargo. Purging should be carried out using either inert gas or vapour from the second cargo, if compatible. Practical steps should be taken to ensure that polymers or peroxides do not accumulate in the cargo system.

500. 17.5 Deck cargo piping

501. One hundred per cent radiography of all butt welded joints in cargo piping exceeding 75 mm in diameter is required.

600. 17.6 Exclusion of air from vapour spaces

601. Air should be removed from the cargo tanks and associated piping before loading and then subsequently excluded by:

- a. 1 introducing inert gas to maintain a positive pressure. Storage or production capacity of the inert gas should be sufficient to meet normal operating requirements and relief valve leakage. The oxygen content of inert gas should at no time be greater than 0.2% by volume; or
- b. 2 control of cargo temperatures such that a positive pressure is maintained at all times.

700. 17.7 Moisture control

701. For gases which are non-flammable and may become corrosive or react dangerously with water, moisture control should be provided to ensure that cargo tanks are dry before loading and that during discharge, dry air or cargo vapour is introduced to prevent negative pressures. For the purposes of this paragraph, dry air is air which has a dewpoint of -45°C or below at atmospheric pressure.

800. 17.8 Inhibition

801. Care should be taken to ensure that the cargo is sufficiently inhibited to prevent polymerization at all times during the voyage. Ships should be provided with a certificate from the manufacturer stating:

- a. 1 name and amount of inhibitor added;
- b. 2 date inhibitor was added and the normally expected duration of its effectiveness;
- c. 3 any temperature limitations affecting the inhibitor;
- d. 4 the action to be taken should the length of the voyage exceed the effective lifetime of the inhibitors.

900. 17.9 Permanently installed toxic gas detectors

901. 17.9.1 Gas sampling lines should not be led into or through gas-safe spaces. Alarms referred to in 13.6.7 should be activated when the vapour concentration reaches the threshold limiting value.

902. 17.9.2 The alternative of using portable equipment in accordance with 13.6.9 should not be permitted.

A2. SPECIAL REQUIREMENTS – PROTECTIONS

100. 17.10 Flame screens on vent outlets

101. Cargo tank vent outlets should be provided with readily renewable and effective flame screens or safety heads of an approved type when carrying a cargo referenced to this section. Due attention should be paid in the design of flame screens and vent heads to the possibility of the blockage of these devices by the freezing of cargo vapour or by icing up in adverse weather conditions. Ordinary protection screens should be fitted after removal of the flame screens.

200. 17.11 Maximum allowable quantity of cargo per tank

201. When carrying a cargo referenced to this section, the quantity of the cargo should not exceed $3\,000\text{ m}^3$ in any one tank.

300. 17.12 Submerged electric cargo pumps

301. The vapour space of cargo tanks equipped with submerged electric motor pumps should be inerted to a positive pressure prior to loading, during carriage and during unloading of flammable liquids.

CHAPTER B SPECIAL REQUIREMENTS FOR CERTAIN PRODUCTS

CHAPTER CONTENTS

B1. MIXED C4 CARGOES

B1. SPECIAL REQUIREMENTS FOR CERTAIN PRODUCTS I

100. 17.13 Ammonia

101. 17.13.1 Anhydrous ammonia may cause stress corrosion cracking in containment and process systems made of carbon manganese steel or nickel steel. To minimize the risk of this occurring, measures detailed in 17.13.2 to 17.13.8 should be taken as appropriate.

102. 17.13.2 Where carbon manganese steel is used, cargo tanks, process pressure vessels and cargo piping should be made of fine grained steel with a specified minimum yield strength not exceeding 355 N/mm^2 and with an actual yield strength not exceeding 440 N/mm^2 . One of the following constructional or operational measures should also be taken:

- a. 1 lower strength material with a specified minimum tensile strength not exceeding 410 N/mm^2 should be used; or
- b. 2 cargo tanks, etc., should be post weld stress relief heat treated: or
- c. 3 carriage temperature should be maintained preferably at a temperature close to the product's boiling point of -33°C but in no case at a temperature above -20°C ; or
- d. 4 the ammonia should contain not less than 0.1% w/w water.

103. 17.13.3 If carbon manganese steels with higher yield properties are used other than those specified in 17.13.2, the completed cargo tanks, piping, etc. should be given a post weld stress relief heat treatment.

104. 17.13.4 Process pressure vessels and piping of the condensate part of the refrigeration system should be given a post-weld stress relief heat treatment when made of materials mentioned in 17.13.1.

105. 17.13.5 The tensile and yield properties of the welding consumables should exceed those of the tank or piping material by the smallest practical amount.

106. 17.13.6 Nickel steel containing more than 5% nickel and carbon manganese steel not complying with the requirements of 17.13.2 and 17.13.3 are particularly susceptible to ammonia stress corrosion cracking and should not be used for containment and piping systems for the carriage of this product.

107. 17.13.7 Nickel steel containing not more than 5% nickel may be used provided the carriage temperature complies with the requirements specified in 17.13.2.3.

108. 17.13.8 In order to minimize the risk of ammonia stress corrosion cracking, it is advisable to keep the dissolved oxygen content below 2.5 ppm/w/w. This can best be achieved by reducing the average oxygen content in the tanks prior to the introduction of liquid ammonia to less than the values given as a function of the carriage temperature T in the table below:

T (°C)	oxygen O ₂ (% v/v)
-30 and below	0.90
-20	0.50
-10	0.28
0	0.16
+10	0.10
+20	0.05
+30	0.03

109. Oxygen percentages for intermediate temperatures may be obtained by direct interpolation.

200. 17.14 Chlorine

201. 17.14.1 *Cargo containment system*

202. 17.14.1.1 The capacity of each tank should not exceed 600 m³ and the total capacity of all cargo tanks should not exceed 1,200 m³.

203. 17.14.1.2 The tank design vapour pressure should not be less than 13.5 bar (see also 7.1.3 and 17.3.2).

204. 17.14.1.3 Parts of tanks protruding above the upper deck should be provided with protection against thermal radiation taking into account total engulfment by fire.

205. 17.14.1.4 Each tank should be provided with two pressure relief valves. A bursting disc of appropriate material should be installed between the tank and the pressure relief valves. The rupture pressure of the bursting disc should be 1 bar lower than the opening pressure of the pressure relief valve, which should be set at the design vapour pressure of the tank but not less than 13.5 bar gauge. The space between the bursting disc and the relief valve should be connected through an excess flow valve to a pressure gauge and a gas detection system. Provision should be made to keep this space at or near the atmospheric pressure during normal operation.

206. 17.14.1.5 Outlets from pressure relief valves should be arranged in such a way as to minimize the hazards on board the ship as well as to the environment. Leakage from the relief valves should be led through the absorption plant to reduce the gas concentration as far as possible. The relief valve exhaust line should be arranged at the forward end of the ship to discharge outboard at deck level with an arrangement to select either port or starboard side, with a mechanical interlock to ensure that one line is always open.

207. 17.14.1.6 The Administration and the port Administration may require that chlorine is carried in refrigerated state at a specified maximum pressure.

208. 17.14.2 *Cargo piping systems*

a. 17.14.2.1 Cargo discharge should be performed by means of compressed chlorine vapour from shore, dry air or another acceptable gas or fully submerged pumps. The pressure in the vapour space of the tank during discharging should not exceed 10.5 bar gauge. Cargo discharge compressors on board ships should not be accepted by the Administration.

b. 17.14.2.2 The design pressure of the cargo piping system should be not less than 21 bar gauge. The internal diameter of the cargo pipes should not exceed 100 mm. Only pipe bends should be accepted for compensation of pipeline thermal

- movement. The use of flanged joints should be restricted to a minimum, and when used the flanges should be of the welding neck type with tongue and groove.
- c. 17.14.2.3 Relief valves of the cargo piping system should discharge to the absorption plant (see also [8.2.16](#)).
209. 17.14.3 *Materials*
- a. 17.14.3.1 The cargo tanks and cargo piping systems should be made of steel suitable for the cargo and for a temperature of -40°C, even if a higher transport temperature is intended to be used.
- b. 17.14.3.2 The tanks should be thermally stress relieved. Mechanical stress relief should not be accepted as an equivalent.
210. 17.14.4 *Instrumentation - safety devices*
- a. 17.14.4.1 The ship should be provided with a chlorine absorbing plant with connections to the cargo piping system and the cargo tanks. The absorbing plant should be capable of neutralizing at least 2% of the total cargo capacity at a reasonable absorption rate.
- b. 17.14.4.2 During the gas-freeing of cargo tanks, vapours should not be discharged to the atmosphere.
- c. 17.14.4.3 A gas detecting system should be provided capable of monitoring chlorine concentrations of at least 1 ppm by volume. Suction points should be located:
- c.1. 1 near near the bottom of the hold spaces;
- c.2. 2 in the pipes from the safety relief valves;
- c.3. 3 at the outlet from the gas absorbing plant;
- c.4. 4 at the inlet to the ventilation systems for the accommodation, service and machinery spaces and control stations;
- c.5. 5 on deck at the forward end, in the middle and at the after end of the cargo area. (Only required to be used during cargo handling and gas-freeing operations.)
- f. The gas detection system should be provided with an audible and visual alarm with a set point of 5 ppm.
- g. 17.14.4.4 Each cargo tank should be fitted with a high-pressure alarm giving an audible alarm at a pressure equal to 10.5 bar gauge.
210. 17.14.5 *Personnel protection*
- In addition to the requirements given in [chapter 14](#) the following requirements should be met:
- a. 1 The enclosed space required by 14.4.5 should be easily and quickly accessible from the open deck and from accommodation spaces and should be capable of being rapidly closed gastight. Access to this space from the deck and from the accommodation spaces should be by means of an air-lock. The space should be so designed as to accommodate the entire crew of the ship and be provided with a source of uncontaminated air for a period of not less than 4 h. One of the decontamination showers required by 14.4.3 should be located near the air-lock to the space.
- b. 2 A compressor and the necessary equipment for filling the air bottles should be provided.
- c. 3 One set of oxygen therapy equipment should be carried in the space referred to in 17.14.5.1.
211. 17.14.6 *Filling limits for cargo tanks*
- a. 17.14.6.1 The requirements of [15.1.4.2](#) do not apply when it is intended to carry chlorine.
- b. 17.14.6.2 The chlorine content of the gas in the vapour space of the cargo tank after loading should be greater than 80% by volume.
- 300. 17.15 Diethyl ether and vinyl ethyl ether**
301. 17.15.1 The cargo should be discharged only by deepwell pumps or by hydraulically operated submerged pumps. These pumps should be of a type designed to avoid liquid pressure against the shaft gland.
302. 17.15.2 Inert gas displacement may be used for discharging cargo from type C independent tanks provided the cargo system is designed for the expected pressure.
- 400. 17.16 Ethylene oxide**
401. 17.16.1 For the carriage of ethylene oxide the requirements of 17.20 apply, with the additions and modifications as given in this section.
402. 17.16.2 Deck tanks should not be used for the carriage of ethylene oxide.
403. 17.16.3 Stainless steels types 416 and 442 as well as cast iron should not be used in ethylene oxide cargo containment and piping systems.

404. 17.16.4 Before loading, tanks should be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipe work, except where the immediate prior cargo has been ethylene oxide, propylene oxide or mixtures of these products. Particular care should be taken in the case of ammonia in tanks made of steel other than stainless steel.

405. 17.16.5 Ethylene oxide should be discharged only by deepwell pumps or inert gas displacement. The arrangement of pumps should comply with 17.20.5.3.

406. 17.16.6 Ethylene oxide should be carried refrigerated only and maintained at temperatures of less than 30°C.

407. 17.16.7 Pressure relief valves should be set at a pressure of not less than 5.5 bar gauge. The maximum set pressure should be specially approved by the Administration.

408. 17.16.8 The protective padding of nitrogen gas as required by 17.20.15 should be such that the nitrogen concentration in the vapour space of the cargo tank will at no time be less than 45% by volume.

409. 17.16.9 Before loading and at all times when the cargo tank contains ethylene oxide liquid or vapour, the cargo tank should be inerted with nitrogen.

410. 17.16.10 The water spray system required by paragraph 17.20.17 and that required by 11.3 should operate automatically in a fire involving the cargo containment system.

411. 17.16.11 A jettisoning arrangement should be provided to allow the emergency discharge of ethylene oxide in the event of uncontrollable self-reaction.

500. 17.17 Isopropylamine and monoethylamine

501. Separate piping systems should be provided as defined in 1.3.32.

600. 17.18 Methyl acetylene-propadiene mixtures

601. 17.18.1 Methyl acetylene-propadiene mixtures should be suitably stabilized for transport. Additionally, upper limits of temperature and pressure during the refrigeration should be specified for the mixtures.

602. 17.18.2 Examples of acceptable, stabilized compositions are:

a. 1 Composition 1:

- a.1. 1.1 maximum methyl acetylene to propadiene molar ratio of 3 to 1

a.2. 1.2 maximum combined concentration of methyl acetylene and propadiene of 65 mol per cent;

a.3. 1.3 minimum combined concentration of propane, butane, and isobutane of 24 mol per cent, of which at least one third (on a molar basis) must be butanes and one third propane; and

a.4. 1.4 maximum combined concentration of propylene and butadiene of 10 mol per cent.

b. Composition 2:

b.1. 2.1 maximum methyl acetylene and propadiene combined concentration of 30 mol per cent;

b.2. 2.2 maximum methyl acetylene concentration of 20 mol per cent;

b.3. 2.3 maximum propadiene concentration of 20 mol per cent;

b.4. 2.4 maximum propylene concentration of 45 mol per cent;

b.5. 2.5 maximum butadiene and butylenes combined concentration of 2 mol per cent;

b.6. 2.6 minimum saturated C4 hydrocarbon concentration of 4 mol per cent; and

b.7. 2.7 minimum propane concentration of 25 mol per cent.

603. 17.18.3 Other compositions may be accepted provided the stability of the mixture is demonstrated to the satisfaction of the Administration.

604. 17.18.4 A ship carrying methyl acetylene-propadiene mixtures should preferably have an indirect refrigeration system as specified in 7.2.4.2. Alternatively, a ship not provided with indirect refrigeration may utilize direct vapour compression refrigeration subject to pressure and temperature limitations depending on the composition. For the example compositions given in 17.18.2, the following features should be provided:

a. 1 A vapour compressor that does not raise the temperature and pressure of the vapour above 60°C and 17.5 bar gauge during its operation, and that does not allow vapour to stagnate in the compressor while it continues to run.

b. 2 Discharge piping from each compressor stage or each cylinder in the same stage of a reciprocating compressor should have:

- b.1. 2.1 two temperature-actuated shutdown switches set to operate at 60°C or less;
- b.2. 2.2 a pressure-actuated shutdown switch set to operate at 17.5 bar gauge or less; and
- b.3. 2.3 a safety relief valve set to relieve at 18.0 bar gauge or less.
- c. 3 The relief valve required by 17.18.4.2.3 should vent to a mast meeting the requirements of 8.2.9, 8.2.10, 8.2.13 and 8.2.14 and should not relieve into the compressor suction line.
- d. 4 An alarm that sounds in the cargo control position and in the navigating bridge when a high-pressure switch, or a high-temperature switch operates.

605. 17.18.5 The piping system, including the cargo refrigeration system, for tanks to be loaded with methyl acetylene-propadiene mixtures should be either independent (as defined in 1.3.20) or separate (as defined in 1.3.32) from piping and refrigeration systems for other tanks. This segregation applies to all liquid and vapour vent lines and any other possible connections, such as common inert gas supply lines.

700. 17.19 Nitrogen

701. Materials of construction and ancillary equipment such as insulation should be resistant to the effects of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system. Due consideration should be given to ventilation in such areas where condensation might occur to avoid the stratification of oxygen-enriched atmosphere.

800. 17.20 Propylene oxide and mixtures of ethylene oxide-propylene oxide with ethylene oxide content of not more than 30% by weight

801. 17.20.1 Products transported under the provisions of this section should be acetylene-free.

802. 17.20.2.1 Unless cargo tanks are properly cleaned, these products should not be carried in tanks which have contained as one of the three previous cargoes any product known to catalyse polymerization, such as:

- a. 1 anhydrous ammonia and ammonia solutions
- b. 2 amines and amine solutions
- c. 3 oxidizing substances (e.g. chlorine).

803. 17.20.2.2 Before loading, tanks should be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipe work, except where the immediate prior cargo has been propylene oxide or ethylene oxide-propylene oxide

mixtures. Particular care should be taken in the case of ammonia in tanks made of steel other than stainless steel.

804. 17.20.2.3 In all cases, the effectiveness of cleaning procedures for tanks and associated pipe work should be checked by suitable testing or inspection to ascertain that no traces of acidic or alkaline materials remain that might create a hazardous situation in the presence of these products.

8005. 17.20.2.4 Tanks should be entered and inspected prior to each initial loading of these products to ensure freedom from contamination, heavy rust deposits and any visible structural defects. When cargo tanks are in continuous service for these products, such inspections should be performed at intervals of not more than 2 years.

806. 17.20.2.5 Tanks for the carriage of these products should be of steel or stainless steel construction.

807. 17.20.2.6 Tanks which have contained these products may be used for other cargoes after thorough cleaning of tanks and associated pipe work systems by washing or purging.

808. 17.20.3.1 All valves, flanges, fittings and accessory equipment should be of a type suitable for use with these products and should be constructed of steel or stainless steel in accordance with recognized standards. Discs or disc faces, seats and other wearing parts of valves should be made of stainless steel containing not less than 11% chromium.

809. 17.20.3.2 Gaskets should 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 should be polytetrafluoroethylene (PTFE) or materials giving a similar degree of safety by their inertness. Spirally-wound stainless steel with a filler of PTFE or similar fluorinated polymer may be accepted by the Administration.

810. 17.20.3.3 Insulation and packing if used should be of a material which does not react with, dissolve in, or lower the autoignition temperature of these products.

811. 17.20.3.4 The following materials are generally found unsatisfactory for gaskets, packing and similar uses in containment systems for these products and would require testing before being approved by the Administration:

- a. 1 Neoprene or natural rubber if it comes into contact with the products;
- b. 2 Asbestos or binders used with asbestos;
- c. 3 Materials containing oxides of magnesium, such as mineral wools.

812. 17.20.4 Filling and discharge piping should extend to within 100 mm of the bottom of the tank or any sump.

813. 17.20.5.1 The products should be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a containment system for the product should be independent of all other containment systems.

814. 17.20.5.2 During discharging operations, the pressure in the cargo tank should be maintained above 0.07 bar gauge.

815. 17.20.5.3 The cargo should be discharged only by deepwell pumps, hydraulically operated submerged pumps, or inert gas displacement. Each cargo pump should be arranged to ensure that the product does not heat significantly if the discharge line from the pump is shut off or otherwise blocked.

816. 17.20.6 Tanks carrying these products should be vented independently of tanks carrying other products. Facilities should be provided for sampling the tank contents without opening the tank to atmosphere.

817. 17.20.7 Cargo hoses used for transfer of these products should be marked "FOR ALKYLENE OXIDE TRANSFER ONLY".

818. 17.20.8 Hold spaces should be monitored for these products. Hold spaces surrounding type A and B independent tanks should also be inerted and monitored for oxygen. The oxygen content of these spaces should be maintained below 2%. Portable sampling equipment is satisfactory.

819. 17.20.9 Prior to disconnecting shore-lines, the pressure in liquid and vapour lines should be relieved through suitable valves installed at the loading header. Liquid and vapour from these lines should not be discharged to atmosphere.

820. 17.20.10 Tanks should be designed for the maximum pressure expected to be encountered during loading, carriage or unloading of cargo.

821. 17.20.11 Tanks for the carriage of propylene oxide with a design vapour pressure of less than 0.6 bar and tanks for the carriage of ethylene oxide-propylene oxide mixtures with a design vapour pressure of less than 1.2 bar should have a cooling system to maintain the cargo below the reference temperature. For reference temperature see 15.1.4.1.

822. 17.20.12 Pressure relief valve settings should not be less than 0.2 bar gauge and for type C independent cargo tanks not greater than 7.0 bar gauge for the carriage of propylene oxide and not greater than 5.3

bar gauge for the carriage of ethylene oxide-propylene oxide mixtures.

823. 17.20.13.1 The piping system for tanks to be loaded with these products should be completely separate from piping systems for all other tanks, including empty tanks, and from all cargo compressors. If the piping system for the tanks to be loaded with these products is not independent as defined in 1.3.20 the required piping separation should be accomplished by the removal of spool pieces, valves, or other pipe sections and the installation of blank flanges at these locations. The required separation applies to all liquid and vapour piping, liquid and vapour vent lines and any other possible connections such as common inert gas supply lines.

824. 17.20.13.2 The products should be transported only in accordance with cargo handling plans that have been approved by the Administration. Each intended loading arrangement should be shown on a separate cargo handling plan. Cargo handling plans should show the entire cargo piping system and the locations for installation of blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan should be kept on board the ship. The International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk should be endorsed to include reference to the approved cargo handling plans.

825. 17.20.13.3 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 should be obtained from a responsible person acceptable to the port Administration and carried on board the ship. Each connection between a blank flange and pipeline flange should be fitted with a wire and seal by the responsible person to ensure that inadvertent removal of the blank flange is impossible.

826. 17.20.14 The maximum allowable tank loading limits for each cargo tank should be indicated for each loading temperature which may be applied and for the applicable maximum reference temperature, on a list to be approved by the Administration. A copy of the list should be permanently kept on board by the master.

827. 17.20.15 The cargo should be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system should be installed to prevent the tank pressure falling below 0.07 bar gauge in the event of product temperature fall due to ambient conditions or malfunctioning of refrigeration system. Sufficient nitrogen should be available on board to satisfy the demand of the automatic pressure control. Nitrogen of commercially pure quality (99.9% by volume) should be used for padding. A battery of nitrogen bottles connected to the cargo tanks through a pressure reduction valve satisfies the intention of the expression "automatic" in this context.

828. 17.20.16 The cargo tank vapour space should be tested prior to and after loading to ensure that the oxygen content is 2% by volume or less.

829. 17.20.17 A water spray system of sufficient capacity should be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling and the tank domes. The arrangement of piping and nozzles should be such as to give a uniform distribution rate of 10 l/m² per minute. The water spray system should be capable of both local and remote manual operation and the arrangement should ensure that any spilled cargo is washed away. Remote manual operation should be arranged such that remote starting of pumps supplying 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. Additionally, a water hose with pressure to the nozzle, when ambient temperatures permit, should be connected ready for immediate use during loading and unloading operations.

900. 17.21 Vinyl chloride

901. In cases where polymerization of vinyl chloride is prevented by addition of an inhibitor, 17.8 is applicable. In cases where no or insufficient inhibitor has been added, any inert gas used for the purposes of 17.6 should contain not more oxygen than 0.1%. Before loading is started, inert gas samples from the tanks and piping should be analyzed. When vinyl chloride is carried, a positive pressure should always be maintained in the tanks, also during ballast voyages between successive carriages.

CHAPTER C SPECIAL REQUIREMENTS – C4 MIXED CARGOES

CHAPTER CONTENTS

C1. MIXED C4 CARGOES

C1. MIXED C4 CARGOES

100. 17.22 Mixed C4 cargoes

101. 17.22.1 Cargoes that may be carried individually under the requirement of this Code, notably Butane, Butylenes and Butadiene, may be carried as mixtures subject to the provisions of this section. These cargoes may variously be referred to as 'Crude C4', 'Crude Butadiene', 'Crude steam-cracked C4', 'Spent steam-cracked C4', 'C4 stream', 'C4 raffinate' or may be shipped under a different description. In all cases, the Material

Safety Data Sheet (MSDS) shall be consulted as the Butadiene content of the mixture is of prime concern as it is potentially toxic and reactive. While it is recognized that Butadiene has a relatively low vapour pressure, if such mixtures contain Butadiene they shall be regarded as toxic and the appropriate precautions applied.

102. 17.22.2 If the Mixed C4 cargo shipped under the terms of this section contains more than 50% (mole) of Butadiene, the inhibitor precautions in 17.8 shall apply.

103. 17.22.3 Unless specific data on liquid expansion coefficients is given for the specific mixture loaded, the Filling Limit restrictions of chapter 15 shall be calculated as if the cargo contained 100% concentration of the component with the highest expansion ratio.

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