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Comparison Table of IGC Code

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با سلام و احترام

با توجه به "تغییرات صورت گرفته در IGC Code" ، بدینوسیله یافته ها در قالب اطلاعیه فنی، جهت اطلاع و بهره برداری لازم حضورتان ایفاد می گردد..

این بخشنامه به انضمام پیوست‌های تکمیلی آن در بخش CLD از شبکه داخلی موسسه با آدرس ذیل قابل دسترسی می‌باشد.

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رضوان پناه
مدیر واحد کنوانسیون ها و مقررات دریایی
موسسه رده بندی ایرانیان

ترک دعوی: اگرچه در گردآوری کلیه راهنماهای فنی ارائه شده توسط موسسه رده بندی ایرانیان ،تا حد ممکن تلاش در دقت و صحت محتوا صورت گرفته است،این موسسه متحمل مسئولیتی در قبال هرگونه اشتباهات ،خسارت های احتمالی و جرائمی که ممکن است در ارتباط با بکار گیری مفاهیم و مطالب ارائه شده رخ دهد، نمی باشد.

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Comparison Table of New IGC Code

	New IGC Code	Old IGC Code	Remarks
CHAPTER 5 PROCESS PRESSURE VESSELS AND LIQUIDS, VAPOUR AND PRESSURE PIPING SYSTEMS			
Goal	*To ensure the safe handling of all cargo and process liquid and vapour, under all operating conditions, to minimize the risk to the ship, crew and to the environment, having regard to the nature of the products involved.* *This will:* *.1 Ensure the integrity of process pressure vessels, piping systems and cargo hoses;* *.2 Prevent the uncontrolled transfer of cargo;* *.3 Ensure reliable means to fill and empty the containment systems; and* *.4 Prevent pressure or vacuum excursions of cargo containment systems, beyond design parameters, during cargo transfer operations.*		Clarify the goal of requirements mentioned in this chapter.
5.1	**General**	5.1 General	
5.1.1	The requirements of this chapter shall apply to products and process piping, including vapour piping, gas fuel piping and vent lines of safety valves or similar piping. Auxiliary piping systems not containing cargo are exempt from the general requirements of this chapter.	5.1.1 The Administration should take appropriate steps to ensure uniformity in the implementation and application of the provisions of this Chapter.*	Editorial modification
5.1.2	The requirements for type C independent tanks provided in chapter 4 may also apply to process pressure vessels. If so	5.1.2 The requirements for type C independent tanks in Chapter 4 may also apply to process pressure vessels if	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	required, the term 'pressure vessels' as used in chapter 4, covers both type C independent tanks and process pressure vessels.	required by the Administration. If so required the term "pressure vessels" as used in Chapter 4 covers both type C independent tanks and process pressure vessels.	
5.1.3	Process pressure vessels include surge tanks, heat exchanges and accumulators that store or treat liquid or vapour cargo.		New requirement
5.2	**System requirements** The cargo handling and cargo control systems shall be designed taking into account the following: .1 prevention of an abnormal condition escalating to a release of liquid or vapour cargo; .2 the safe collection and disposal of cargo fluids released; .3 prevention of the formation of flammable mixtures; .4 prevention of ignition of flammable liquids or gases and vapours released; and .5 limiting the exposure of personnel to fire and other hazards.	5.2 Cargo and process piping	1. New requirement 2. Clarify the items we have to consider when we design.
5.2.1	*Arrangements – general*	5.2.1 General	
5.2.1.1	Any piping system that may contain cargo liquid or vapour shall: .1 be segregated from other piping systems, except where interconnections are required for cargo related operations such as purging, gas-freeing or inerting. The requirements of 9.4.4 shall be taken into account with regard to preventing back-flow of cargo. In such cases, precautions shall be taken to ensure that cargo or cargo vapour cannot enter other piping systems through the interconnections; .2 except as provided in chapter 16, not pass through any accommodation space, service space or control station or	5.2.1.1 The requirements of sections 5.2 to 5.5 apply to product and process piping including vapour piping and vent lines of safety valves or similar piping. Instrument piping not containing cargo is exempt from these requirements.	

	New IGC Code	Old IGC Code	Remarks
	through a machinery space other than a cargo machinery space; .3 be connected to the cargo containment system directly from the weather decks except where pipes installed in a vertical trunkway or equivalent are used to traverse void spaces above a cargo containment system and except where pipes for drainage, venting or purging traverse cofferdams; .4 be located in the cargo area above the weather deck except for bow or stern loading and unloading arrangements in accordance with 3.8, emergency cargo jettisoning piping systems in accordance with 5.3.1, turret compartment systems in accordance with 5.3.3 and except in accordance with chapter 16, and .5 be located inboard of the transverse tank location requirements of 2.4.1, except for athwartship shore connection piping not subject to internal pressure at sea or emergency cargo jettisoning piping systems.		
5.2.1.2	Suitable means shall be provided to relieve the pressure and remove liquid cargo from loading and discharging crossover headers; likewise, any piping between the outermost manifold valves and loading arms or cargo hoses to the cargo tanks, or other suitable location, prior to disconnection.	5.2.1.5 Suitable means should be provided to relieve the pressure and remove liquid contents from cargo loading and discharging crossover headers and cargo hoses to the cargo tanks or other suitable location, prior to disconnecting the cargo hoses.	Editorial modification
5.2.1.3	Piping systems carrying fluids for direct heating or cooling of cargo shall not be led outside the cargo area unless a suitable means is provided to prevent or detect the migration of cargo		New requirement

	New IGC Code	Old IGC Code	Remarks
	vapour outside the cargo area (see also 13.6.2.6).		
5.2.1.4	Relief valves discharging liquid cargo from the piping system shall discharge into the cargo tanks. Alternatively, they may discharge to the cargo vent mast if means are provided to detect and dispose of any liquid cargo that may flow into the vent system. Where required to prevent overpressure in downstream piping, relief valves on cargo pumps shall discharge to the pump suction.	5.2.1.6 All pipelines or components which may be isolated in a liquid full condition should be provided with relief valves. 5.2.1.7 Relief valves discharging liquid cargo from the cargo piping system should discharge into the cargo tanks; alternatively they may discharge to the cargo vent mast if means are provided to detect and dispose of any liquid cargo which may flow into the vent system. Relief valves on cargo pumps should discharge to the pump suction.	Editorial modification
5.3	Arrangements for cargo piping outside the cargo area		
5.3.1	*Emergency cargo jettisoning* If fitted, an emergency cargo jettisoning piping system shall comply with 5.2.1, as appropriate, and may be led aft, external to accommodation spaces, service spaces or control stations or machinery spaces, but shall not pass through them. If an emergency cargo jettisoning piping system is permanently installed, a suitable means of isolating the piping system from the cargo piping shall be provided within the cargo area.		1. New requirement on emergency cargo jettisoning
5.3.2	*Bow and stern loading arrangements* Subject to the requirements of 3.8, this section and 5.10.1, cargo piping may be arranged to permit bow or stern loading and unloading. Arrangements shall be made to allow such piping to be purged and gas-freed after use. When not in use, the spool pieces shall be removed and the pipe ends blank-flanged. The vent pipes connected with the purge shall be located in the cargo area.		1. New requirement on bow and stern loading

	New IGC Code	Old IGC Code	Remarks
5.3.3	*Turret compartment transfer systems* For the transfer of liquid or vapour cargo through an internal turret arrangement located outside the cargo area, the piping serving this purpose shall comply with 5.2.1, as applicable, 5.10.2 and the following: .1 piping shall be located above the weather deck except for the connection to the turret; .2 portable arrangements shall not be permitted; and .3 arrangements shall be made to allow such piping to be purged and gas-freed after use. When not in use, the spool pieces for isolation from the cargo piping shall be removed and the pipe ends blank-flanged. The vent pipes connected with the purge shall be located in the cargo area.		1. New requirement on turret
5.3.4	*Gas fuel piping systems* Gas fuel piping in machinery spaces shall comply with all applicable sections of this chapter in addition to the requirements of chapter 16.		New requirement
	5.4 Design pressure	5.2.3 Design pressure	
5.4.1	The design pressure *Po*, used to determine minimum scantlings of piping and piping system components, shall be not less than the maximum gauge pressure to which the system may be subjected in service. The minimum design pressure used shall not be less than 1 MPa, except for: open-ended lines or pressure relief valve discharge lines, where it shall be not less than the lower of 0.5 MPa, or 10 times the relief valve set pressure.	5.2.3.1 The design pressure P in the formula for in 5.2.2.1 is the maximum gauge pressure to which the system may be subjected in service. 5.2.3.3 The design pressure should not be less than 10 bar gauge except for open ended lines where it should be not less than 5 bar.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
5.4.2	The greater of the following design conditions shall be used for piping, piping systems and components, based on the cargoes being carried: .1 for vapour piping systems or components that may be separated from their relief valves and which may contain some liquid: the saturated vapour pressure at a design temperature of 45°C. Higher or lower values may be used; see 4.13.1.2; or .2 for systems or components that may be separated from their relief valves and which contain only vapour at all times: the superheated vapour pressure at 45°C. Higher or lower values may be used; see 4.13.1.2, assuming an initial condition of saturated vapour in the system at the system operating pressure and temperature; or .3 the MARVS of the cargo tanks and cargo processing systems; or .4 the pressure setting of the associated pump or compressor discharge relief valve; or .5 the maximum total discharge or loading head of the cargo piping system considering all possible pumping arrangements or the relief valve setting on a pipeline system.	5.2.3.2 The greater of the following design conditions should be used for piping, piping systems and components as appropriate : .1 for vapour piping systems or components which may be separated from their relief valves and which may contain some liquid : the saturated vapour pressure at 45°C, or higher or lower if agreed upon by the Society (see 4.2.6.2) ; .2 for systems or components which may be separated from their relief valves and which contain only vapour at all times: the superheated vapour pressure at 45°C or higher or lower if agreed upon by the Society (see 4.2.6.2), assuming an initial condition of saturated vapour in the system at the system operating pressure and temperature ; or .3 the MARVS of the cargo tanks and cargo processing systems ; or .4 the pressure setting of the associated pump or compressor discharge relief valve ; or .5 the maximum total discharge or loading head of the cargo piping system ; or .6 the relief valve setting on a pipeline system.	Editorial modification
5.4.3	Those parts of the liquid piping systems that may be subjected to surge pressures shall be designed to withstand this pressure.		New requirement
5.4.4	The design pressure of the outer pipe or duct of gas fuel systems shall not be less than the maximum working pressure of the inner gas pipe. Alternatively, for gas fuel piping systems with		New requirement on gas fuel piping system

	New IGC Code	Old IGC Code	Remarks
	a working pressure greater than 1 MPa, the design pressure of the outer duct shall not be less than the maximum built-up pressure arising in the annular space considering the local instantaneous peak pressure in way of any rupture and the ventilation arrangements.		
5.5	**Cargo system valve requirements** 5.5.1.1 Every cargo tank and piping system shall be fitted with manually operated valves for isolation purposes as specified in this section. 5.5.1.2 In addition, remotely operated valves shall also be fitted, as appropriate, as part of the "Emergency Shutdown (ESD) System". The purpose of this ESD system is to stop cargo flow or leakage in the event of an emergency when cargo liquid or vapour transfer is in progress. The ESD system is intended to return the cargo system to a safe static condition so that any remedial action can be taken. Due regard shall be given in the design of the ESD system to avoid the generation of surge pressures within the cargo transfer pipework. The equipment to be shut down on ESD activation includes: manifold valves during loading or discharge, any pump or compressor, etc., transferring cargo internally or externally (e.g. to shore or another ship/barge) plus cargo tank valves, if the MARVS exceeds 0.07 MPa.	5.6 Cargo system valving requirements (Paragraph 5.6.5 applies to ships constructed on or after 1 July 2002.) 5.6.1 Every cargo piping system and cargo tank should be provided with the following valves, as applicable: .1 For cargo tanks with a MARVS not exceeding 0.7 bar gauge, all liquid and vapour connections, except safety relief valves and liquid level gauging devices, should have shutoff valves located as close to the tank as practicable. These valves may be remotely controlled but should be capable of local manual operation and provide full closure. One or more remotely controlled emergency shutdown valves should be provided on the ship for shutting down liquid and vapour cargo transfer between ship and shore. Such valves may be arranged to suit the ship's design and may be the same valve as required in 5.6.3 and should comply with the requirements of 5.6.4. .2 For cargo tanks with a MARVS exceeding 0.7 bar gauge, all liquid and vapour connections, except safety relief valves and liquid level gauging devices, should be equipped with a manually operated stop valve and a remotely controlled emergency shutdown valve. These valves should be located as close to the tank as	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		practicable. Where the pipe size does not exceed 50 mm in diameter, excess flow valves may be used in lieu of the emergency shutdown valve. A single valve may be substituted for the two separate valves provided the valve complies with the requirements of 5.6.4, is capable of local manual operation and provides full closure of the line. .3 Cargo pumps and compressors should be arranged to shutdown automatically if the emergency shutdown valves required by 5.6.1.1and 2 are closed by the emergency shutdown system required by 5.6.4. 5.6.2 Cargo tank connections for gauging or measuring devices need not be equipped with excess flow or emergency shutdown valves provided that the devices are so constructed that the outward flow of tank contents cannot exceed that passed by a 1.5 mm diameter circular hole.	
5.5.2	*Cargo tank connections* .1 All liquid and vapour connections, except for safety relief valves and liquid level gauging devices, shall have shut-off valves located as close to the tank as practicable. These valves shall provide full closure and shall be capable of local manual operation; they may also be capable of remote operation. .2 For cargo tanks with a MARVS exceeding 0.07 MPa, the above connections shall also be equipped with remotely controlled ESD valves. These valves shall be located as close to the tank as practicable. A single valve may be substituted		

	New IGC Code	Old IGC Code	Remarks
	for the two separate valves provided the valve complies with the requirements of 18.10.2 and provides full closure of the line.		
5.5.3	*Cargo Manifold Connections* .1 One remotely controlled ESD valve shall be provided at each cargo transfer connection in use to stop liquid and vapour transfer to or from the ship. Transfer connections not in use shall be isolated with suitable blank flanges. .2 If the cargo tank MARVS exceeds 0.07 MPa, an additional manual valve shall be provided for each transfer connection in use, and may be inboard or outboard of the ESD valve to suit the ship's design.	5.6.3 One remotely operated emergency shutdown valve should be provided at each cargo hose connection in use. Connections not used in transfer operations may be blinded with blank flanges in lieu of valves. 5.6.4 The control system for all required emergency shutdown valves should be so arranged that all such valves may be operated by single controls situated in at least two remote locations on the ship. One of these locations should be the control position required by 13.1.3 or cargo control room. The control system should also be provided with fusible elements designed to melt at temperatures between 98 °Cand 104 °C which will cause the emergency shutdown valves to close in the event of fire. Locations for such fusible elements should include the tank domes and loading stations. Emergency shutdown valves should be of the fail-closed (closed on loss of power) type and be capable of local manual closing operation. Emergency shutdown valves in liquid piping should fully close under all service conditions within 30 s of actuation as measured from the time of manual or automatic initiation to final closure. This is called the total shutdown time and is made up of a signal response time and a valve closure time. The valve closure time should be such as to avoid surge pressures in pipelines. Information about the closing time of the valves and their	1. Requirements on ESD have been moved to 18.10.2

	New IGC Code	Old IGC Code	Remarks
		operating characteristics should be available on board and the valve closure time should be verifiable and reproducible. Such valves should close in such a manner as to cut off the flow smoothly. 5.6.5 The closure time of 30s for the emergency shutdown valve referred to in 5.6.4 should be measured from the time of manual or automatic initiation to final closure. This is called the total shutdown time and is made up of a signal response time and a valve closure time. The valve closure time should be such as to avoid surge pressure in pipelines. Such valves should close in such a manner as to cut off the flow smoothly.	
5.5.3	Excess flow valves may be used in lieu of ESD valves if the diameter of the pipe protected does not exceed 50 mm. Excess flow valves shall close automatically at the rated closing flow of vapour or liquid as specified by the manufacturer. The piping including fittings, valves and appurtenances protected by an excess flow valve shall have a capacity greater than the rated closing flow of the excess flow valve. Excess flow valves may be designed with a bypass not exceeding the area of a 1.0 mm diameter circular opening to allow equalization of pressure after a shutdown activation.	5.6.6 Excess flow valves should close automatically at the rated closing flow of vapour or liquid as specified by the manufacturer. The piping including fittings, valves, and appurtenances protected by an excess flow valve, should have a greater capacity than the rated closing flow of the excess flow valve. Excess flow valves may be designed with a bypass not exceeding an area of 1.0 mm diameter circular opening to allow equalization of pressure, after an operating shutdown.	Editorial modification
5.5.4	Cargo tank connections for gauging or measuring devices need not be equipped with excess flow valves or ESD valves, provided that the devices are constructed so that the outward flow of tank contents cannot exceed that passed by a 1.5 mm diameter circular hole.	5.6.2 Cargo tank connections for gauging or measuring devices need not be equipped with excess flow or emergency shutdown valves provided that the devices are so constructed that the outward flow of tank contents cannot exceed that passed by a 1.5 mm diameter circular	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		hole.	
5.5.5	All pipelines or components which may be isolated in a liquid full condition shall be protected with relief valves for thermal expansion and evaporation.		New requirement
5.5.6	All pipelines or components which may be isolated automatically due to a fire with a liquid volume of more than 0.05 m3 entrapped shall be provided with PRVs sized for a fire condition.		New requirement
5.6	**Cargo transfer arrangements**	**5.8 Cargo transfer methods**	
5.6.1	Where cargo transfer is by means of cargo pumps that are not accessible for repair with the tanks in service, at least two separate means shall be provided to transfer cargo from each cargo tank and the design shall be such that failure of one cargo pump or means of transfer will not prevent the cargo transfer by another pump or pumps, or other cargo transfer means.	5.8.1 Where cargo transfer is by means of cargo pumps not accessible for repair with the tanks in service, at least two separate means should be provided to transfer cargo from each cargo tank and the design should be such that failure of one cargo pump, or means of transfer, will not prevent the cargo transfer by another pump or pumps, or other cargo transfer means.	Editorial modification
5.6.2	The procedure for transfer of cargo by gas pressurization shall preclude lifting of the relief valves during such transfer. Gas pressurization may be accepted as a means of transfer of cargo for those tanks where the design factor of safety is not reduced under the conditions prevailing during the cargo transfer operation. If the cargo tank relief valves or set pressure are changed for this purpose, as it is permitted in accordance with 8.2.7 and 8.2.8, the new set pressure is not to exceed *Ph* as is defined in 4.13.1.	5.8.2 The procedure for transfer of cargo by gas pressurization should preclude lifting of the relief valves during such transfer. Gas pressurization may be accepted as a means of transfer of cargo for those tanks so designed that the design factor of safety is not reduced under the conditions prevailing during the cargo transfer operation.	Editorial modification
5.6.3	*Vapour return connections* Connections for vapour return to the shore installations shall be	5.9 Vapour return connexions Connections for vapour return lines to the shore	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	provided.	installations should be provided.	
5.6.4	*Cargo tank vent piping systems* The pressure relief system shall be connected to a vent piping system designed to minimize the possibility of cargo vapour accumulating on the decks, or entering accommodation spaces, service spaces, control stations and machinery spaces, or other spaces where it may create a dangerous condition.		
5.6.5	*Cargo sampling connections*		
5.6.5.1	Connections to cargo piping systems for taking cargo liquid samples shall be clearly marked and shall be designed to minimize the release of cargo vapours. For vessels permitted to carry cargoes noted as toxic in chapter 19, the sampling system shall be of a closed loop design to ensure that cargo liquid and vapour are not vented to atmosphere.		1. New requirement 2. Provide cargo sampling connections
5.6.5.2	Liquid sampling systems shall be provided with two valves on the sample inlet. One of these valves shall be of the multi-turn type to avoid accidental opening, and shall be spaced far enough apart to ensure that they can isolate the line if there is blockage, by ice or hydrates for example.		
5.6.5.3	On closed loop systems, the valves on the return pipe shall also comply with 5.6.5.2.		
5.6.5.4	The connection to the sample container shall comply with recognized standards and be supported so as to be able to support the weight of a sample container. Threaded connections shall be tack-welded, or otherwise locked, to prevent them being unscrewed during the normal connection and disconnection of		

	New IGC Code	Old IGC Code	Remarks
	sample containers. The sample connection shall be fitted with a closure plug or flange to prevent any leakage when the connection is not in use.		
5.6.5.5	Sample connections used only for vapour samples may be fitted with a single valve in accordance with 5.5, 5.8 and 5.13, and shall also be fitted with a closure plug or flange.		
5.6.5.6	Sampling operations shall be undertaken as in 18.9.		
5.6.6	*Cargo filters* The cargo liquid and vapour systems shall be capable of being fitted with filters to protect against damage by foreign objects. Such filters may be permanent or temporary, and the standards of filtration shall be appropriate to the risk of debris etc., entering the cargo system. Means shall be provided to indicate that filters are becoming blocked. Means shall be provided to isolate, depressurize and clean the filters safely.		1. New requirement 2. Provide cargo filter
5.7	**Installation requirements**		
5.7.1	*Design for expansion and contraction* Provision shall be made to protect the piping, piping system and components and cargo tanks from excessive stresses due to thermal movement and from movements of the tank and hull structure. The preferred method outside the cargo tanks is by means of offsets, bends or loops, but multi-layer bellows may be used if offsets, bends or loops are not practicable.	5.2.1.2 Provision should be made by the use of offsets, loops, bends, mechanical expansion joints such as bellows, slip joints and ball joints or similar suitable means to protect the piping, piping system components and cargo tanks from excessive stresses due to thermal movement and from movements of the tank and hull structure. Where mechanical expansion joints are used in piping they should be held to a minimum and, where located outside cargo tanks, should be of the bellows type.	Editorial modification
5.7.2	*Precautions against low-temperature* Low temperature piping shall be thermally isolated from the	5.2.1.3 Low-temperature piping should be thermally isolated from the adjacent hull structure, where necessary, to	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	adjacent hull structure, where necessary, to prevent the temperature of the hull from falling below the design temperature of the hull material. Where liquid piping is dismantled regularly, or where liquid leakage may be anticipated, such as at shore connections and at pump seals, protection for the hull beneath shall be provided.	prevent the temperature of the hull from falling below the design temperature of the hull material. Where liquid piping is dismantled regularly, or where liquid leakage may be anticipated, such as at shore connections and at pump seals, protection for the hull beneath should be provided.	
5.7.3	*Water curtain* For cargo temperatures below -110°C, a water distribution system shall be fitted in way of the hull under the shore connections to provide a low-pressure water curtain for additional protection of the hull steel and the ship's side structure. This system is in addition to the requirements of 11.3.1.4, and shall be operated when cargo transfer is in progress.		New requirement
5.7.4	*Bonding* Where tanks or cargo piping and piping equipment are separated from the ship's structure by thermal isolation, provision shall be made for electrically bonding both the piping and the tanks. All gasketed pipe joints and hose connections shall be electrically bonded. Except where bonding straps are used, it shall be demonstrated that the electrical resistance of each joint or connection is less than 1MΩ.	5.2.1.4 Where tanks or piping are separated from the ship's structure by thermal isolation, provision should be made for electrically bonding both the piping and the tanks. All gasketed pipe joints and hose connections should be electrically bonded.	Editorial modification
5.8	**Piping fabrication and joining details**		
5.8.1	*General* The requirements of this section apply to piping inside and outside the cargo tanks. Relaxation from these requirements may be accepted, in accordance with recognized standards for piping	5.4 Piping fabrication and joining details 5.4.1 The requirements of the Article apply to piping inside and outside the cargo tanks. Relaxations from these requirements may be accepted, in accordance with	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	inside cargo tanks and open-ended piping.	recognized standards, for piping inside cargo tanks and open-ended piping.	
5.8.2	*Direct connections* The following direct connection of pipe lengths, without flanges, may be considered: .1 butt-welded joints with complete penetration at the root may be used in all applications. For design temperatures colder than -10 °C, butt welds shall be either double welded or equivalent to a double welded butt joint. This may be accomplished by use of a backing ring, consumable insert or inert gas backup on the first pass. For design pressures in excess of 1 MPa and design temperatures of -10°C or colder, backing rings shall be removed; .2 slip-on welded joints with sleeves and related welding, having dimensions in accordance with recognized standards, shall only be used for instrument lines and open-ended lines with an external diameter of 50 mm or less and design temperatures not colder than -55°C; and .3 screwed couplings complying with recognized standards shall only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.	5.4.2 The following direct connection of pipe lengths, without flanges, may be considered: .1 Butt-welded joints with complete penetration at the root may be used in all applications. For design temperatures below -10°C, butt welds should be either double welded or equivalent to a double welded butt joint. This may be accomplished by use of a backing ring, consumable insert or inert gas back-up on the first pass. For design pressures in excess of 10 bar and design temperatures of -10°C or lower, backing rings should be removed. .2 Slip-on welded joints with sleeves and related welding, having dimensions in accordance with recognized standards should only be used for open-ended lines with external diameter of 50 mm or less and design temperatures not lower than -55°C. .3 Screwed couplings complying with recognized standards only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.	
5.8.3	*Flanged connections*	5.4.3.1 Flanges in flange connections should be of the welded neck, slip-on or socket welded type.	
5.8.3.1	Flanges in flange connections shall be of the welded neck, slip-on or socket welded type.	5.4.3.2 Flanges should be selected as to type, and made and tested in accordance with a recognized standards. In particular, for all piping except open ended, the following restrictions apply : .1 For design temperatures lower than -55°C, only welded neck flanges should be used.	
5.8.3.2	Flanges shall comply with recognized standards for their type, manufacture and test. For all piping except open ended, the following restrictions apply: .1 for design temperatures colder than -55°C, only welded neck		

	New IGC Code	Old IGC Code	Remarks
	flanges shall be used; and .2 for design temperatures colder than -10°C, slip-on flanges shall not be used in nominal sizes above 100 mm and socket welded flanges shall not be used in nominal sizes above 50 mm	.2 For design temperatures lower than -10°C, slip-on flanges should not be used in nominal sizes above 100 mm and socket welded flanges should not be used in nominal sizes above 50 mm.	
5.8.4	*Expansion joints* Where bellows and expansion joints are provided in accordance with 5.7.1, the following requirements apply: .1 if necessary, bellows shall be protected against icing; and .2 slip joints shall not be used except within the cargo tanks.	5.4.4 Piping connections, other than those mentioned in 5.4.2 and .3, may be accepted by the Administration in each case. 5.4.5 Bellows and expansion joints should be provided to allow for expansion of piping. .1 If necessary, bellows should be protected against icing. .2 Slip joints should not be used except within the cargo tanks.	
5.8.5	*Other connections* Piping connections shall be joined in accordance with 5.8.2 to 5.8.4, but for other exceptional cases the Administration may consider alternative arrangements.		
5.9	**Welding, post-weld heat treatment and non-destructive testing**		
5.9.1	*General* Welding shall be carried out in accordance with 6.5.	5.4.6 Welding, post-weld heat treatment and non-destructive testing. .1 Welding should be carried out in accordance with 6.3.	
5.9.2	*Post-weld heat treatment* Post-weld heat treatment shall be required for all butt welds of pipes made with carbon, carbon-manganese and low alloy steels. The Administration or recognized organization acting on its behalf may waive the requirements for thermal stress relieving of pipes with wall thickness less than 10 mm in relation to the design temperature and pressure of the piping system concerned.	.2 Post-weld heat treatment should be required for all butt welds of pipes made with carbon, carbon-manganese and low alloy steels. The Administration may waive the requirement for thermal stress relieving of pipes having wall thickness less than 10 mmin relation to the design temperature and pressure of the piping system concerned.	Editorial modification
5.9.3	*Non-destructive testing* In addition to normal controls before and during the welding, and to the visual inspection of the finished welds, as necessary for	.3 In addition to normal controls before and during the welding and to the visual inspection of the finished welds, as necessary for proving that the welding has been carried out correctly and according to the requirements of this	

	New IGC Code	Old IGC Code	Remarks
	proving that the welding has been carried out correctly and according to the requirements of this paragraph, the following tests shall be required: .1 100% radiographic or ultrasonic inspection of butt-welded joints for piping systems with; design temperatures colder than -10°C, or with inside diameters of more than 75 mm, or wall thicknesses greater than 10 mm; .2 when such butt welded joints of piping sections are made by automatic welding procedures approved by the Administration or recognized organization acting on its behalf, then a progressive reduction in the extent of radiographic or ultrasonic inspection can be agreed, but in no case to less than 10% of each joint. If defects are revealed, the extent of examination shall be increased to 100% and shall include inspection of previously accepted welds. This approval can only be granted if well-documented quality assurance procedures and records are available to assess the ability of the manufacturer to produce satisfactory welds consistently; and .3 for other butt-welded joints of pipes not covered by 5.9.3.1 and 5.9.3.2, spot radiographic or ultrasonic inspection or other non-destructive tests shall be carried out depending upon service, position and materials. In general, at least 10% of butt-welded joints of pipes shall be subjected to radiographic or ultrasonic inspection.	paragraph, the following tests should be required : .3.1 100% radiographic inspection of butt welded joints for piping systems with design temperatures lower than -10°C and with inside diameters of more than 75 mmor wall thicknesses greater than 10 mm. When such butt welded joints of piping sections are made by automatic welding procedures in the pipe fabrication shop, upon special approval by the Administration, the extent of radiographic inspection may be progressively reduced but in no case to less than 10% of each joint. If defects are revealed the extent of examination should be increased to 100% and should include inspection of previously accepted welds. This special approval can only be granted if well-documented quality assurance procedures and records are available to enable the Administration to assess the ability of the manufacturer to produce satisfactory welds consistently. .3.2 For other butt-welded joints of pipes, not covered by 5.4.6.3.1 spot radiographic tests or other non-destructive tests should be carried out at the discretion of the Administration depending upon service, position and materials. In general, at least 10% of butt-welded joints of pipes should be radiographed.	
5.10	**Installation requirements for cargo piping outside the cargo area**		

	New IGC Code	Old IGC Code	Remarks
5.10.1	*Bow and stern loading arrangements* The following provisions shall apply to cargo piping and related piping equipment located outside the cargo area: .1 cargo piping and related piping equipment outside the cargo area shall have only welded connections. The piping outside the cargo area shall run on the weather decks and shall be at least 0.8 m inboard, except for athwartships shore connection piping. Such piping shall be clearly identified and fitted with a shutoff valve at its connection to the cargo piping system within the cargo area. At this location it shall also be capable of being separated, by means of a removable spool piece and blank flanges, when not in use; and .2 the piping shall be full penetration butt-welded and subjected to full radiographic or ultrasonic inspection, regardless of pipe diameter and design temperature. Flange connections in the piping shall only be permitted within the cargo area and at the shore connection.		New requirement on bow and stern loading
5.10.2	*Turret compartment transfer systems* The following provisions shall apply to liquid and vapour cargo piping where it is run outside the cargo area: .1 cargo piping and related piping equipment outside the cargo area shall have only welded connections; and .2 the piping shall be full penetration butt welded, and subjected to full radiographic or ultrasonic inspection, regardless of pipe diameter and design temperature. Flange connections in the		New requirement on turret

	New IGC Code	Old IGC Code	Remarks
	piping shall only be permitted within the cargo area and at connections to cargo hoses and the turret connection.		
5.10.3	*Gas fuel piping* Gas fuel piping, as far as practicable, shall have welded joints. Those parts of the gas fuel piping that are not enclosed in a ventilated pipe or duct according to 16.4.3, and are on the weather decks outside the cargo area, shall have full penetration butt-welded joints and shall be subjected to full radiographic or ultrasonic inspection.		1. New requirement on gas fuel piping 2. Welded joints
5.11	**Piping system component requirements**		
5.11.1	Piping scantlings: piping systems shall be designed in accordance with recognized standards.		
5.11.2	.1 The following criteria shall be used for determining pipe wall thickness. .2 The wall thickness of pipes shall not be less than: $T = (to + b + c) / (1 - a/100)$ (mm), where: to = theoretical thickness; $to = PD/(2Ke + P)$ (mm), with: P = design pressure (MPa) referred to in 5.4; D = outside diameter (mm); K = allowable stress (N/mm²) referred to in 5.11.3; e = efficiency factor equal to 1.0 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, that are considered equivalent to	5.2 Cargo and process piping 5.2.1 General 5.2.1.1 The requirements of sections 5.2 to 5.5 apply to product and process piping including vapour piping and vent lines of safety valves or similar piping. Instrument piping not containing cargo is exempt from these requirements. 5.2.1.2 Provision should be made by the use of offsets, loops, bends, mechanical expansion joints such as bellows, slip joints and ball joints or similar suitable means to protect the piping, piping system components and cargo tanks from excessive stresses due to thermal movement and from movements of the tank and hull structure. Where mechanical expansion joints are used in piping they should be held to a minimum and, where located outside cargo	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	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: $B = Dt0/2.5r$ (mm), with: r = mean radius of the bend (mm); c = corrosion allowance (mm). If corrosion or erosion is expected, the wall thickness of the piping shall be increased over that required by other design requirements. This allowance shall be consistent with the expected life of the piping; and A = negative manufacturing tolerance for thickness (%).	tanks, should be of the bellows type. 5.2.1.3 Low-temperature piping should be thermally isolated from the adjacent hull structure, where necessary, to prevent the temperature of the hull from falling below the design temperature of the hull material. Where liquid piping is dismantled regularly, or where liquid leakage may be anticipated, such as at shore connections and at pump seals, protection for the hull beneath should be provided. 5.2.1.4 Where tanks or piping are separated from the ship's structure by thermal isolation, provision should be made for electrically bonding both the piping and the tanks. All gasketed pipe joints and hose connections should be electrically bonded. 5.2.1.5 Suitable means should be provided to relieve the pressure and remove liquid contents from cargo loading and discharging crossover headers and cargo hoses to the cargo tanks or other suitable location, prior to disconnecting the cargo hoses. 5.2.1.6 All pipelines or components which may be isolated in a liquid full condition should be provided with relief valves. 5.2.1.7 Relief valves discharging liquid cargo from the cargo piping system should discharge into the cargo tanks; alternatively they may discharge to the cargo vent mast if means are provided to detect and dispose of any liquid cargo which may flow into the vent system. Relief valves on cargo pumps should discharge to the pump suction. 5.2.2 Scantlings based on internal pressure	

	New IGC Code	Old IGC Code	Remarks
		5.2.2.1 Subject to the conditions stated in 5.2.4, the wall thickness of pipes should not be less than : $T = (to + b + c) / (1 - a/100)$ (mm), where : t0 = theoretical thickness t0 = PD/(20Ke+P)(mm) with : P = design pressure (bar) referred to in 5.2.3 D = outside diameter (mm) K = allowable stress (N/mm^2) referred to in 5.2.4 e = efficiency factor equal to 1.0 for seamless pipes and longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, which are considered equivalent to seamless pipes when on-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 should be chosen so that the calculated stress in the bend, due to internal pressure only, does not exceed the allowable stress. Where such justification is not given, b should be : c = corrosion allowance (mm). If corrosion or erosion is expected, the wall thickness of the piping should be increased over that required by other design requirements. This allowance should be consistent with the expected life	

	New IGC Code	Old IGC Code	Remarks
		of the piping. a = negative manufacturing tolerance of thickness (%). 5.2.3 Design pressure 5.2.3.1 The design pressure P in the formula for in 5.2.2.1 is the maximum gauge pressure to which the system may be subjected in service. 5.2.3.2 The greater of the following design conditions should be used for piping, piping systems and components as appropriate : .1 for vapour piping systems or components which may be separated from their relief valves and which may contain some liquid : the saturated vapour pressure at 45°C, or higher or lower if agreed upon by the Society (see 4.2.6.2) ; .2 for systems or components which may be separated from their relief valves and which contain only vapour at all times: the superheated vapour pressure at 4 5°C or higher or lower if agreed upon by the Society (see 4.2.6.2), assuming an initial condition of saturated vapour in the system at the system operating pressure and temperature ; or .3 the MARVS of the cargo tanks and cargo processing systems ; or .4 the pressure setting of the associated pump or compressor discharge relief valve ; or .5 the maximum total discharge or loading head of the cargo piping system ; or .6 the relief valve setting on a pipeline system.	

	New IGC Code	Old IGC Code	Remarks
		5.2.3.3 The design pressure should not be less than 10 bar gauge except for open ended lines where it should be not less than 5 bar.	
5.11.2	.3 The minimum wall thickness shall be in accordance with recognized standards.	5.2.4.2 The minimum wall thickness should be in accordance with Recognized Standards.	
5.11.2	.4 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads, the wall thickness shall be increased over that required by 5.11.2 or, if this is impracticable or would cause excessive local stresses, these loads may be reduced, protected against or eliminated by other design methods. Such superimposed loads may be due to: supporting structures, ship deflections, liquid pressure surge during transfer operations, the weight of suspended valves, reaction to loading arm connections, or otherwise.	5.2.4.3 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads from supports, ship deflection or other causes, the wall thickness should be increased over that required by 5.2.2, or, if this is impracticable or would cause excessive local stresses, these loads should be reduced, protected against or eliminated by other design methods.	
5.11.3	*Allowable stress*		
5.11.3.1	For pipes, the allowable stress to be considered in the formula for t in 5.11.2 is the lower of the following values: *Rm*/A or *Re*/B, where: *Rm* = specified minimum tensile strength at room temperature (N/mm²); and *Re* = specified minimum yield stress at room temperature (N/mm²). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies. The values of A and B shall be shown on the International	5.2.4 Permissible stresses 5.2.4.1 For pipes, the permissible stress to be considered in the formula for t in 5.2.2.1 is the lower of the following values : *Rm*/A or *Re*/B, where : = specified minimum tensile strength at room temperature (N/mm²) = specified minimum yield stress at room temperature (N/mm²). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	Certificate of Fitness for the Carriage of Liquefied Gases in Bulk, as required in 1.4, and have values of at least A = 2.7 and B = 1.8.	The values of A and B should be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk as provide for in 1.5 and have values of at least A = 2.7 and B = 1.8.	
5.11.4	*High pressure gas fuel outer pipes or ducting scantlings* In fuel gas piping systems of design pressure greater than the critical pressure, the tangential membrane stress of a straight section of pipe or ducting shall not exceed the tensile strength divided by 1.5 (Rm/1.5) when subjected to the design pressure specified in 5.4. The pressure ratings of all other piping components shall reflect the same level of strength as straight pipes.		New requirement
5.11.5	*Stress analysis* When the design temperature is -110°C or lower, a complete stress analysis, taking into account all the stresses due to weight of pipes, including acceleration loads if significant, internal pressure, thermal contraction and loads induced by hog and sag of the ship for each branch of the piping system [shall be submitted to the Administration]. For temperatures above –110°C, a stress analysis may be required by the Administration in relation to such matters as the design or stiffness of the piping system and the choice of materials. In any case, consideration shall be given to thermal stresses even though calculations are not submitted. The analysis may be carried out according to a Code of Practice acceptable to the Administration.	5.2.5 Stress analysis When the design temperature is -110°C or lower, a complete stress analysis, taking into account all the stresses due to weight of pipes, including acceleration loads if significant, internal pressure, thermal contraction and loads induced by hog and sag of the ship for each branch of the piping system should be submitted to the Society. For temperatures of above -110°C, a stress analysis may be required by the Society in relation to such matters as the design or stiffness of the piping system and the choice of materials. In any case, consideration should be given to thermal stresses, even though calculations are not submitted. The analysis may be carried out according to a code of practice acceptable to the Administration.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
5.11.6	*Flanges, valves and fittings*		
5. 11.6.1	Flanges, valves and other fittings shall comply with recognized standards, taking into account the material selected and the design pressure defined in 5.4. For bellows expansion joints used in vapour service, a lower minimum design pressure may be accepted.	5.2.4.4 Flanges, valves and other fittings should comply with recognized standards, taking into account the design pressure defined in 5.2.2. For bellows expansion joints used in vapour service, a lower minimum design pressure may be accepted.	Editorial modification
5.11.6.2	For flanges not complying with a recognized standard, the dimensions of flanges and related bolts shall be to the satisfaction of the Administration or recognized organization acting on its behalf.	5.2.4.5 For flanges not complying with a standard, the dimensions of flanges and related bolts should be to the satisfaction of the Administration.	Editorial modification
5.11.6.3	All emergency shutdown valves shall be of the "fire closed" type (see 5.13.1.1 and 18.10.2).		New requirement
5.11.6.4	The design and installation of expansion bellows shall be in accordance with recognized standards and be fitted with means to prevent damage due to over-extension or compression.		New requirement
5.11.7	*Ships' cargo hoses*		
5.11.7.1	Liquid and vapour hoses used for cargo transfer shall be compatible with the cargo and suitable for the cargo temperature.	5.7 Ship's cargo hoses 5.7.1 Liquid and vapour hoses used for cargo transfer should be compatible with the cargo and suitable for the cargo temperature. 5.7.2 Hoses subject to tank pressure, or the discharge pressure of pumps or vapour compressors, should be designed for a bursting pressure not less than 5 times the maximum pressure the hose will be subjected to during cargo transfer. 5.7.3 For cargo hoses installed on board ships on or after 1 July 2002, each new type of cargo hose, complete with	Editorial modification
5.11.7.2	Hoses subject to tank pressure, or the discharge pressure of pumps or vapour compressors, shall be designed for a bursting pressure not less than five times the maximum pressure the hose will be subjected to during cargo transfer.		
5.11.7.3	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		

	New IGC Code	Old IGC Code	Remarks
	pressure of at least 5 times its specified maximum working pressure at the upper and lower 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 ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure shall not be less than 1 MPa.	end-fittings, should 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 should demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the extreme service temperature. Hoses used for prototype testing should not be used for cargo service. Thereafter, before being placed in service, each new length of cargo hose produced should be hydrostatically tested at ambient temperature to a pressure not less than 1.5 times its specified maximum working pressure but not more than two-fifths of its bursting pressure. The hose should be stencilled or otherwise marked with 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 should not be less than 10 bar gauge.	
5.12	**Materials**		
5.12.1	The choice and testing of materials used in piping systems shall comply with the requirements of chapter 6, taking into account the minimum design temperature. However, some relaxation may be permitted in the quality of material of open-ended vent piping, providing the temperature of the cargo at the pressure relief valve setting is not lower than -55°C, and provided no liquid discharge to the vent piping can occur. Similar relaxations may	5.2.6 Materials 5.2.6.1 The choice and testing of materials used in piping systems should comply with the requirements of Chapter 6 taking into account the minimum design temperature. However, some relaxation may be permitted in the quality of material of open ended vent piping, provided the temperature of the cargo at the pressure relief valve setting is -55°C or greater and provided no liquid	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	be permitted under the same temperature conditions to open-ended piping inside cargo tanks, excluding discharge piping and all piping inside membrane and semi-membrane tanks.	discharge to the vent piping can occur. Similar relaxations may be permitted under the same temperature conditions to open ended piping inside cargo tanks, excluding discharge piping and all piping inside membrane and semi-membrane tanks.	
5.12.2	Materials having a melting point below 925°C shall not be used for piping outside the cargo tanks except for short lengths of pipes attached to the cargo tanks, in which case fire-resisting insulation shall be provided.	5.2.6.2 Materials having a melting point below 925°C should not be used for piping outside the cargo tanks except for short lengths of pipes attached to the cargo tanks, in which case fire-resisting insulation should be provided.	Editorial modification
5.12.3	*Cargo piping insulation system*		
5.12.3.1	Cargo piping systems shall be provided with a thermal insulation system as required to minimize heat leak into the cargo during transfer operations and to protect personnel from direct contact with cold surfaces.		New requirement on pipe insulation
5.12.3.2	Where applicable, due to location or environmental conditions, insulation materials shall have suitable properties of resistance to fire and flame spread and shall be adequately protected against penetration of water vapour and mechanical damage.		New requirement on pipe insulation
5.12.4	Where the cargo piping system is of a material susceptible to stress corrosion cracking in the presence of a salt-laden atmosphere, adequate measures to avoid this occurring shall be taken by considering material selection, protection of exposure to salty water and/or readiness for inspection.		New requirement on pipe insulation
5.13	**Testing requirements**		
5.13.1	*Type testing of piping components*	5.3 Type tests on piping components	
5.13.1.1	*Valves* Each type of piping component shall be subject to the following	5.3.1 Each type of piping component should be subject to type tests.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	type tests: Each type of piping component intended to be used at a working temperature below -55oC shall be subject to the following type tests: .1 each size and type of valve shall be subjected to seat tightness testing over the full range of operating pressures for bi-directional flow and temperatures, at intervals, up to the rated design pressure of the valve. Allowable leakage rates shall be to the requirements of the Administration or recognized organization acting on its behalf. During the testing, satisfactory operation of the valve shall be verified; .2 the flow or capacity shall be certified to a recognized standard for each size and type of valve; .3 pressurized components shall be pressure tested to at least 1.5 times the rated pressure; and .4 for emergency shutdown valves, with materials having melting temperatures lower than 925°C, the type testing shall include a fire test to a standard acceptable to the Administration.	5.3.2.1 Each size and type of valve intended to be used at a working temperature below -55°C should be subjected to a tightness test to the minimum design temperature or lower, and to a pressure not lower than the design pressure of the valve. During the test the satisfactory operation of the valve should be ascertained.	
5.13.1.2	*Expansion bellows* The following type tests shall be performed on each type of expansion bellows intended for use on cargo piping outside the cargo tank and where required by the Administration or recognized organization acting on its behalf, on those installed within the cargo tanks: .1 elements of the bellows, not pre-compressed, shall be	5.3.2.2 The following type tests should be performed on each type of expansion bellows intended for use on cargo piping outside the cargo tank and, where required, on those expansion bellows installed within the cargo tanks: .1 A type element of the bellows, not precompressed, should be pressure tested at not less than 5 times the design pressure without bursting. The duration of the test should not be less than 5 min.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	pressure tested at not less than five times the design pressure without bursting. The duration of the test shall not be less than five minutes; .2 a pressure test shall be performed on a type expansion joint, complete with all the accessories such as flanges, stays and articulations, at the minimum design temperature and twice the design pressure at the extreme displacement conditions recommended by the manufacturer without permanent deformation; .3 a cyclic test (thermal movements) shall be performed on a complete expansion joint, which shall withstand at least as many cycles under the conditions of pressure, temperature, axial movement, rotational movement and transverse movement as it will encounter in actual service. Testing at ambient temperature is permitted when this testing is at least as severe as testing at the service temperature; and .4 a cyclic fatigue test (ship deformation) shall be performed on a complete expansion joint, without internal pressure, by simulating the bellows movement corresponding to a compensated pipe length, for at least 2,000,000 cycles at a frequency not higher than 5 Hz. This test is only required when, due to the piping arrangement, ship deformation loads are actually experienced.	.2 A pressure test should be performed on a type expansionjoint complete with all the accessories such as flanges, stays and articulations, at twice the design pressure at the extreme displacement conditions recommended by the manufacturer without permanent deformation. Depending on the materials used, the Administration may require the test to be at the minimum design temperature. .3 A cyclic test (thermal movements) should be performed on a complete expansion joint, which is to successfully withstand at least as many cycles, under the conditions of pressure, temperature, axial movement, rotational movement and transverse movement, as it will encounter in actual service. Testing at ambient temperature is permitted, when this testing is at least as severe as testing at the service temperature. .4 A cyclic fatigue test (ship deformation) should be performed on a complete expansion joint, without internal pressure, by simulating the bellows movement corresponding to a compensated pipe length, for at least 2,000,000 cycles at a frequency not higher than 5 cycles/s. This test is only required when, due to the piping arrangement, ship deformation loads are actually experienced. .5 The Administration may waive performance of the tests referred to in this paragraph provided that complete documentation is supplied to establish the suitability of the expansion joints to withstand the expected working	

	New IGC Code	Old IGC Code	Remarks
		conditions. When the maximum internal pressure exceeds 1.0 bar gauge this documentation is to include sufficient test data to justify the design method used, with particular reference to correlation between calculation and test results.	
5.13.2	*System testing requirements*	5.5 Testing of piping	
5.13.2.1	The requirements of this section shall apply to piping inside and outside the cargo tanks.	5.5.1 The requirements of this Article apply to piping inside and outside the cargo tanks. However, the Administration may accept relaxations from these requirements for piping inside cargo tanks and open-ended piping.	Editorial modification
5.13.2.2	After assembly, all cargo and process piping shall be subjected to a strength test with a suitable fluid. The test pressure shall be at least 1.5 times the design pressure (1.25 times the design pressure where the test fluid is compressible) for liquid lines and 1.5 times the maximum system working pressure (1.25 times the maximum system working pressure where the test fluid is compressible) for vapour lines. When piping systems or parts of systems are completely manufactured and equipped with all fittings, the test may be conducted prior to installation on board the ship. Joints welded on board shall be tested to at least 1.5 times the design pressure.	5.5.2 After assembly, all cargo and process piping should be subjected 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 ship. Joints welded on board should be hydrostatically tested to at least 1.5 times the design pressure. Where water cannot be tolerated and the piping cannot be dried prior to putting the system into service, proposals for alternative testing fluids or testing means should be submitted to the Administration for approval.	Editorial modification
5.13.2.3	After assembly on board, each cargo and process piping system shall be subjected to a leak test using air, or other suitable medium to a pressure depending on the leak detection method applied.	5.5.3 After assembly on board, each cargo and process piping system should be subjected to a leak test using air, halides, or other suitable medium to a pressure depending on the leak detection method applied.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
5.13.2.4	In double wall gas-fuel piping systems the outer pipe or duct shall also be pressure tested to show that it can withstand the expected maximum pressure at gas pipe rupture.		
5.13.2.5	All piping systems, including valves, fittings and associated equipment for handling cargo or vapours, shall be tested under normal operating conditions not later than at the first loading operation, in accordance with recognized standards.	5.5.4 All piping systems including valves, fittings and associated equipment for handling cargo or vapours should be tested under normal operating conditions not later than at the first loading operation.	Editorial modification
5.13.3	*Emergency shutdown valves* The closing characteristics of emergency shutdown valves used in liquid cargo piping systems shall be tested to demonstrate compliance with 18.10.2.1.3. This testing may be carried out on board after installation.		
CHAPTER 7 CARGO PRESSURE/TEMPERATURE CONTROL			
Goal	*To maintain the cargo tank pressure and temperature within design limits of the containment system and/or carriage requirements of the cargo.*		Clarify the goal of requirements mentioned in this chapter.
7.1	**Methods of control**	7.1 General	
7.1.1	With the exception of tanks designed to withstand full gauge vapour pressure of the cargo under conditions of the upper ambient design temperatures, cargo tanks' pressure and temperature shall be maintained at all times within their design range by either one, or a combination of, the following methods: .1 reliquefaction of cargo vapours; .2 thermal oxidation of vapours; .3 pressure accumulation; and .4 liquid cargo cooling.	7.1.1 Unless the entire cargo system is designed to withstand the full gauge vapour pressure of the cargo under conditions of the upper ambient design temperatures, maintenance of the cargo tank pressure below the MARVS should be provided by one or more of the following means, except as otherwise provided in this section: .1 a system which regulates the pressure in the cargo tanks by the use of mechanical refrigeration ; .2 a system whereby the boil-off vapours are utilized as	Methods of control the pressure & temp. in cargo tanks

	New IGC Code	Old IGC Code	Remarks
		fuel for shipboard use or waste heat system subject to the provisions of Chapter 16. This system may be used at all times, including while in port and while manoeuvring, provided that a means of disposing of excess energy is provided, such as a steam dump system, that is satisfactory to the Administration; .3 a system allowing the product to warm up and increase in pressure. The insulation or cargo tank design pressure or both should be adequate to provide for a suitable margin for the operating time and temperatures involved. The system should be acceptable to the Administration in each case ; .4 other systems acceptable to the Administration; .5 in addition to the above means, the Administration may permit certain cargoes to be controlled by venting cargo vapours to the atmosphere at sea. This may also be permitted in port with the permission of the port Administration ;	**Old** 1. mechanical refrigeration 2. utilized as fuel ⇩ **New** 1. reliquefaction of cargo vapours; 2. thermal oxidation of vapours; 3. pressure accumulation; and 4. liquid cargo cooling.
7.1.2	For certain cargoes, where required by chapter 17, the cargo containment system shall be capable of withstanding the full vapour pressure of the cargo under conditions of the upper ambient design temperatures, irrespective of any system provided for dealing with boil-off gas.	7.1.2 The systems required by 7.1.1 should be constructed, fitted and tested to the satisfaction of the Administration. Materials used in their construction should be suitable for use with the cargoes to be carried. For normal service, the upper ambient design temperature should be : sea : 32°C air : 45°C For service in especially hot or cold zones these design temperatures should be increased or reduced, as	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		appropriate, by the Administration.	
7.1.3	Venting of the cargo to maintain cargo tank pressure and temperature is not acceptable except in emergency situations. The Administration may permit certain cargoes to be controlled by venting cargo vapours to the atmosphere at sea. This may also be permitted in port with the permission of the port Administration.	7.1.3 For certain highly dangerous cargoes specified in Chapter 17, the cargo containment system should be capable of withstanding the full vapour pressure of the cargo under condition of the upper ambient design temperature irrespective of any system provided for dealing with boil-off gas.	Editorial modification
7.2	**Design of systems**	7.2 Refrigeration systems	
	For normal service, the upper ambient design temperature shall be: sea : 32°C air : 45°C For service in particularly hot or cold zones, these design temperatures shall be increased or decreased, to the satisfaction of the Administration. The overall capacity of the system shall be such that it can control the pressure within the design conditions without venting to atmosphere.	7.2.1 A refrigeration system should consist of one or more units capable of maintaining the required cargo pressure/temperature under conditions of the upper ambient design temperatures. Unless an alternative means of controlling the cargo pressure/temperature is provided to the satisfaction of the Administration, a stand-by unit (or units) affording spare capacity at least equal to the largest required single unit should be provided. A stand-by unit should consist of a compressor with its driving motor, control system and any necessary fittings to permit operation independently of the normal service units. A stand-by heat exchanger should be provided unless the normal heat exchanger for the unit has an excess capacity of at least 25% of the largest required capacity. Separate piping systems are not required. 7.2.2.1 Where two or more refrigerated cargoes which may react chemically in a dangerous manner are carried simultaneously, special consideration should be given to the refrigeration systems to avoid the possibility of mixing cargoes. For the carriage of such cargoes, separate	

	New IGC Code	Old IGC Code	Remarks
		refrigeration systems, each complete with a stand-by unit as specified in 7.2.1, should be provided for each cargo. However, where cooling is provided by an indirect or combined system and leakage in the heat exchangers cannot cause mixing of the cargoes under any envisaged condition, separate refrigeration units need not be fitted. 7.2.2.2 Where two or more refrigerated cargoes are not mutually soluble under the conditions of carriage, so that their vapour pressures would be additive on mixing, special consideration should be given to the refrigeration systems to avoid the possibility of mixing cargoes. 7.2.3 Where cooling water is required in refrigeration systems, an adequate supply should be provided by a pump or pumps used exclusively for this purpose. This pump or these pumps should have at least two sea suction lines, where practicable leading from sea-chests, one port and one starboard. A spare pump of adequate capacity should be provided, which may be a pump used for other services so long as its use for cooling would not interfere with any other essential service. 7.2.4 The refrigeration system may be arranged in one of the following ways : .1 a direct system where evaporated cargo is compressed, condensed and returned to cargo tanks. For certain cargoes specified in Chapter 17 this system should not be used ; .2 an indirect system where cargo or evaporated cargo is	

	New IGC Code	Old IGC Code	Remarks
		cooled or condensed by refrigerant without being compressed ; .3 a combined system where evaporated cargo is compressed and condensed in a cargo/refrigerant heat exchanger and returned to the cargo tanks. For certain cargoes specified in Chapter 17 this system should not be used. 7.2.5 All primary and secondary refrigerants must be compatible with each other and with the cargo with which they come into contact. The heat exchange may take place either remotely from the cargo tank or by cooling coils fitted inside or outside the cargo tank.	
7.3	**Reliquefaction of cargo vapours**		
7.3.1	General The reliquefaction system may be arranged in one of the following ways: .1 a direct system where evaporated cargo is compressed, condensed and returned to the cargo tanks; .2 an indirect system where cargo or evaporated cargo is cooled or condensed by refrigerant without being compressed; .3 a combined system where evaporated cargo is compressed and condensed in a cargo/refrigerant heat exchanger and returned to the cargo tanks; and .4 if the reliquefaction system produces a waste stream containing methane during pressure control operations within the design conditions, these waste gases, as far as reasonably practicable, are disposed of without venting to atmosphere.		Change of wording **Old** 1. mechanical refrigeration ⇩ **New** 1. reliquefaction of cargo vapours;

	New IGC Code	Old IGC Code	Remarks
	Note: The requirements of chapters 17 and 19 may preclude the use of one or more of these systems or may specify the use of a particular system.		
7.3.2	Compatibility Refrigerants used for reliquefaction shall be compatible with the cargo they may come into contact with. In addition, when several refrigerants are used and may come into contact, they shall be compatible with each other.		Editorial modification
7.4	**Thermal oxidation of vapours**		
7.4.1	General Maintaining the cargo tank pressure and temperature by means of thermal oxidation of cargo vapours, as defined in 1.2.53 and 16.2. This is permitted only for LNG cargoes. .1 Thermal oxidation systems shall exhibit no externally visible flame and shall maintain the uptake exhaust temperature below 535°C. .2 Arrangement of spaces where oxidation systems are located shall comply with 16.3 and supply systems shall comply with 16.4. .3 If waste gases coming from any other system are to be burnt, the oxidation system shall be designed to accommodate all anticipated feed gas compositions.		Change of wording. The meaning of 'thermal oxidation' includes DFDE, boilers. **Old** 2. utilized as fuel ⇩ **New** 2. thermal oxidation of vapours;
7.4.2	Oxidation systems shall comply with the following: .1 each thermal oxidation system shall have a separate uptake; .2 each thermal oxidation system shall have a dedicated forced		Editorial modification

	New IGC Code	Old IGC Code	Remarks
	draught system; and .3 combustion chambers and uptakes of thermal oxidation systems shall be designed to prevent any accumulation of gas.		
7.4.3	Burners Burners shall be designed to maintain stable combustion under all design firing conditions.		Editorial modification
7.4.4	Safety		
7.4.4.1	Suitable devices shall be installed and arranged to ensure that gas flow to the burner is cut off unless satisfactory ignition has been established and maintained.		Editorial modification
7.4.4.2	Each oxidation system shall have provision to manually isolate its gas fuel supply from a safely accessible position.		Editorial modification
7.4.4.3	Provision shall be made for automatic purging the gas supply piping to the burners by means of an inert gas, after the extinguishing of these burners.		Editorial modification
7.4.4.4	In case of flame failure of all operating burners for gas or oil or for a combination thereof, the combustion chambers of the oxidation system shall be automatically purged before relighting.		Editorial modification
7.4.4.5	Arrangements shall be made to enable the combustion chamber to be manually purged.		Editorial modification
7.5	**Pressure accumulation systems** The containment system insulation, design pressure or both shall be adequate to provide for a suitable margin for the operating time and temperatures involved. No additional pressure and temperature control system is required. Conditions for acceptance shall be recorded in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk, as required in 1.4.		New requirements

	New IGC Code	Old IGC Code	Remarks
7.6	**Liquid cargo cooling** The bulk cargo liquid may be refrigerated by coolant circulated through coils fitted either inside the cargo tank or onto the external surface of the cargo tank.		New requirements
7.7	**Segregation** Where two or more cargoes that may react chemically in a dangerous manner are carried simultaneously, separate systems as defined in 1.2.48, each complying with availability criteria as specified in 7.8, shall be provided for each cargo. For simultaneous carriage of two or more cargoes that are not reactive to each other but where, due to properties of their vapour, separate systems are necessary, separation may be by means of isolation valves.		Editorial modification
7.8	**Availability** The availability of the system and its supporting auxiliary services shall be such that: .1 in case of a single failure of a mechanical non-static component or a component of the control systems, the cargo tanks' pressure and temperature can be maintained within their design range without affecting other essential services; .2 redundant piping systems are not required; .3 heat exchangers that are solely necessary for maintaining the pressure and temperature of the cargo tanks within their design ranges shall have a stand-by heat exchanger, unless they have a capacity in excess of 25% of the largest required capacity for		New requirements

	New IGC Code	Old IGC Code	Remarks
	pressure control and they can be repaired on board without external resources. Where an additional and separate method of cargo tank pressure and temperature control is fitted that is not reliant on the sole heat exchanger, then a standby heat exchanger is not required; and .4 for any cargo heating or cooling medium, provisions shall be made to detect the leakage of toxic or flammable vapours into an otherwise non-hazardous area or overboard in accordance with 13.6. Any vent outlet from this leak detection arrangement shall be to a non-hazardous area and be fitted with a flame screen.		
CHAPTER 8 VENT SYSTEMS FOR CARGO CONTAINMENT			
	To protect cargo containment systems from harmful overpressure or underpressure at all times.		Clarify the goal of requirements mentioned in this chapter.
8.1	**General** All cargo tanks shall be provided with a pressure relief system appropriate to the design of the cargo containment system and the cargo being carried. Hold space and interbarrier spaces, which may be subject to pressures beyond their design capabilities, shall also be provided with a suitable pressure relief system. Pressure control systems specified in chapter 7 shall be independent of the pressure relief systems.	8.1 General All cargo tanks should be provided with a pressure relief system appropriate to the design of the cargo containment system and the cargo being carried. Hold spaces, interbarrier spaces and cargo piping which may be subject to pressures beyond their design capabilities should also be provided with a suitable pressure relief system. The pressure relief system should be connected to a vent piping system so designed as to minimize the possibility of cargo vapour accumulating on the decks, or entering accommodation spaces, service spaces, control stations and machinery spaces, or other spaces where it may	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		create a dangerous condition. Pressure control systems specified by Chapter 7 should be independent of the pressure relief valves.	
8.2	**Pressure relief systems**	8.2 Pressure relief systems	
8.2.1	Cargo tanks, including deck tanks, shall be fitted with a minimum of two pressure relief valves (PRVs), each being of equal size within manufacturer's tolerances and suitably designed and constructed for the prescribed service.	8.2.1 Each cargo tank with a volume exceeding 20 m^3 should be fitted with at least two pressure relief valves of approximately equal capacity, suitably designed and constructed for the prescribed service. For cargo tanks with a volume not exceeding 20 m^3, a single relief valve may be fitted.	1. Editorial modification 2. Delete '20 m^3'
8.2.2	Interbarrier spaces shall be provided with pressure relief devices5. For membrane systems, the designer shall demonstrate adequate sizing of interbarrier space PRVs.	8.2.2 Interbarrier spaces should be provided with pressure relief devices complying with recognized standards.	Editorial modification
8.2.3	The setting of the PRVs shall not be higher than the vapour pressure that has been used in the design of the tank. Where two or more PRVs are fitted, valves comprising not more than 50 per cent of the total relieving capacity may be set at a pressure up to 5 per cent above MARVS to allow sequential lifting, minimizing unnecessary release of vapour.	8.2.3 In general, the setting of the pressure relief valves should not be higher than the vapour pressure which has been used in the design of the tank. However, where two or more pressure relief valves are fitted, valves comprising not more than 50% of the total relieving capacity may be set at a pressure up to 5% above MARVS.	Editorial modification
8.2.4	The following temperature requirements apply to PRVs fitted to pressure relief systems: .1 PRVs on cargo tanks with a design temperature below 0°C shall be designed and arranged to prevent their becoming inoperative due to ice formation; .2 the effects of ice formation due to ambient temperatures shall be considered in the construction and arrangement of PRVs; .3 PRVs shall be constructed of materials with a melting point	8.2.4 Pressure relief valves should be connected to the highest part of the cargo tank above deck level. Pressure relief valves on cargo tanks with a design temperature below 0 °C should be arranged to prevent their becoming inoperative due to ice formation when they are closed. Due consideration should be given to the construction and arrangement of pressure relief valves on cargo tanks subject to low ambient temperatures. Valves should be constructed of materials with a melting point above 925	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	above 925°C. Lower melting point materials for internal parts and seals may be accepted, provided that fail-safe operation of the PRV is not compromised; and .4 sensing and exhaust lines on pilot operated relief valves shall be of suitably robust construction to prevent damage.	°C. Consideration of lower melting point materials for internal parts and seals should be given if their use provides significant improvement to the general operation of the valve.	
8.2.5	*Valve testing* PRVs shall be tested in accordance with recognized standards.	8.2.5 Pressure relief valves should be prototype tested to ensure that the valves have the capacity required. Each valve should be tested to ensure that it opens at the prescribed pressure setting with an allowance not exceeding ±10% for 0 to 1.5 bar,±6% for 1.5 to 3.0 bar,±3% for 3.0 bar and above. Pressure relief valves should be set and sealed by a competent authority acceptable to the Administration and a record of this action, including the values of set pressure, should be retained aboard the ship.	Editorial modification
8.2.5.1	PRVs shall be type tested. Type tests shall include: .1 verification of relieving capacity; .2 cryogenic testing when operating at design temperatures colder than -55°C; .3 seat tightness testing; and .4 pressure containing parts are pressure tested to at least 1.5 times the design pressure.		Editorial modification
8.2.5.2	Each PRV shall be tested to ensure that: .1 it opens at the prescribed pressure setting, with an allowance not exceeding ± 10% for 0 to 0.15 MPa, ± 6% for 0.15 to 0.3 MPa, ± 3% for 0.3 MPa and above; .2 seat tightness is acceptable; and		Editorial modification

	New IGC Code	Old IGC Code	Remarks
	.3 pressure containing parts are to withstand at least 1.5 times the design pressure.		
8.2.6	PRVs shall be set and sealed by the Administration or recognized organization acting on its behalf, and a record of this action, including the valves' set pressure, shall be retained on board the ship.		Editorial modification
8.2.7	Cargo tanks may be permitted to have more than one relief valve set pressure in the following cases: .1 installing two or more properly set and sealed PRVs and providing means, as necessary, for isolating the valves not in use from the cargo tank; or .2 installing relief valves whose settings may be changed by the use of a previously approved device not requiring pressure testing to verify the new set pressure. All other valve adjustments shall be sealed.	8.2.6 In the case of cargo tanks permitted to have more than one relief valve setting this may be accomplished by : .1 installing two or more properly set and sealed valves and providing means as necessary for isolating the valves not in use from the cargo tank ; or .2 installing relief valves whose settings may be changed by the insertion of previously approved spacer pieces or alternative springs or by other similar means not requiring pressure testing to verify the new set pressure. All other valve adjustment should be sealed.	Editorial modification
8.2.8	Changing the set pressure under the provisions of 8.2.7 and the corresponding resetting of the alarms referred to in 13.4.2 shall be carried out under the supervision of the master in accordance with approved procedures and as specified in the ship's operating manual. Changes in set pressure shall be recorded in the ship's log and a sign shall be posted in the cargo control room, if provided, and at each relief valve, stating the set pressure.	8.2.7 The changing of the set pressure under the provisions of 8.2.6, and the corresponding resetting of the alarms referred to in 13.4.1, should be carried out under the supervision of the master in accordance with procedures approved by the Administration and specified in the ship's operating manual. Changes in set pressures should be recorded in the ship's log and a sign posted in the cargo control room, if provided, and at each relief valve, stating the set pressure.	
8.2.9	In the event of a failure of a cargo tank PRV, a safe means of	8.2.8 Stop valves or other means of blanking off pipes	1. Editorial modification

	New IGC Code	Old IGC Code	Remarks
	emergency isolation shall be available. .1 Procedures shall be provided and included in the cargo operations manual (see 18.2). .2 The procedures shall allow only one of the cargo tanks installed PRVs to be isolated. .3 Isolation of the PRV shall be carried out under the supervision of the master. This action shall be recorded in the ship's log and a sign posted in the cargo control room, if provided, and at the PRV. .4 The tank shall not be loaded until the full relieving capacity is restored.	between tanks and pressure relief valves to facilitate maintenance should not be fitted unless all the following arrangements are provided : .1 suitable arrangements to prevent more than one pressure relief valve being out of service at the same time . .2 a device which automatically and in a clearly visible way indicates which one of the pressure relief valves is out of service; and .3 pressure relief valve capacities such that if one valve is out of service the remaining valves have the combined relieving capacity required by 8.5. However, this capacity may be provided by the combined capacity of all valves, if a suitably maintained spare valve is carried on board.	2. Add 'a safe means of emergency isolation shall'
8.2.10	Each PRV installed on a cargo tank shall be connected to a venting system, which shall be: .1 so constructed that the discharge will be unimpeded and directed vertically upwards at the exit; .2 arranged to minimize the possibility of water or snow entering the vent system; .3 arranged such that the height of vent exits shall not be less than *B/3* or 6 m, whichever is the greater, above the weather deck; and .4 6 m above working areas and walkways.	8.2.9 Each pressure relief valve installed on a cargo tank should be connected to a venting system which should be so constructed that the discharge of gas will be unimpeded and directed vertically upwards at the exit and so arranged as to minimize the possibility of water or snow entering the vent system. The height of vent exits should not be less than B/3 or 6 m, whichever is the greater, above the weather deck and 6 m above the working area, the fore and aft gangway, deck storage tanks and cargo liquid lines.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
8.2.11	Cargo PRV vent exits shall be arranged at a distance at least equal to B or 25 m, whichever is less, from the nearest air intake, outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous areas. For ships less than 90 m in length, smaller distances may be permitted. All other vent outlets connected to the cargo containment system shall be arranged at a distance of at least 10 m from the nearest air intake, outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous areas.	8.2.10 Cargo tank pressure relief valve vent exits should be arranged at a distance at least equal to B or 25 m, whichever is less, from the nearest air intake or opening to accommodation spaces, service spaces and control stations, or other gas safe spaces. For ships less than 90 m in length, smaller distances may be permitted by the Administration. All other vent exits connected to the cargo containment system should be arranged at a distance of at least 10 m from the nearest air intake or opening to accommodation spaces, service spaces and control stations, or other gas-safe spaces.	Editorial modification
8.2.12	All other cargo vent outlets not dealt with in other chapters shall be arranged in accordance with 8.2.10 and 8.2.11. Means shall be provided to prevent liquid overflow from vent mast outlets, due to hydrostatic pressure from spaces to which they are connected.	8.2.11 All other cargo vent exits not dealt with in other sections should be arranged in accordance with Pars 8.2.9 and 8.2.10.	Editorial modification
8.2.13	If cargoes that react in a dangerous manner with each other are carried simultaneously, a separate pressure relief system shall be fitted for each one.	8.2.12 If cargoes which react in a hazardous manner with each other are carried simultaneously, a separate pressure relief system should be fitted for each cargo carried.	Editorial modification
8.2.14	In the vent piping system, means for draining liquid from places where it may accumulate shall be provided. The PRVs and piping shall be arranged so that liquid can, under no circumstances, accumulate in or near the PRVs.	8.2.13 In the vent piping system, means for draining liquid from places where it may accumulate should be provided. The pressure relief valves and piping should be so arranged that liquid can under no circumstances accumulate in or near the pressure relief valves.	Editorial modification
8.2.15	Suitable protection screens of not more than 13 mm square	8.2.14 Suitable protection screens should be fitted on vent	1. Editorial modification

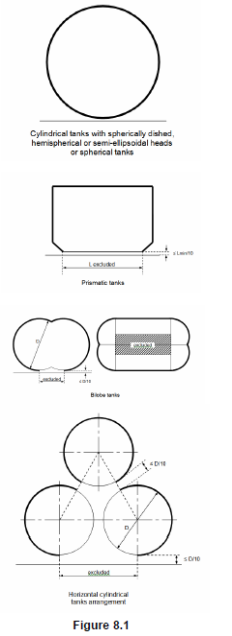
	New IGC Code	Old IGC Code	Remarks
	mesh shall be fitted on vent outlets to prevent the ingress of foreign objects without adversely affecting the flow. Other requirements for protection screens apply when carrying specific cargoes (see 17.9 and 17.21).	outlets to prevent the ingress of foreign objects.	2. Clarify the mesh size
8.2.16	All vent piping shall be designed and arranged not to be damaged by the temperature variations to which it may be exposed, forces due to flow or the ship's motions.	8.2.15 All vent piping should be so designed and arranged that it will not be damaged by temperature variations to which it may be exposed, or by the ship's motions.	Editorial modification
8.2.17	PRVs shall be connected to the highest part of the cargo tank above deck level. PRVs shall be positioned on the cargo tank so that they will remain in the vapour phase at the filling limit (*FL*) as defined in chapter 15, under conditions of 15° list and 0.015*L* trim, where L is defined in 1.2.31.	8.2.17 Pressure relief valves should be positioned on the cargo tank so that they will remain in the vapour phase under conditions of 15 °list and 0.015 L trim, where L is as defined in 1.3.22. at the maximum allowable filling limit (FL).	Editorial modification
8.2.18	The adequacy of the vent system fitted on tanks loaded in accordance with 15.5.2 shall be demonstrated using Assembly resolution A.829(19) on Guidelines for the evaluation of the adequacy of type C tank vent systems. A relevant certificate shall be permanently kept on board the ship. For the purposes of this paragraph, vent system means: .1 the tank outlet and the piping to the PRV; .2 the PRV; .3 the piping from the PRVs to the location of discharge to the atmosphere, including any interconnections and piping that joins other tanks.	8.2.18 The adequacy of the vent system fitted on tanks loaded in accordance with 15.1.5 is to be demonstrated using the guidelines developed by the Organization*. A relevant certificate should be permanently kept on board the ship. For the purposes of this paragraph, vent system means : * Refer to the guidelines to be developed by the Organization. .1 the tank outlet and the piping to the pressure relief valves ; .2 the pressure relief valve ; .3 the piping from the pressure relief valve to the location of discharge to the atmosphere and including any interconnections and piping which joins other tanks. This paragraph may apply to all ships regardless of the date of	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		construction.	
8.3	**Vacuum protection systems**	8.4 Vacuum protection systems	
8.3.1	Cargo tanks not designed to withstand a maximum external pressure differential 0.025 MPa, or tanks that cannot withstand the maximum external pressure differential that can be attained at maximum discharge rates with no vapour return into the cargo tanks, or by operation of a cargo refrigeration system, or by thermal oxidation, shall be fitted with: .1 two independent pressure switches to sequentially alarm and subsequently stop all suction of cargo liquid or vapour from the cargo tank and refrigeration equipment, if fitted, by suitable means at a pressure sufficiently below the maximum external designed pressure differential of the cargo tank; or .2 vacuum relief valves with a gas flow capacity at least equal to the maximum cargo discharge rate per cargo tank, set to open at a pressure sufficiently below the external design differential pressure of the cargo tank.	8.4.1 Cargo tanks designed to withstand a maximum external pressure differential exceeding 0.25 bar and capable of withstanding the maximum external pressure differential which can be attained at maximum discharge rates with no vapour return into the cargo tanks, or by operation of a cargo refrigeration system, need no vacuum relief protection. 8.4.2 Cargo tanks designed to withstand a maximum external pressure differential not exceeding 0.25 bar, or tanks which cannot withstand the maximum external pressure differential that can be attained at maximum discharge rates with no vapour return into the cargo tanks, or by operation of a cargo refrigeration system, or by sending boiloff vapour to the machinery spaces, should be fitted with : .1 two independent pressure switches to sequentially alarm and subsequently stop all suction of cargo liquid or vapour from the cargo tank, and refrigeration equipment if fitted, by suitable means at a pressure sufficiently below the maximum external designed pressure differential of the cargo tank ; or .2 vacuum relief valves with a gas flow capacity at	Editorial modification

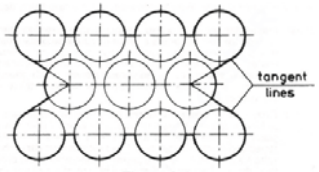
	New IGC Code	Old IGC Code	Remarks
		least equal to the maximum cargo discharge rate per cargo tank, set to open at a pressure sufficiently below the external design differential pressure of the cargo tank ; or .3 other vacuum relief systems acceptable to the Administration.	
8.3.2	Subject to the requirements of chapter 17, the vacuum relief valves shall admit an inert gas, cargo vapour or air to the cargo tank and shall be arranged to minimize the possibility of the entrance of water or snow. If cargo vapour is admitted it shall be from a source other than the cargo vapour lines.	8.4.3 Subject to the requirements of Chapter 17, the vacuum relief valves should admit an inert gas, cargo vapour or air to the cargo tank and should be arranged to minimize the possibility of the entrance of water or snow. If cargo vapour is admitted, it should be from a source other than the cargo vapour lines.	Editorial modification
8.3.3	The vacuum protection system shall be capable of being tested to ensure that it operates at the prescribed pressure.	8.4.4 The vacuum protection system should be capable of being tested to ensure that it operates at the prescribed pressure.	Editorial modification
8.4	**Sizing of pressure relieving system**		
8.4.1	*Sizing of pressure relief valves* PRVs shall have a combined relieving capacity for each cargo tank to discharge the greater of the following, with not more than a 20 per cent rise in cargo tank pressure above the MARVS:	8.5 Size of valves Pressure relief valves should have a combined relieving capacity for each cargo tank to discharge the greater of the following with not more than a 20% rise in cargo tank pressure above the MARVS :	Editorial modification
8.4.1.1	the maximum capacity of the cargo tank inerting system if the maximum attainable working pressure of the cargo tank inerting system exceeds the MARVS of the cargo tanks; or	.1 the maximum capacity of the cargo tank inerting system if the maximum attainable working pressure of the cargo tank inerting system exceeds the MARVS of the cargo tanks ; or	Editorial modification
8.4.1.2	Vapours generated under fire exposure computed using the following formula: $Q = FGA^{0.82}$ (m3/s),	.2 vapours generated under fire exposure computed	1. Editorial modification 2. Add new methods to calculate the external surface area.

	New IGC Code	Old IGC Code	Remarks
	where: Q = minimum required rate of discharge of air at standard conditions of 273.15 Kelvin (K) and 0.1013 MPa; F = fire exposure factor for different cargo types: F = 1.0 for tanks without insulation located on deck; F = 0.5 for tanks above the deck when insulation is approved by the Administration. (Approval will be based on the use of a fireproofing material, the thermal conductance of insulation, and its stability under fire exposure); F = 0.5 for uninsulated independent tanks installed in holds; F = 0.2 for insulated independent tanks in holds (or uninsulated independent tanks in insulated holds); F = 0.1 for insulated independent tanks in inerted holds (or uninsulated independent tanks in inerted, insulated holds); F = 0.1 for membrane and semi-membrane tanks. For independent tanks partly protruding through the weather decks, the fire exposure factor shall be determined on the basis of the surface areas above and below deck. G = gas factor: $G = \frac{12.4}{LD}\sqrt{\frac{ZT}{M}}$ with: T = temperature in degrees Kelvin at relieving conditions, i.e. 120% of the pressure at which the pressure relief valve is set;	using the following formula : $Q=FGA^{0.82}$ (m3/s) where : Q = minimum required rate of discharge of air at standard conditions of 273 K and 1.013 bar. F = fire exposure factor for different cargo tank types : F = 1.0 for tanks without insulation located on deck ; F = 0.5 for tanks above the deck when insulation is approved by the Administration (Approval will be based on the use of an approved fireproofing material, the thermal conductance of insulation, and its stability under fire exposure) ; F = 0.5 for uninsulated independent tanks installed in holds ; F = 0.2 for insulated independent tanks in holds (or uninsulated independent tanks in insulated holds) ; F = 0.1 for insulated independent tanks in inerted holds (or uninsulated independent tanks in inerted, insulated holds) ; F = 0.1 for membrane and semimembrane tanks. For independent tanks partly protruding through the open deck, the fire exposure factor should be determined on the basis of the surface areas above and below deck. G = gas factor	

	New IGC Code	Old IGC Code	Remarks
	L = latent heat of the material being vaporized at relieving conditions, in kJ/kg; *D* = a constant based on relation of specific heats *k* and is calculated as follows: *D* = $\sqrt{k\left(\frac{2}{k+1}\right)^{\frac{k+1}{k-1}}}$ *k* = ratio of specific heats at relieving conditions, and the value of which is between 1.0 and 2.2. If *k* is not known, *D* = 0.606 shall be used; *Z* = compressibility factor of the gas at relieving conditions; if not known, *Z* = 1.0 shall be used; and *M* = molecular mass of the product. The gas factor of each cargo to be carried shall be determined and the highest value shall be used for PRV sizing. *A = external surface area of the tank (m2), as defined in 1.2.14, for different tank types,* as shown in Figure 8.1:	$G=\frac{12.4}{LD}\sqrt{\frac{Z\cdot T}{M}}$ with : T = temperature in kelvins (K) at relieving conditions, i.e. 120% of the pressure at which the pressure relief valve is set. L = latent heat of the material being vaporized at relieving conditions, in kJ/kg. D = constant based on relation of specific heats k, shown in Table 8.2; if k is not known, D = 0.606 should be used. The constant D may also be calculated by the following formula : $D=\sqrt{k\left(\frac{2}{k+1}\right)^{\frac{k+1}{k-1}}}$ Z = compressibility factor of the gas at relieving conditions ; if not known, Z = 1.0 should be used. M = molecular mass of the product A = external surface area of the tank (m²) for different tank types : for body-of-revolution type tanks : A = external surface area ; for other than body-of-revolution type tanks : A = external surface area less the projected bottom surface area ; for tanks consisting of an array of pressure vessel tanks : insulation on the ship's structure	

	New IGC Code	Old IGC Code	Remarks
	 **Figure 8.1**	: A = external surface area of the hold less its projected bottom area ; insulation on the tank structure : A = external surface area of the array of pressure vessels excluding insulation, less the projected bottom area as shown in figure 8.1. Table 8.2 CONSTANT D	

	New IGC Code	Old IGC Code	Remarks
		k c k c 1.00 0.606 1.52 0.704 1.02 0.611 1.54 0.707 1.04 0.615 1.56 0.710 1.06 0.620 1.58 0.713 1.08 0.624 1.60 0.716 1.10 0.628 1.62 0.719 1.12 0.633 1.64 0.722 1.14 0.637 1.66 0.725 1.16 0.641 1.68 0.728 1.18 0.615 1.70 0.731 1.20 0.649 1.72 0.734 1.22 0.652 1.74 0.736 1.24 0.626 1.76 0.739 1.26 0.660 1.78 0.742 1.28 0.664 1.80 0.745 1.30 0.667 1.82 0.747	

	New IGC Code	Old IGC Code	Remarks
		1.32 0.671 1.84 0.750 1.34 0.674 1.86 0.752 1.36 0.677 1.88 0.755 1.38 0.681 1.90 0.758 1.40 0.685 1.92 0.760 1.42 0.688 1.94 0.763 1.44 0.691 1.96 0.732 1.46 0.695 1.98 0.767 1.48 0.698 2.00 0.770 1.50 0.701 2.02 0.772 2.20 0.792  Figure 8.1	
8.4.1.3	The required mass flow of air at relieving conditions is given by: M_{air} = Q * ρ_{air} (kg/s), where: density of air (ρair) = 1.293 kg/m3 (air at 273.15 K, 0.1013 MPa).		1. New requirements 2. Add 'required mass flow'.
8.4.2	Sizing of vent pipe system		
8.4.2.1	Pressure losses upstream and downstream of the PRVs, shall be		Editorial modification

	New IGC Code	Old IGC Code	Remarks
	taken into account when determining their size to ensure the flow capacity required by 8.4.1.		
8.4.3	*Upstream pressure losses*	8.2.16 The back pressure in the vent lines from the pressure relief valves should be taken into account in determining the flow capacity required by 8.5. The pressure drop in the vent line from the tank to the pressure relief valve inlet should not exceed 3% of the valve set pressure. For unbalanced pressure relief valves the back pressure in the discharge line should not exceed 10% of the gauge pressure at the relief valve inlet with the vent lines under fire exposure as referred to in 8.5.2.	1. Editorial modification 2. Develop the specified requirement highlighted in aqua.
8.4.3.1	The pressure drop in the vent line from the tank to the PRV inlet shall not exceed 3 per cent of the valve set pressure at the calculated flow rate, in accordance with 8.4.1.		
8.4.3.2	Pilot-operated PRVs shall be unaffected by inlet pipe pressure losses when the pilot senses directly from the tank dome.		
8.4.3.3	Pressure losses in remotely sensed pilot lines shall be considered for flowing type pilots.		
8.4.4	*Downstream pressure losses*		
8.4.4.1	Where common vent headers and vent masts are fitted, calculations shall include flow from all attached PRVs.		
8.4.4.2	The built-up back pressure in the vent piping from the PRV outlet to the location of discharge to the atmosphere, and including any vent pipe interconnections that join other tanks, shall not exceed the following values: for unbalanced PRVs: 10% of MARVS; for balanced PRVs: 30% of MARVS; for pilot operated PRVs: 50% of MARVS. Alternative values provided by the PRV manufacturer may be accepted.		
8.4.5	To ensure stable PRV operation, the blow-down shall not be less than the sum of the inlet pressure loss and 0.02 × MARVS at the rated capacity.		1. New requirements 2. Add 'blow down amount'
		8.3 Additional pressure relieving system for liquid level control	Become one with 8.4.1.2.

	New IGC Code	Old IGC Code	Remarks
		8.3.1 Where required by 15.1.4.2, an additional pressure relieving system to prevent the tank from becoming liquid full at any time during relief under the fire exposure conditions referred to in 8.5 should be fitted to each tank. This pressure relieving system should consist of : .1 one or more relief valves set at a pressure corresponding to the gauge vapour pressure of the cargo at the reference temperature defined in 15.1.4.2; and .2 an override arrangement, whenever necessary, to prevent its normal operation. This arrangement should include fusible elements designed to melt at temperatures between 98°C and 104°C and to cause relief valves specified in 8.3.1.1 to become operable. The fusible elements should be located, in particular, in the vicinity of relief valves. The system should become operable upon loss of system power if provided. The override arrangement should not be dependent on any source of ship's power.	
		8.3.2 The total relieving capacity of the additional pressure relieving system at the pressure relieving system at the pressure mentioned in 8.3.1.1 should not be less than : Q' = FG'A0.82 (m3/s) where :	Become one with 8.4.1.2.

<table>
<tr><th></th><th>New IGC Code</th><th>Old IGC Code</th><th>Remarks</th></tr>
<tr><td></td><td></td><td>Q' =minimum required rate of discharge of air at standard conditions of 273 K and 1.013 bar.
with :
=relative density of liquid phase of product at relieving conditions (>
= 1.0 for fresh water) ;
m=di/
= gradient of decrease of liquid phase enthalpy against increase of liquid phase density (kJ/kg) at relieving conditions. For set pressures not higher than 2.0 bar the value in Table 8.1 may be used. For products not listed in the table and for higher set pressures, the value of m should be calculated on the basis of the thermodynamic data of the product itself ;
i=enthalpy of liquid (kJ/kg) ;
T' =temperature in kelvins (K) at relieving conditions, i.e. at the pressure at which the additional pressure relieving system is set ; F, A, L, D, Z and M are defined in 8.5.2.</td><td></td></tr>
<tr><td></td><td></td><td>8.3.3 Compliance with 8.3.1.1 requires changing of the setting of the relief valves provided for in this Article. This should be accomplished in accordance with the provisions of 8.2.6 and 8.2.7.</td><td>Become one with 8.4.1.2.</td></tr>
<tr><td></td><td></td><td>8.3.4 Relief valves mentioned under 8.3.1.1 above may be the same as the pressure relief valves mentioned in 8.2, provided the setting pressure and the relieving capacity are in compliance with the requirements of this section.</td><td>Become one with 8.4.1.2.</td></tr>
<tr><td></td><td></td><td>8.3.5 The exhaust of such pressure relief valves may</td><td>Become one with</td></tr>
</table>

<table>
<tr><th></th><th>New IGC Code</th><th>Old IGC Code</th><th>Remarks</th></tr>
<tr><td></td><td></td><td>be led to the venting system referred to in 8.2.9. If separate venting arrangements are fitted these should be in accordance with the requirements of 8.2.9 to 8.2.15.
Table 8.1 FACTOR m
<table><tr><th>Product</th><th>m=-di/ (KJ/kg)</th></tr><tr><td>Amoonia, anhydrous</td><td>3400</td></tr><tr><td>Butadiene</td><td>1800</td></tr><tr><td>Butane</td><td>2000</td></tr><tr><td>Butylenes</td><td>1900</td></tr><tr><td>Ethane</td><td>2100</td></tr><tr><td>Ethylene</td><td>1500</td></tr><tr><td>Methane</td><td>2300</td></tr><tr><td>Methyl chloride</td><td>816</td></tr><tr><td>Nitrogen</td><td>400</td></tr><tr><td>Propane</td><td>2000</td></tr><tr><td>Propylene</td><td>1600</td></tr><tr><td>Propylene oxide</td><td>1550</td></tr><tr><td>Vinyl choride</td><td>900</td></tr></table>The value in this table may be used for set pressures not higher than 2.0 bar.</td><td>8.4.1.2.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">CHAPTER 9 CARGO CONTAINMENT SYSTEM ATMOSPHERE CONTROL</td></tr>
<tr><td>Goal</td><td>To enable monitoring of the integrity of the containment system and to ensure that the atmosphere within the system and hold spaces is maintained in a safe condition at all times that the vessel is in service.</td><td></td><td>Clarify the goal of requirements mentioned in this chapter.</td></tr>
<tr><td>9.1</td><td>Atmosphere control within the cargo containment system</td><td>9.1 Environmental control within cargo tanks and cargo piping systems</td><td></td></tr>
</table>

	New IGC Code	Old IGC Code	Remarks
9.1.1	A piping system shall be arranged to enable each cargo tank to be safely gas-freed, and to be safely filled with cargo vapour from a gas-free condition. The system shall be arranged to minimize the possibility of pockets of gas or air remaining after changing the atmosphere.	9.1.1 A piping system should be provided to enable each cargo tank to be safely gas-freed, and to be safely purged with cargo gas from a gas-free condition. The system should be arranged to minimize the possibility of pockets of gas or air remaining after gas-freeing or purging.	Editorial modification
9.1.2	For flammable cargoes, the system shall be designed to eliminate the possibility of a flammable mixture existing in the cargo tank during any part of the atmosphere change operation by utilizing an inerting medium as an intermediate step.	9.1.3 For flammable gases, the system should be arranged to minimize the possibility of a flammable mixture existing in the cargo tank during any part of the gas-freeing operation by utilizing an inerting medium as an intermediate step. In addition, the system should enable the cargo tank to be purged with an inerting medium prior to filling with cargo vapour or liquid, without permitting a flammable mixture to exist at any time within the cargo tank.	Editorial modification
9.1.3	Piping systems that may contain flammable cargoes shall comply with 9.1.1 and 9.1.2.	9.1.4 Piping systems which may contain cargo should be capable of being gas-freed and purged as provided in 9.1.1 and 9.1.3.	Editorial modification
9.1.4	A sufficient number of gas sampling points shall be provided for each cargo tank and cargo piping system to adequately monitor the progress of atmosphere change. Gas sampling connections shall be fitted with a single valve above the main deck, sealed with a suitable cap or blank. See also 5.6.5.5	9.1.2 A sufficient number of gas sampling points should be provided for each cargo tank in order to adequately monitor the progress of purging and gas-freeing. Gas sampling connections should be valved and capped above the main deck.	Editorial modification
9.1.5	Inert gas utilized in these procedures may be provided from the shore or from the ship.	9.1.5 Inert gas utilized in these procedures may be provided from the shore or from the ship.	Editorial modification
9.2	**Atmosphere control within the hold spaces (cargo containment systems other than type C independent tanks)**	9.2 Environmental control within the hold spaces (cargo containment systems other than type C independent tanks)	
9.2.1	Interbarrier and hold spaces associated with cargo containment systems for flammable gases requiring full or partial secondary	9.2.1 Interbarrier and hold spaces associated with cargo containment systems for flammable gases requiring full	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	barriers shall be inerted with a suitable dry inert gas and kept inerted with make-up gas provided by a shipboard inert gas generation system, or by shipboard storage, which shall be sufficient for normal consumption for at least 30 days.	secondary barriers should be inerted with a suitable dry inert gas and kept inerted with make-up gas provided by a shipboard inert gas generation system, or by shipboard storage which should be sufficient for normal consumption for at least 30 days.	
9.2.2	Alternatively, subject to the restrictions specified in chapter 17, the spaces referred to in 9.2.1 requiring only a partial secondary barrier may be filled with dry air provided that the ship maintains a stored charge of inert gas or is fitted with an inert gas generation system sufficient to inert the largest of these spaces, and provided that the configuration of the spaces and the relevant vapour detection systems, together with the capability of the inerting arrangements, ensures that any leakage from the cargo tanks will be rapidly detected and inerting effected before a dangerous condition can develop. Equipment for the provision of sufficient dry air of suitable quality to satisfy the expected demand shall be provided.	9.2.2.1 Inter-barrier and hold spaces associated with cargo containment systems for flammable gases requiring partial secondary barriers should be inerted with suitable dry inert gas and kept inerted with makeup gas provided by a shipboard inert gas generation system or by shipboard storage which should be sufficient for normal consumption for at least 30 days; alternatively 9.2.2.2 Subject to the restrictions specified in Chapter 17, the Administration may allow the spaces referred to in 9.2.2.1 to be filled with dry air provided that the ship maintains a stored charge of inert gas or is fitted with an inert gas generation system sufficient to inert the largest of these spaces; and provided that the configuration of the spaces and the relevant vapour detection systems, together with the capability of the inerting arrangements, ensure that any leakage from the cargo tanks will be rapidly detected and inerting effected before a dangerous condition can develop. Equipment for the provision of sufficient dry air of suitable quality to satisfy the expected demand should be provided.	Editorial modification
9.2.3	For non-flammable gases, the spaces referred to in 9.2.1 and 9.2.2 may be maintained with a suitable dry air or inert	9.2.3 For non-flammable gases, the spaces referred to in 9.2.1 and 9.2.2 may be maintained with a suitable dry air	

	New IGC Code	Old IGC Code	Remarks
	atmosphere.	or inert atmosphere. 9.2.4 In case of internal insulation tanks, environmental control arrangements are not required for inter-barrier spaces and spaces between the secondary barrier and the inner hull or independent tank structures completely filled with insulation materials complying with 4.9.7.2.	
9.3	Environmental control of spaces surrounding type C independent tanks Spaces surrounding cargo tanks that do not have secondary barriers shall be filled with suitable dry inert gas or dry air and be maintained in this condition with make-up inert gas provided by a shipboard inert gas generation system, shipboard storage of inert gas, or with dry air provided by suitable air drying equipment. If the cargo is carried at ambient temperature, the requirement for dry air or inert gas is not applicable.	9.3 Environmental control of spaces surrounding type C independent tanks Spaces surrounding refrigerated cargo tanks not having secondary barriers should be filled with suitable dry inert gas or dry air and be maintained in this condition with make-up inert gas provided by a ship-board inert gas generation system, shipboard storage of inert gas, or dry air provided by suitable air drying equipment.	Editorial modification
9.4	**Inerting**	9.4 Inerting	
9.4.1	Inerting refers to the process of providing a non-combustible environment. Inert gases shall be compatible chemically and operationally at all temperatures likely to occur within the spaces and the cargo. The dew points of the gases shall be taken into consideration.	9.4.1 Inerting refers to the process of providing a noncombustible environment by the addition of compatible gases, which may be carried in storage vessels or produced on board the ship or supplied from the shore. The inert gases should be compatible chemically and operationally, at all temperatures likely to occur within the spaces to be inerted, with the materials of construction of the spaces and the cargo. The dew points of the gases should be taken into consideration.	Editorial modification
9.4.2	Where inert gas is also stored for fire-fighting purposes, it shall be carried in separate containers and shall not be used for cargo	9.4.2 Where inert gas is also stored for fire-fighting purposes, itshould be carried in separate containers and	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	services.	should not be used for cargo services.	
9.4.3	Where inert gas is stored at temperatures below 0°C, either as a liquid or as a vapour, the storage and supply system shall be designed so that the temperature of the ship's structure is not reduced below the limiting values imposed on it.	9.4.3 Where inert gas is stored at temperature below 0°C, either as a liquid or as a vapour, the storage and supply system should be so designed that the temperature of the ship's structure is not reduced below the limiting values imposed on it.	Editorial modification
9.4.4	Arrangements to prevent the backflow of cargo vapour into the inert gas system that are suitable for the cargo carried, shall be provided. If such plants are located in machinery spaces or other spaces outside the cargo area, two non-return valves or equivalent devices and, in addition, a removable spool piece shall be fitted in the inert gas main in the cargo area. When not in use, the inert gas system shall be made separate from the cargo system in the cargo area except for connections to the hold spaces or interbarrier spaces.	9.4.4 Arrangements suitable for the cargo carried should be provided to prevent the backflow of cargo vapour into the inert gas system.	Editorial modification
9.4.5	The arrangements shall be such that each space being inerted can be isolated and the necessary controls and relief valves, etc., shall be provided for controlling pressure in these spaces.	9.4.5 The arrangements should be such that each space being inerted can be isolated and the necessary controls and relief valves etc. should be provided for controlling pressure in these spaces.	Editorial modification
9.4.6	Where insulation spaces are continually supplied with an inert gas as part of a leak detection system, means shall be provided to monitor the quantity of gas being supplied to individual spaces.		1. New requirements 2. Add monitor the quantity of inert gas incase the gas is used as part of a leak detection sys.
9.5	**Inert gas production on board**	9.5 Inert gas production on board	
9.5.1	The equipment shall be capable of producing inert gas with an oxygen content at no time greater than 5 per cent by volume, subject to the special requirements of chapter 17. A continuous-reading oxygen content meter shall be fitted to the inert gas supply from the equipment and shall be fitted with an	9.5.1 The equipment should be capable of producing inert gas with an oxygen content at no time greater than 5% by volume subject to the special requirements of Chapter 17. A continuous-reading oxygen content meter should be fitted	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	alarm set at a maximum of 5 per cent oxygen content by volume, subject to the requirements of chapter 17.	to the inert gas supply from the equipment and should be fitted with an alarm set at a maximum of 5% oxygen content by volume subject to the requirements of Chapter 17. Additionally, where inert gas is made by an on-board process of fractional distillation of air which involves the storage of the cryogenic liquefied nitrogen for subsequent release, the liquefied gas entering the storage vessel should be monitored for traces of oxygen to avoid possible initial high oxygen enrichment of the gas when released for inerting purposes.	
9.5.2	An inert gas system shall have pressure controls and monitoring arrangements appropriate to the cargo containment system.	9.5.2 An inert gas system should have pressure controls and monitoring arrangements appropriate to the cargo containment system. A means acceptable to the administration, located in the cargo area, of preventing the back flow of cargo gas should be provided.	Editorial modification
9.5.3	Spaces containing inert gas generation plants shall have no direct access to accommodation spaces, service spaces or control stations, but may be located in machinery spaces. Inert gas piping shall not pass through accommodation spaces, service spaces or control stations.	9.5.3 Spaces containing inert gas generating plants should have no direct access to accommodation spaces, service spaces or control stations, but may be located in machinery spaces. If such plants are located in machinery spaces or other spaces outside the cargo area, two non-return valves, or equivalent devices should be fitted in the inert gas main in the cargo area as required in 9.5.2. Inert gas piping should not pass through accommodation spaces, service spaces or control stations. When not in use, the inert gas system should be made separate from the cargo system in the cargo area except for connections to the hold spaces or interbarrier spaces.	Editorial modification
9.5.4	Combustion equipment for generating inert gas shall not be located within the cargo area. Special consideration may be given	9.5.4 Flame burning equipment for generating inert gas	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	to the location of inert gas generating equipment using a catalytic combustion process.	should not be located within the cargo area. Special consideration may be given to the location of inert gas generating equipment using the catalytic combustion process.	
CHAPTER 10 ELECTRICAL INSTALLATIONS			
Goal	*To ensure electrical installations are designed such as to minimize the risk of fire and explosion from flammable products. Ensure availability of electrical generation and distribution systems relating to the safe carriage, handling and conditioning of cargo liquid and vapour.*		
10.1	**General requirements**		
10.1.1	Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products.	10.1 General 10.1.1 The provisions of this chapter are applicable to ships carrying flammable products and should be applied in conjunction with part D of chapter II-1of the 1983 SOLAS amendments.	
10.1.2	Electrical installation shall be in accordance with recognized standards.	10.1.2 Electrical installations should be such as to minimize the risk of fire and explosion from flammable products*. Electrical installations complying with this Section need not be considered as a source of ignition for the purposes of Chapter 3. * Refer to the relevant standards of the International Electrotechnical Commission, in particular publication 60092-502.	
10.1.3	Electrical equipment or wiring shall not be installed in hazardous areas unless essential for operational purposes or safety enhancement.	10.1.3 Administration should take appropriate steps to ensure uniformity in the implementation and application of the provisions of this Chapter in respect of electrical installations.	
10.1.4	Where electrical equipment is installed in hazardous areas as	10.1.4 Electrical equipment or wiring should not be	

	New IGC Code	Old IGC Code	Remarks
	provided in 10.1.3 it shall be selected, installed and maintained in accordance with standards not inferior to those acceptable to the Organization... Equipment for hazardous areas shall be evaluated and certified or listed by an accredited testing authority or notified body recognized by the Administration. Automatic isolation of non-certified equipment on detection of a flammable gas shall not be accepted as an alternative to the use of certified equipment.	installed in gas-dangerous spaces or zones unless essential for operational purposes. Electrical equipment, cables and wiring should not be installed in hazardous locations unless it conforms with the standards not inferior to those acceptable to the Organization*. However, for locations not covered by such standards, electrical equipment, cables and wiring which do not conform to the standards may be installed in hazardous locations based on a risk assessment to the satisfaction of the Administration, to ensure that an equivalent level of safety is assured. * Refer to the standards published by the International Electrotechnical Commission, IEC 60092-502:1999 'Electrical installations in ships - Tankers'.	
10.1.5	To facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones in accordance with recognized standards...	10.1.5 Where electrical equipment is installed in gas-dangerous spaces or zones as provided in 10.1.4, it should be to the satisfaction of the Administration and approved by the relevant authorities recognized by the Administration for operation in the flammable atmosphere concerned.	
10.1.6	Electrical generation and distribution systems, and associated control systems, shall be designed such that a single fault will not result in the loss of ability to maintain cargo tank pressures, as required by 7.8.1, and hull structure temperature, as required by 4.19.1.6, within normal operating limits. Failure modes and effects shall be analysed and documented to a standard not inferior to those acceptable to the Administration8.		
10.1.7	The lighting system in hazardous areas 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		

	New IGC Code	Old IGC Code	Remarks
	non-hazardous area.		
10.1.8	Electrical depth sounding or log devices and impressed current cathodic protection system anodes or electrodes shall be housed in gastight enclosures.		
10.1.9	Submerged cargo pump motors and their supply cables may be fitted in cargo containment systems. Arrangements shall be made to automatically shut down the motors in the event of low-liquid level. This may be accomplished by sensing low pump discharge pressure, low motor current, or low liquid level. This shutdown shall be alarmed at the cargo control station. Cargo pump motors shall be capable of being isolated from their electrical supply during gas-freeing operations.		
10.2	**Definitions** [For the purpose of this chapter, unless expressly provided otherwise, the definitions below shall apply.]		
10.2.1	*Hazardous area* is an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus9.		
10.2.1.1	*Zone 0 hazardous area* is an area in which an explosive gas atmosphere is present continuously or is present for long periods.		
10.2.1.2	*Zone 1 hazardous area* is an area in which an explosive gas atmosphere is likely to occur in normal operation.		
10.2.1.3	*Zone 2 hazardous area* is an area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so infrequently and for a short period only.		
10.2.2	*Non-hazardous area* is an area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.		
CHAPTER 11 FIRE PROTECTION AND EXTINCTION			

	New IGC Code	Old IGC Code	Remarks
Goal	To ensure that suitable systems are provided to protect the ship and crew from fire in the cargo area.		Clarify the goal of requirements mentioned in this chapter.
11.1	Fire safety requirements		
11.1.1	The requirements for tankers in SOLAS chapter II-2 shall apply to ships covered by the Code, irrespective of tonnage including ships of less than 500 gross tonnage, except that: .1 regulations 4.5.1.6 and 4.5.10 do not apply; .2 regulation 10.2 as applicable to cargo ships, and regulations 10.4 and 10.5 shall apply as they would apply to tankers of 2,000 gross tonnage and over; .3 regulation 10.5.6 shall apply to ships of 2,000 gross tonnage and over; .4 the following regulations of SOLAS chapter II-2 related to tankers do not apply and are replaced by chapters and sections of the Code as detailed below: Regulation — Replaced by 10.10 — 11.6 4.5.1.1 and 4.5.1.2 — Chapter 3 4.5.5 — Relevant sections in the Code 10.8 — 11.3 and 11.4 10.9 — 11.5 10.2 — 11.2.1 to 11.2.4; .5 regulations 13.3.4 and 13.4.3 shall apply to ships of 500 gross tonnage and over.	11.1.1 The requirements for tankers in SOLAS chapter II-2 should apply to ships covered by this Chapter, irrespective of tonnage including ships of less than 500 tons gross tonnage, except that : .1 regulations 4.5.1.6 and 4.5.10 do not apply; .2 regulation 10.2 as applicable to cargo ships and regulations 10.4 and 10.5 should apply as they would apply to tankers of 2,000 gross tonnage and over; .3 regulation 10.5.6 should apply to ships of 2,000 gross tonnage and over; .4 the following regulations of SOLAS chapter II-2 related to tankers do not apply and are replaced by chapters and sections of the Code as detailed below: Regulation — Replaced by 10.10 — 11.6 4.5.1.1 and 4.5.1.2 — chapter 3 4.5.5 and 10.8 — 11.3 and 11.4 10.9 — 11.5 .5 regulations 13.3.4 and 13.4.3 should apply to ships of 500 gross tonnage and over.	Editorial modification
11.1.2	All sources of ignition shall be excluded from spaces where flammable vapour may be present, except as otherwise provided	11.1.2 All sources of ignition should be excluded from spaces where flammable vapour may be present except as	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	in chapters 10 and 16.	otherwise provided in Chapters 10 and 16	
11.1.3	The provisions of this section shall apply in conjunction with chapter 3.	11.1.3 The provisions of this section apply in conjunction with Chapter 3.	Editorial modification
11.1.4	For the purposes of fire fighting, any weather deck areas above cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forwardmost hold space shall be included in the cargo area.	11.1.4 For the purposes of fire fighting, any open deck areas above cofferdams, ballast or void spaces at the after end of the after most hold space or at the forward end of the forward most hold space should be included in the cargo area.	Editorial modification
11.2	Fire mains and hydrants		
11.2.1	All ships, irrespective of size, carrying products that are subject to the Code shall comply with the requirements of regulation II-2/10.2 of the SOLAS Convention, except that the required fire pump capacity and fire main and water service pipe diameter shall not be limited by the provisions of regulations II-2/10.2.2.4.1 and II-2/10.2.1.3, when a fire pump is used to supply the water spray system, as permitted by 11.3.3 of this Code. The capacity of this fire pump shall be such that these areas can be protected when simultaneously supplying two jets of water from fire hoses with 19 mm nozzles at a pressure of at least 0.5 MPa.	11.2.1 All ships, irrespective of size, carrying products which are subject to this Chapter should comply with the requirements of SOLAS regulations II-2/10.2, 10.4 and 10.5, except that the required fire pump capacity and fire main and water service pipe diameter should not be limited by the provisions of regulations II-2/10.2.2.4.1 and II-2/10.2.1.3 when the fire pump and fire main are used as part of the water spray system as permitted by 11.3.3. In addition, the requirements of regulation II-2/10.2.1.6 should be met at a pressure of at least 5.0 bar.	1. Editorial modification 2. Add 'The capacity of this fire pump shall be such that these areas can be protected when simultaneously supplying two jets of water from fire hoses with 19 mm nozzles at a pressure of at least 0.5 MPa.'
11.2.2	The arrangements shall be such that at least two jets of water can reach any part of the deck in the cargo area and those portions of the cargo containment system and tank covers that are above the deck. The necessary number of fire hydrants shall be located to satisfy the above arrangements and to comply with the requirements of regulations II-2/10.2.1.5.1 and II-2/10.2.3.3 of the SOLAS convention, with hose lengths as specified in	11.2.2 The arrangements should be such that at least two jets of water can reach any part of the deck in the cargo area and those portions of the cargo containment system and tank covers above the deck. The necessary number of fire hydrants should be located to satisfy the above arrangements and to comply with the requirements of SOLAS regulations II-2/10.2.1.5.1 and II-2/10.2.3.3, with	1. Editorial modification 2. Add 'at least 0.5 MPa'.

	New IGC Code	Old IGC Code	Remarks
	regulation II-2/10.2.3.1.1. In addition, the requirements of regulation II-2/10.2.1.6 shall be met at a pressure of at least 0.5 MPa.	hose lengths as specified in regulation II-2/10.2.3.1.1.	
11.2.3	Stop valves shall be fitted in any crossover provided and in the fire main or mains in a protected location, before entering the cargo area and at intervals ensuring isolation of any damaged single section of the fire main, so that 11.2.2 can be complied with using not more than two lengths of hoses from the nearest fire hydrant. The water supply to the fire main serving the cargo area shall be a ring main supplied by the main fire pumps or a single main supplied by fire pumps positioned fore and aft of the cargo area, one of which shall be independently driven.	11.2.3 Stop valves should be fitted in any crossover provided and in the fire main or mains at the poop front and at intervals of not more than 40 m between hydrants on the deck in the cargo area for the purpose of isolating damaged sections of the main.	1. Editorial modification 2. Delete '40m'.
11.2.4	All nozzles provided for fire hoses shall be of an approved dual purpose type, capable of producing either a spray or a jet. All pipes, valves, nozzles and other fittings in the fire fighting systems shall be resistant to corrosion by sea water. Fixed piping, fittings and related components within the cargo area (except gaskets) shall be designed to withstand 925°C and remain functional.	11.2.4 All water nozzles provided for fire-fighting use should be of an approved dual-purpose type capable of producing either a spray or a jet. All pipes, valves, nozzles and other fittings in the fire-fighting systems should be resistant to the effects of fire and to corrosion by water.	1. Editorial modification 2. Add '925℃'
		11.2.5 Where the ship's engine-room is unattended, arrangements should be made to start and connect to the fire main at least one fire pump by remote control from the navigating bridge or other control station outside the cargo area.	1. Delete the requirement.
11.2.5	After installation, the pipes, valves, fittings and assembled system shall be subject to a tightness and function test.		1. New requirement on tightness and function test.

	New IGC Code	Old IGC Code	Remarks
11.3	Water spray system		
11.3.1	On ships carrying flammable or toxic products, or both, a water application system, which may be based on water spray nozzles, for cooling, fire prevention and crew protection shall be installed to cover: .1 exposed cargo tank domes, any exposed parts of cargo tanks and any part of cargo tank covers that may be exposed to heat from fires in adjacent equipment containing cargo such as exposed booster pumps/heaters/re-gasification or re-liquefaction plants, hereafter addressed as gas process units, positioned on weather decks; .2 exposed on-deck storage vessels for flammable or toxic products; .3 gas process units, positioned on deck; .4 cargo liquid and vapour discharge and loading connections, including the presentation flange and the area where their control valves are situated, which shall be at least equal to the area of the drip trays provided; .5 all exposed emergency shut-down (ESD) valves in the cargo liquid and vapour pipes, including the master valve for supply to gas consumers; .6 exposed boundaries facing the cargo area, such as bulkheads of superstructures and deckhouses normally manned, cargo machinery spaces, store-rooms containing high fire risk items	11.3.1 On ships carrying flammable or toxic products or both, a water spray system for cooling, fire prevention and crew protection should be installed to cover : .1 exposed cargo tank domes and any exposed parts of cargo tanks ; .2 exposed on-deck storage vessels for flammable or toxic products ; .3 cargo liquid and vapour discharge and loading manifolds and the area of their control valves and any other areas where essential control valves are situated and which should be at least equal to the area of the drip trays provided ; and .4 boundaries of superstructures and deckhouses normally manned, cargo compressors rooms, cargo pump rooms, store-rooms containing high fire risk items and cargo control rooms, all facing the cargo area. Boundaries of unmanned forecastle structures not containing high fire risk items or equipment do not require water spray protection.	1. Specify the areas which are covered by water spray system.

	New IGC Code	Old IGC Code	Remarks
	and cargo control rooms. Exposed horizontal boundaries of these areas do not require protection unless detachable cargo piping connections are arranged above or below. Boundaries of unmanned forecastle structures not containing high fire-risk items or equipment do not require water-spray protection; .7 exposed lifeboats, life rafts and muster stations facing the cargo area, regardless of distance to cargo area; .8 any semi-enclosed cargo machinery spaces and semi-enclosed cargo motor room; and .9 ships intended for operation as listed in 1.1.10, shall be subject to special consideration.		
11.3.2	.1 The system shall be capable of covering all areas mentioned in 11.3.1.1 to 11.3.1.8, with a uniformly distributed water application rate of at least 10 ℓ/m2/minute for the largest projected horizontal surfaces and 4 ℓ/m2/minute for vertical surfaces. For structures having no clearly defined horizontal or vertical surface, the capacity of the water application shall not be less than the projected horizontal surface multiplied by 10 ℓ/m2/minute. .2 On vertical surfaces, spacing of nozzles protecting lower areas may take account of anticipated rundown from higher areas. Stop valves shall be fitted in the spray water application main supply line(s), at intervals not exceeding 40 m, for the purpose of isolating damaged sections. Alternatively, the system may be divided into two or more sections that may be operated	11.3.2 The system should be capable of covering all areas mentioned in 11.3.1 with a uniformly distributed water spray of at least 10ℓ/m² per minute for horizontal projected surfaces and 4ℓ/m² per minute for vertical surfaces. For structures having no clearly defined horizontal or vertical surfaces, the capacity of the water spray system should be the greater of the following : .1 projected horizontal surface multiplied by 10ℓ/m²per minute ; or .2 actual surface multiplied by 4ℓ/m²per minute. On vertical surfaces, spacing of nozzles protecting lower areas may take account of anticipated rundown from higher areas. Stop valves should be fitted at intervals in the spray main for the purpose of isolating damaged	1. Add the new requirement. 'Stop valves shall be fitted in the spray water application main supply line(s), at intervals not exceeding 40 m, for the purpose of isolating damaged sections.'

	New IGC Code	Old IGC Code	Remarks
	independently, provided the necessary controls are located together in a readily accessible position outside of the cargo area. A section protecting any area included in 11.3.1.1 and 2 shall cover at least the entire athwartship tank grouping in that area. Any gas process unit(s) included in 11.3.1.3 may be served by an independent section.	sections. Alternatively, the system may be divided into two or more sections which may be operated independently provided the necessary controls are located together, aft of the cargo area. A section protecting any area included in 11.3.1.1 and .2 should cover the whole of the athwartship tank grouping which includes that area.	
11.3.3	The capacity of the water application pumps shall be capable of simultaneous protection of the greater of the following: .1 any two complete athwartship tank groupings, including any gas process units within these areas; or .2 for ships intended for operation as listed in 1.1.10, necessary protection subject to special consideration under 11.3.1.9 of any added fire hazard and the adjacent athwartship tank grouping, in addition to surfaces specified in 11.3.1.4,.5,.6,.7 and .8. Alternatively, the main fire pumps may be used for this service, provided that their total capacity is increased by the amount needed for the water-spray application system. In either case a connection, through a stop valve, shall be made between the fire main and water-spray application system main supply line outside of the cargo area.	11.3.3 The capacity of the water spray pumps should be sufficient to deliver the required amount of water to all areas simultaneously or where the system is divided into sections, the arrangements and capacity should be such as to supply water simultaneously to anyone section and to the surfaces specified in 11.3.1.3 and .4. Alternatively, the main fire pumps may be used for this service provided that their total capacity is increased by the amount needed for the spray system. In either case, a connection, through a stop valve, should be made between the fire main and water spray main outside the cargo area.	1. Editorial modification 2. Specify the requirements on the capacity of the water application pumps
11.3.4	The boundaries of superstructures and deckhouses normally manned, and lifeboats, life-rafts and muster areas facing the cargo area, shall also be capable of being served by one of the fire pumps or the emergency fire pump, if a fire in one		1. New requirement

	New IGC Code	Old IGC Code	Remarks
	compartment could disable both fire pumps.		
11.3.5	Water pumps normally used for other services may be arranged to supply the water spray application system main supply line.	11.3.4 Subject to the approval of the Administration, water pumps normally used for other services may be arranged to supply the water spray main.	Editorial modification
11.3.6	All pipes, valves, nozzles and other fittings in the water application systems shall be resistant to corrosion by seawater. Piping, fittings and related components within the cargo area (except gaskets) shall be designed to withstand 925°C. The water application system shall be arranged with in-line filters to prevent blockage of pipes and nozzles. In addition, means shall be provided to back flush the system with fresh water.	11.3.5 All pipes, valves, nozzles and other fittings in the water spray systems should be resistant to corrosion by sea-water, for which purpose galvanized pipe, for example, may be used, and to the effect of fire.	Editorial modification
11.3.7	Remote starting of pumps supplying the water application system and remote operation of any normally closed valves in the system shall be arranged in suitable locations outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the protected areas.	11.3.6 Remote starting of pumps supplying the water spray system and remote operation of any normally closed valves in the system should be arranged in suitable locations outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.	Editorial modification
11.3.8	After installation, the pipes, valves, fittings and assembled system shall be subject to a tightness and function test.		1. New requirement
11.4	Dry chemical powder fire-extinguishing systems		
11.4.1	Ships in which the carriage of flammable products is intended shall be fitted with fixed dry chemical powder fire-extinguishing systems, complying with the provisions of the FSS Code10, for the purpose of fire fighting on the deck in the cargo area, including any cargo liquid and vapour discharge and loading connections on deck and bow or stern cargo handling areas, as	11.4.1 Ships in which the carriage of flammable products is intended should be fitted with fixed dry chemical powder type extinguishing systems for the purpose of fighting fire on the deck in the cargo area and bow or stern cargo handling areas if applicable. The system and the dry chemical powder should be adequate for this purpose and satisfactory to the Administration.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	applicable.		
11.4.2	The system shall be capable of delivering powder from at least two hand hose lines, or a combination of monitor/hand hose lines, to any part of the exposed cargo liquid and vapour piping, load/unload connection and exposed gas process units.	11.4.2 The system should be capable of delivering powder from at least two hand hose lines or combination monitor/hand hose lines to any part of the above-deck exposed cargo area including above-deck product piping. The system should be activated by an inert gas such as nitrogen, used exclusively for this purpose and stored in pressure vessels adjacent to the powder containers.	Editorial modification
11.4.3	The dry chemical powder fire-extinguishing system shall be designed with not less than two independent units. Any part required to be protected by 11.4.2 shall be capable of being reached from not less than two independent units with associated controls, pressurizing medium fixed piping, monitors or hand hose lines. For ships with a cargo capacity of less than 1,000 m3, only one such unit need be fitted. A monitor shall be arranged to protect any load/unload connection area and be capable of actuation and discharge both locally and remotely. The monitor is not required to be remotely aimed if it can deliver the necessary powder to all required areas of coverage from a single position. One hose line shall be provided at both port- and starboard side at the end of the cargo area facing the accommodation and readily available from the accommodation.	11.4.3 The system for use in the cargo area should consist of at least two independent self-contained dry chemical powder units with associated controls, pressurizing medium fixed piping, monitors or hand hose lines. For ships with a cargo capacity of less than 1,000 m³ only one such unit need be fitted, subject to approval by the Administration. A monitor should be provided and so arranged as to protect the cargo loading and discharge manifold areas and be capable of actuation and discharge locally and remotely. The monitor is not required to be remotely aimed if it can deliver the necessary powder to all required areas of coverage from a single position. All hand hose lines and monitors should be capable of actuation at the hose storage reel or monitor. At least one hand hose line or monitor should be situated at the after end of the cargo area.	1.Editorial modification 2.One hose line shall be provided at both port- and starboard side at the end of the cargo area facing the accommodation and readily available from the accommodation.
		11.4.4 A fire extinguishing unit having two or more monitors, hand hose lines, or combinations thereof, should have independent pipes with a manifold at the powder container, unless a suitable alternative means is provided	1. Editorial modification 2. Mentioned in FSS Code

	New IGC Code	Old IGC Code	Remarks
		to ensure proper performance as approved by the Administration. Where two or more pipes are attached to a unit the arrangement should be such that any or all of the monitors and hand hose lines should be capable of simultaneous or sequential operation at their rated capacities.	
11.4.4	The capacity of a monitor shall be not less than 10 kg/s. Hand hose lines shall be non-kinkable and be fitted with a nozzle capable of on/off operation and discharge at a rate not less than 3.5 kg/s. The maximum discharge rate shall allow operation by one man. The length of a hand hose line shall not exceed 33 m. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping shall not exceed that length which is capable of maintaining the powder in a fluidized state during sustained or intermittent use, and which can be purged of powder when the system is shut down. Hand hose lines and nozzles shall be of weather-resistant construction or stored in weather resistant housing or covers and be readily accessible.	11.4.5 The capacity of a monitor should be not less than 10 kg/s. Hand hose lines should be non-kinkable and be fitted with a nozzle capable of on/off operation and discharge at a rate not less than 3.5 kg/s. The maximum discharge rate should be such as to allow operation by one man. The length of a hand hose line should not exceed 33 m. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping should not exceed that length which is capable of maintaining the powder in a fluidized state during sustained or intermittent use, and which can be purged of powder when the system is shut down. Hand hose lines and nozzles should be of weather-resistant construction or stored in weather resistant housing or covers and be readily accessible.	Editorial modification
11.4.6	Hand hose lines shall be considered to have a maximum effective distance of coverage equal to the length of hose. Special consideration shall be given where areas to be protected are substantially higher than the monitor or hand hose reel locations.	11.4.6 A sufficient quantity of dry chemical powder should be stored in each container to provide a minimum 45 seconds discharge time for all monitors and hand hose lines attached to each powder unit. Coverage from fixed monitors should be in accordance with the following requirements: Capacity of fixed monitors (kg/s) each 10 25 45	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		Maximum distance of coverage (m) 10 30 40 Hand hose lines should be considered to have a maximum effective distance of coverage equal to the length of hose. Special consideration should be given where areas to be protected are substantially higher than the monitor or hand hose reel locations.	
11.4.7	Ships fitted with bow, stern load/unload connections shall be provided with independent dry powder unit protecting the cargo liquid and vapour piping, aft or forward of the cargo area, by hose lines and a monitor covering the bow, stern load/unload complying with the requirements of 11.4.1 to 11.4.6.	11.4.7 Ships fitted with bow or stern loading and discharge arrangements should be provided with an additional dry chemical powder unit complete with at least one monitor and one hand hose line complying with the requirements of 11.4.1 to 11.4.6. This additional unit should be located to protect the bow or stern loading and discharge arrangements. The area of the cargo line forward or aft of the cargo area should be protected by hand hose lines.	Editorial modification
11.4.8	Ships intended for operation as listed in 1.1.10 shall be subject to special consideration.		1. New requirement
11.4.9	After installation, the pipes, valves, fittings and assembled systems shall be subjected to a tightness test and functional testing of the remote and local release stations. The initial testing shall also include a discharge of sufficient amounts of dry chemical powder to verify that the system is in proper working order. All distribution piping shall be blown through with dry air to ensure that the piping is free of obstructions.		1. New requirement 2. Requirements on test
11.5	Enclosed spaces containing cargo handling equipment		
11.5.1	Enclosed spaces meeting the criteria of cargo machinery spaces in 1.2.10, and the cargo motor room within the cargo area of any ship, shall be provided with a fixed fire-extinguishing system	11.5.1 The cargo compressor and pump rooms of any ship should be provided with a carbon dioxide system as specified in SOLAS regulation II-2/10.9.1.1 (replace by Res.MSC.220(82)). A notice should be exhibited at the	1. Editorial modification

	New IGC Code	Old IGC Code	Remarks
	complying with the provisions of the FSS Code and taking into account the necessary concentrations/application rate required for extinguishing gas fires.	controls stating that the system is only to be used for fire-extinguishing and not for inerting purposes, due to the electrostatic ignition hazard. The alarms referred to in SOLAS regulation II-2/10.9.1.1.1 (replace by Res.MSC.220(82)) should be safe for use in a flammable cargo vapour-air mixture. For the purpose of this requirement, an extinguishing system should be provided which would be suitable for machinery spaces. However, the amount of carbon dioxide gas carried should be sufficient to provide a quantity of free gas equal to 45% of the gross volume of the cargo compressor and pump rooms in all cases.	Old carbon dioxide system ⇩ New Fixed fire-extinguishing system
11.5.2	Enclosed spaces meeting the criteria of cargo machinery spaces in chapter 3.3, within the cargo area of ships that are dedicated to the carriage of a restricted number of cargoes, shall be protected by an appropriate fire-extinguishing system for the cargo carried.	11.5.2 Cargo compressor and pump rooms of ships which are dedicated to the carriage of a restricted number of cargoes should be protected by an appropriate fire-extinguishing system approved by the Administration.	Editorial modification
11.5.3	Turret compartments of any ship shall be protected by internal water spray, with an application rate of not less than 10 ℓ/m2/minute of the largest projected horizontal surface. If the pressure of the gas flow through the turret exceeds 4 MPa, the application rate shall be increased to 20 ℓ/m2/minute. The system shall be designed to protect all internal surfaces.		1. New requirement 2. Requirement on turret compartment
11.6	Firefighters' outfits		
11.6.1	Every ship carrying flammable products shall carry firefighter's outfits complying with the requirements of regulation II-2/10.10 of the SOLAS Convention, as follows:	11.6.1 Every ship carrying flammable products should carry fire-fighter's outfits complying with the requirements of SOLAS regulation II-2/10.10 (replaced by	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	Total cargo capacity Number of outfits 5,000 m3 and below 4 Above 5,000 m3 5	Res.MSC.220(82)) as follows : Total cargo capacity : number of outfits 5,000m³ and below 4 above 5,000m³ 5	
11.6.2	Additional requirements for safety equipment are given in chapter 14.	11.6.2 Additional requirements for safety equipment are given in Chapter 14.	Editorial modification
11.6.3	Any breathing apparatus required as part of a firefighter's outfit shall be a self-contained compressed air-operated breathing apparatus having a capacity of at least 1,200ℓ of free air.	11.6.3 Any breathing apparatus required as part of afireman's outfit should be a self-contained air-breathing apparatus having a capacity of at least 1,200ℓof free air.	Editorial modification
CHAPTER 12 ARTIFICIAL VENTILATION IN THE CARGO AREA			
Goal	*To ensure arrangement are provided for enclosed spaces in the cargo area to control the accumulation of flammable and or toxic vapours.*		Clarify the goal of requirements mentioned in this chapter.
Scope	The requirements of this chapter replace the requirements of SOLAS regulations II-1/4.5.2.6 and 4.5.4.1, as amended.		
12.1.1	Electric motor rooms, cargo compressor and pump rooms, spaces containing cargo handling equipment and other enclosed spaces where cargo vapours may accumulate shall be fitted with fixed artificial ventilation systems capable of being controlled from outside such spaces. The ventilation shall be run continuously to prevent the accumulation of toxic and/or flammable vapours, with a means of monitoring acceptable to the Administration to be provided. A warning notice requiring the use of such ventilation prior to entering shall be placed outside the compartment.	12.1.1 Electric motor rooms, cargo compressor and pump rooms, other enclosed spaces which contain cargo handling equipment and similar spaces in which cargo handling operations are performed should be fitted with mechanical ventilation systems capable of being controlled from outside such spaces. Provision should be made to ventilate such spaces prior to entering the compartment and operating the equipment and a warning notice requiring the use of such ventilation should be placed outside the compartment.	Editorial modification
12.1.2	Artificial ventilation inlets and outlets shall be arranged to ensure sufficient air movement through the space to avoid accumulation of flammable, toxic or asphixiant vapours, and to ensure a safe	12.1.2 Mechanical ventilation inlets and outlets should be arranged to ensure sufficient air movement through the space to avoid the accumulation of flammable or toxic	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	working environment.	vapours and to ensure a safe working environment, but in no case should the ventilation system have a capacity of less than 30 changes of air per hour based upon the total volume of the space. As an exception, gas-safe cargo control rooms may have eight changes of air per hour.	
12.1.3	The ventilation system shall have a capacity of not less than 30 changes of air per hour, based upon the total volume of the space. As an exception, non-hazardous cargo control rooms may have eight changes of air per hour.		
12.1.4	Where a space has an opening into an adjacent more hazardous space or area, it shall be maintained at an over-pressure. It may be made into a less hazardous space or non-hazardous space by over-pressure protection in accordance with recognized standards*.	12.1.4 In rooms housing electric motors driving cargo compressors or pumps, spaces except machinery spaces containing inert gas generators, cargo control rooms if considered as gas-safe spaces and other gas-safe spaces within the cargo area, the ventilation should be of the positive pressure type.	Editorial modification
12.1.5	Ventilation ducts, air intakes and exhaust outlets serving artificial ventilation systems shall be positioned in accordance with recognized standards.	12.1.3 Ventilation systems should be fixed and, if of the negative pressure type, permit extraction from either the upper or the lower parts of the spaces, or from both the upper and the lower parts, depending on the density of the vapours of the products carried.	Editorial modification
12.1.6	Ventilation ducts serving hazardous areas shall not be led through accommodation, service and machinery spaces or control stations, except as allowed in chapter 16.	12.1.6 Ventilation exhaust ducts from gas-dangerous spaces should discharge upwards in locations at least 10 m in the horizontal direction from ventilation intakes and openings to accommodation spaces, service spaces and control stations and other gas-safe spaces.	1. Editorial modification 2. Delete '10m'
12.1.7	Electric motors driving fans shall be placed outside the ventilation ducts that may contain flammable vapours. Ventilation fans shall not produce a source of ignition in either the ventilated space or the ventilation system associated with the space. For hazardous areas, ventilation fans and ducts, adjacent to the fans, shall be of non-sparking construction, as defined below: .1 impellers or housing of non-metallic construction, with due	12.1.9 Electric motors driving fans should be placed outside the ventilation ducts if the carriage of flammable products is intended. Ventilation fans should not produce a source of vapour ignition in either the ventilated space or the ventilation system associated with the space. Ventilation fans and fan ducts, in way of fans only, for gas-dangerous spaces should be of non-sparking	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	regard being paid to the elimination of static electricity; .2 impellers and housing of non-ferrous materials; .3 impellers and housing of austenitic stainless steel; and .4 ferrous impellers and housing with not less than 13 mm design tip clearance. Any combination of an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regard	construction defined as : .1 impellers or housing of nonmetallic construction, due regard being paid to the elimination of static electricity ; .2 impellers and housing of nonferrous 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 or an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and should not be used in these places.	
		12.1.7 Ventilation intakes should be so arranged as to minimize the possibility of re-cycling hazardous vapours from any ventilation discharge opening.	Delete
12.1.8	Where fans are required by this chapter, full required ventilation capacity for each space shall be available after failure of any single fan or spare parts shall be provided comprising; a motor, starter spares and complete rotating element, including bearings of each type.	12.1.8 Ventilation ducts from gas-dangerous spaces should not be led through accommodation, service and machinery spaces or control stations, except as allowed in Chapter 16.	Editorial modification
12.1.9	Protection screens of not more than 13 mm square mesh shall be fitted to outside openings of ventilation ducts.	12.1.11 Protection screens of not more than 13 mm square mesh should be fitted in outside openings of ventilation ducts.	Editorial modification
12.1.10	Where spaces are protected by pressurization the ventilation shall be designed and installed in accordance with recognized standards13.	12.1.5 In cargo compressor and pump rooms and in cargo control rooms if considered gas-dangerous, the ventilation should be of the negative pressure type.	Editorial modification
		12.1.10 Spare parts should be carried for each type of fan on board referred to in this Chapter.	

	New IGC Code	Old IGC Code	Remarks
12.2	Spaces not normally entered .1 Enclosed spaces where cargo vapours may accumulate shall be capable of being ventilated to ensure a safe environment when entry into them is necessary. This shall be capable of being achieved without the need for prior entry. .2 For permanent installations, the capacity of 8 air changes per hour shall be provided and for portable systems, the capacity of 16 air changes per hour. .3 Fans or blowers shall be clear of personnel access openings, and shall comply with 12.1.7.	12.2 Spaces not normally entered Hold spaces, inter-barrier spaces, void spaces, cofferdams, spaces containing cargo piping and other spaces where cargo vapour may accumulate, should be capable of being ventilated to ensure a safe environment when entry into the spaces is necessary. Where a permanent ventilation system is not provided for such spaces, approved means of portable mechanical ventilation should be provided. Where necessary owing to the arrangement of spaces, such as hold spaces and inter-barrier spaces, essential ducting for such ventilation should be permanently installed. Fans or blowers should be clear of personnel access openings, and should comply with 12.1.9.	1. Clarify the air changes in accordance with IEC 60092. 'For permanent installations, the capacity of 8 air changes per hour shall be provided and for portable systems, the capacity of 16 air changes per hour.'
CHAPTER 13 INSTRUMENTATION AND AUTOMATION SYSTEMS			
Goal	*To ensure that the instrumentation and automation systems provides for the safe carriage, handling and conditioning of cargo liquid and vapour.*		Clarify the goal of requirements mentioned in this chapter.
13.1	**General**		
13.1.1	Each cargo tank shall be provided with a means for indicating level, pressure and temperature of the cargo. Pressure gauges and temperature indicating devices shall be installed in the liquid and vapour piping systems, in cargo refrigeration installations.	13.1.1 Each cargo tank should be provided with means for indicating level, pressure and temperature of the cargo. Pressure gauges and temperature indicating devices should be installed in the liquid and vapour piping systems, in cargo refrigerating installations and in the inert gas systems as detailed in this Chapter.	1. Delete 'in the inert gas system'
13.1.2	If loading and unloading of the ship is performed by means of remotely controlled valves and pumps, all controls and indicators associated with a given cargo tank shall be concentrated in one control position.	13.1.3 If the loading and unloading of the ship is performed by means of remotely controlled valves and pumps, all controls and indicators associated with a given cargo tank should be concentrated in one control position.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
13.1.3	Instruments shall be tested to ensure reliability under the working conditions, and recalibrated at regular intervals. Test procedures for instruments and the intervals between recalibration shall be in accordance with manufacturer's recommendations	13.1.4 Instruments should be tested to ensure reliability in the working conditions and recalibrated at regular intervals. Test procedures for instruments and the intervals between recalibration should be approved by the Administration.	1. Delete "approved by the Administration."
13.2	**Level indicators for cargo tanks**		
13.2.1	Each cargo tank shall be fitted with liquid level gauging device(s), arranged to ensure that a level reading is always obtainable whenever the cargo tank is operational. The device(s) shall be designed to operate throughout the design pressure range of the cargo tank and at temperatures within the cargo operating temperature range.	13.2.1 Each cargo tank should be fitted with at least one liquid level gauging device, designed to operate at pressures not less than the MARVS of the cargo tank and at temperatures within the cargo operating temperature range. Where only one liquid level gauge is fitted it should be so arranged that any necessary maintenance can be carried out while the cargo tank is in service.	Editorial modification
13.2.2	Where only one liquid level gauge is fitted, it shall be arranged so that it can be maintained in an operational condition without the need to empty or gas-free the tank.		
13.2.3	Cargo tank liquid level gauges may be of the following types, subject to special requirements for particular cargoes shown in column "g" in the table of chapter 19: .1 indirect devices, which determine the amount of cargo by means such as weighing or in-line flow metering; .2 closed devices which do not penetrate the cargo tank, such as devices using radio-isotopes or ultrasonic devices; .3 closed devices which penetrate the cargo tank, but which form part of a closed system and keep the cargo from being released, such as float type systems, electronic probes, magnetic probes and bubble tube indicators. If closed gauging	13.2.2 Cargo tank liquid level gauges may be of the following types subject to any special requirement for particular cargoes shown in column "g" in the table of Chapter 19: .1 indirect devices, which determine the amount of cargo by means such as weighing or pipe flow meters ; .2 closed devices, which do not penetrate the cargo tank, such as devices using radioisotopes or ultrasonic devices ; .3 closed devices, which penetrate the cargo tank, but	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	device is not mounted directly onto the tank, it shall be provided with a shutoff valve located as close as possible to the tank; and .4 restricted devices which penetrate the tank and, when in use, permit a small quantity of cargo vapour or liquid to escape to the atmosphere, such as fixed tube and slip tube gauges. When not in use, the devices shall be kept completely closed. The design and installation shall ensure that no dangerous escape of cargo can take place when opening the device. Such gauging devices shall be so designed that the maximum opening does not exceed 1.5 mm diameter or equivalent area, unless the device is provided with an excess flow valve.	which form part of a closed system and keep the cargo from being released, such as float type systems, electronic probes, magnetic probes and bubble tube indicators. If a closed gauging device is not mounted directly on the tank it should be provided with a shutoff valve located as close as possible to the tank; and .4 restricted devices, which penetrate the tank and when in use permit a small quantity of cargo vapour or liquid to escape to the atmosphere, such as fixed tube and slip tube gauges. When not in use, the devices should be kept completely closed. The design and installation should ensure that no dangerous escape of cargo can take place when opening the device. Such gauging devices should be so designed that the maximum opening does not exceed 1.5 mm diameter or equivalent area unless the device is provided with an excess flow valve.	
		13.2.3 Sighting ports with a suitable protective cover and situated above the liquid level with an internal scale may be allowed by the Administration as a secondary means of gauging for cargo tanks having a design vapour pressure not higher than 0.7 bar.	Delete
		13.2.4 Tubular gauge glasses should not be fitted. Gauge glasses of the robust type as fitted on	Delete

	New IGC Code	Old IGC Code	Remarks
		high-pressure boilers and fitted with excess flow valves may be allowed by the Administration for deck tanks, subject to any provisions of Chapter 17.	
13.3	**Overflow control**		
13.3.1	Except as provided in 13.3.4, each cargo tank shall be fitted with a high liquid level alarm operating independently of other liquid level indicators and giving an audible and visual warning when activated.	13.3.1 Except as provided in 13.3.2, each cargo tank should be fitted with a high liquid level alarm operating independently of other liquid level indicators and giving an audible and visual warning when activated. Another sensor operating independently of the high liquid level alarm should automatically actuate a shutoff valve in a manner which will both avoid excessive liquid pressure in the loading line and prevent the tank from becoming liquid full. The emergency shutdown valve referred to in 5.6.4 may be used for this purpose. If another valve is used for this purpose, the same information as referred to in 5.6.4 should be available on board. During loading, whenever the use of these valves may possibly create a potential excess pressure surge in the loading system, the Administration and the Port Administration may agree to alternative arrangements such as limiting the loading rate, etc.	Delete "the Administration and the Port Administration~"
13.3.2	An additional sensor operating independently of the high liquid level alarm shall automatically actuate a shutoff valve in a manner that will both avoid excessive liquid pressure in the loading line and prevent the tank from becoming liquid full.		
13.3.3	The emergency shutdown valve referred to in 5.5 and 18.10 may be used for this purpose. If another valve is used for this purpose, the same information as referred to in 18.10.2.1.3 shall be available on board. During loading, whenever the use of these valves may possibly create a potential excess pressure surge in the loading system, alternative arrangements such as limiting the loading rate shall be used.		
13.3.4	A high liquid level alarm and automatic shut-off of cargo tank filling need not be required, when the cargo tank: .1 is a pressure tank with a volume not more than 200 m3; or .2 is designed to withstand the maximum possible pressure during the loading operation, and such pressure is below that	13.3.2 A high liquid level alarm and automatic shutoff of cargo tank filling need not be required when the cargo tank : .1 is a pressure tank with a volume not more than 200 m³; or	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	of the set pressure of the cargo tank relief valve.	.2 is designed to withstand the maximum possible pressure during the loading operation and such pressure is below that of the start-to-discharge pressure of the cargo tank relief valve.	
13.3.5	The position of the sensors in the tank shall be capable of being verified before commissioning. At the first occasion of full loading after delivery and after each dry-docking, testing of high-level alarms shall be conducted by raising the cargo liquid level in the cargo tank to the alarm point.		New requirement
13.3.6	All elements of the level alarms, including the electrical circuit and the sensor(s), of the high, and overfill alarms, shall be capable of being functionally tested. Systems shall be tested prior to cargo operation in accordance with 18.6.2.	13.3.3 Electrical circuits, if any, of level alarms should be capable of being tested prior to loading.	Editorial modification
13.3.7	Where arrangements are provided for overriding the overflow control system, they shall be such that inadvertent operation is prevented. When this override is operated, continuous visual indication shall be given at the relevant control station(s) and the navigation bridge.		New requirement
13.4	**Pressure monitoring**		
13.4.1	The vapour space of each cargo tank shall be provided with a direct reading gauge. Additionally, an indirect indication shall be provided at the control position required by 13.1.2. Maximum and minimum allowable pressures shall be clearly indicated.	13.4.1 The vapour space of each cargo tank should be provided with a pressure gauge which should incorporate an indicator in the control position required by 13.1.3. In addition, a high-pressure alarm and, if vacuum protection is required, a low-pressure alarm should be provided on the navigating bridge. Maximum and minimum allowable pressures should be marked on	Editorial modification
13.4.2	A high-pressure alarm and, if vacuum protection is required, a low-pressure alarm shall be provided on the navigation bridge and at the control position required by 13.1.2. Alarms shall be		

	New IGC Code	Old IGC Code	Remarks
	activated before the set pressures are reached.	the indicators. The alarms should be activated before the set pressures are reached. For cargo tanks fitted with pressure relief valves, which can be set at more than one set pressure in accordance with 8.2.6, high-pressure alarms should be provided for each set pressure.	
13.4.3	For cargo tanks fitted with PRVs which can be set at more than one set pressure in accordance with 8.2.7, high-pressure alarms shall be provided for each set pressure.		
13.4.4	Each cargo-pump discharge line and each liquid and vapour cargo manifold shall be provided with at least one pressure indicator.	13.4.2 Each cargo pump discharge line and each liquid and vapour cargo manifold should be provided with at least one pressure gauge.	Editorial modification
13.4.5	Local-reading manifold pressure indication shall be provided to indicate the pressure between ship's manifold valves and hose connections to the shore.	13.4.3 Local-reading manifold pressure gauges should be provided to indicate the pressure between stop valves and hose connections to the shore.	Editorial modification
13.4.6	Hold spaces and interbarrier spaces without open connection to the atmosphere shall be provided with pressure indication.	13.4.4 Hold spaces and inter-barrier spaces without open connection to the atmosphere should be provided with pressure gauges.	Editorial modification
13.4.7	All pressure indications provided shall be capable of indicating throughout the operating pressure range.		New requirement
13.5	**Temperature indicating devices**		
13.5.1	Each cargo tank shall be provided with at least two devices for indicating cargo temperatures, one placed at the bottom of the cargo tank and the second near the top of the tank, below the highest allowable liquid level. The lowest temperature for which the cargo tank has been designed, as shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required by 1.4.4, shall be clearly indicated by means of a sign on or near the temperature indicating devices.	13.5.1 Each cargo tank should be provided with at least two devices for indicating cargo temperatures, one placed at the bottom of the cargo tank and the second near the top of the tank, below the highest allowable liquid level. The temperature indicating devices should be marked to show the lowest temperature for which the cargo tank has been approved by the Administration.	Delete "by the Administration"

	New IGC Code	Old IGC Code	Remarks
13.5.2	The temperature indicating devices shall be capable of providing temperature indication across the expected cargo operating temperature range of the cargo tanks.		
13.5.3	Where thermo wells are fitted, they shall be designed to minimize failure due to fatigue in normal service.		
13.6	**Gas detection**		
13.6.1	Gas detection equipment shall be installed to monitor the integrity of the cargo containment, cargo handling and ancillary systems, in accordance with this section.		New requirement
13.6.2	A permanently installed system of gas detection and audible and visual alarms shall be fitted in: .1 all enclosed cargo and cargo machinery spaces (including turrets compartments) containing gas piping, gas equipment or gas consumers; .2 other enclosed or semi-enclosed spaces where cargo vapours may accumulate, including interbarrier spaces and hold spaces for independent tanks other than type C tanks; .3 airlocks; .4 spaces in gas-fired internal combustion engines, referred to in 16.7.3.3; .5 ventilation hoods and gas ducts required by chapter 16; .6 cooling/heating circuits, as required by 7.8.4; .7 inert gas generator supply headers; and .8 motor rooms for cargo handling machinery.	13.6.7 A permanently installed system of gas detection and audible and visual alarms should be provided for : .1 cargo pump rooms ; .2 cargo compressor rooms ; .3 motor rooms for cargo handling machinery ; .4 cargo control rooms unless designated as gas-safe ; .5 other enclosed spaces in the cargo area where vapour may accumulate including hold spaces and inter-barrier spaces for independent tanks other than type C ; .6 ventilation hoods and gas ducts where required by Chapter 16; and .7 air locks.	1. Clarify spaces in which detection system is to be installed.
13.6.3	Gas detection equipment shall be designed, installed and tested in accordance with recognized standards17 and shall be suitable	13.6.1 Gas detection equipment acceptable to the Administration and suitable for the gases to be carried	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	for the cargoes to be carried in accordance with column "f" in table of chapter 19.	should be provided in accordance with column "f" in the table of Chapter 19.	
13.6.4	Where indicated in column "f" in the table of chapter 19 ships certified for carriage of non-flammable products, oxygen deficiency monitoring shall be fitted in cargo machinery spaces and cargo tank hold spaces. Furthermore, oxygen deficiency monitoring equipment shall be installed in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment such as nitrogen generators, inert gas generators or nitrogen cycle refrigerant systems.		New requirement
13.6.5	In the case of toxic products or both toxic and flammable products, except when column "i" in the table of chapter 19 refers to 17.5.3, portable equipment can be used for the detection of toxic products as an alternative to a permanently installed system. This equipment shall be used prior to personnel entering the spaces listed in 13.6.2 and at 30-minute intervals while they remain in the space.	13.6.9 In the case of products which are toxic or both toxic and flammable, the Administration except when column "i" in the table of Chapter 19 refers to 17.9, may authorize the use of portable equipment for detection of toxic products as an alternative to a permanently installed system, if such equipment is used before personnel enter the spaces listed in 13.6.7 and at 30 min intervals while they remain therein.	Editorial modification
13.6.6	In the case of gases classified as toxic products, hold spaces and interbarrier spaces shall be provided with a permanently installed piping system for obtaining gas samples from the spaces. Gas from these spaces shall be sampled and analysed from each sampling head location.	13.6.12 In case of toxic gases, hold spaces and inter-barrier spaces should be provided with a permanently installed piping system for obtaining gas samples from the spaces. Gas from these spaces should be sampled and analysed from each sampling head location by means for fixed or portable equipment at intervals not exceeding 4 hours and in any event before personnel enter the space and at 30 min	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		intervals while they remain therein	
13.6.7	Permanently installed gas detection shall be of the continuous detection type, capable of immediate response. Where not used to activate safety shutdown functions required by 13.6.9 and chapter 16, sampling type detection may be accepted.		New requirement
13.6.8	When sampling type gas detection equipment is used, the following requirements shall be met: .1 the gas detection equipment shall be capable of sampling and analysing for each sampling head location sequentially at intervals not exceeding 30 min; .2 individual sampling lines from sampling heads to the detection equipment shall be fitted; and .3 pipe runs from sampling heads shall not be led through non-hazardous spaces except as permitted by 13.6.9.	13.6.8 The gas detection equipment should be capable of sampling and analysing from each sampling head location sequentially at intervals not exceeding 30 min, except that in the case of gas detection for the ventilation hoods and gas ducts referred to in 13.6.7.6 sampling should be continuous. Common sampling lines to the detection equipment should not be fitted. 13.6.3 Pipe runs from sampling heads should not be led through gas-safe spaces except as permitted by 13.6.5.	Editorial modification
13.6.9	The gas detection equipment may be located in a non-hazardous space, provided that the detection equipment such as sample piping, sample pumps, solenoids and analysing units are located in a fully enclosed steel cabinet with the door sealed by a gasket. The atmosphere within the enclosure shall be continuously monitored. At gas concentrations above 30% lower flammable limit (LFL) inside the enclosure, the gas detection equipment shall be automatically shut down.		New requirement
13.6.10	Where the enclosure cannot be arranged directly on the forward bulkhead, sample pipes shall be of steel or equivalent material and be routed on their shortest way. Detachable connections,		New requirement

	New IGC Code	Old IGC Code	Remarks
	except for the connection points for isolating valves required in 13.6.11 and analysing units, are not permitted.		
13.6.11	When gas sampling equipment is located in a non-hazardous space, a flame arrester and a manual isolating valve shall be fitted in each of the gas sampling lines. The isolating valve shall be fitted on the non-hazardous side. Bulkhead penetrations of sample pipes between hazardous and non-hazardous areas shall maintain the integrity of the division penetrated. The exhaust gas shall be discharged to the open air in a non-hazardous area.	13.6.5 Gas detection equipment may be located in the control position required by 13.1.3, on the navigating bridge or at other suitable locations. When such equipment is located in a gas-safe space the following conditions should be met : .1 gas-sampling lines should have shutoff valves or an equivalent arrangement to prevent cross-communication with gas-dangerous spaces ; and .2 exhaust gas from the detector should be discharged to the atmosphere in a safe location.	Editorial modification
13.6.12	In every installation, the number and the positions of detection heads shall be determined with due regard to the size and layout of the compartment, the compositions and densities of the products intended to be carried and the dilution from compartment purging or ventilation and stagnant areas.	13.6.2 In every installation, the positions of fixed sampling heads should be determined with due regard to the density of the vapours of the products intended to be carried and the dilution from compartment purging or ventilation.	Editorial modification
13.6.13	Any alarms status within a gas detection system required by this section shall initiate an audible and visible alarm: .1 on the navigation bridge; .2 at the relevant control station(s) where continuous monitoring of the gas levels is recorded; and .3 at the gas detector readout location.	13.6.4 Audible and visual alarms from the gas detection equipment, if required by this Article, should be located on the navigating bridge, in the control position required by 13.1.3, and at the gas detector readout location.	Editorial modification
13.6.14	In the case of flammable products, the gas detection equipment provided for hold spaces and interbarrier spaces that are required to be inerted shall be capable of measuring gas concentrations of	13.6.11 In the case of flammable products, where cargo containment systems other than independent tanks are used, hold spaces and inter-barrier spaces should be	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	0% to 100% by volume.	provided with a permanently installed gas detection system capable of measuring gas concentrations of 0% to 100% by volume. The detection equipment, equipped with audible and visual alarms, should be capable of sampling and detecting from each sampling head location sequentially at intervals not exceeding 30 min. Alarms should be activated when the vapour concentration reaches the equivalent of 30% of the lower flammable limit in air or such other limit as may be approved by the Administration in the light of particular cargo containment arrangements. Common sampling lines to the detection equipment should not be fitted.	
13.6.15	Alarms shall be activated when the vapour concentration by volume reaches the equivalent of 30% LFL in air.	13.6.10 For the spaces listed in 13.6.7, alarms should be activated for flammable products when the vapour concentration reaches 30% of the lower flammable limit.	Editorial modification
13.6.16	For membrane containment systems, the primary and secondary insulation spaces shall be able to be inerted and their gas content analysed individually. The alarm in the secondary insulation space shall be set in accordance with 13.6.15, that in the primary space is set at a value approved by the Administration or recognized organization acting on its behalf.		New requirement
13.6.17	For other spaces described by 13.6.2, alarms shall be activated when the vapour concentration reaches 30% LFL and safety functions required by chapter 16 shall be activated before the vapour concentration reaches 60% LFL. The crankcases of		New requirement

	New IGC Code	Old IGC Code	Remarks
	internal combustion engines that can run on gas shall be arranged to alarm before 100% LFL.		
13.6.18	Gas detection equipment shall be so designed that it may readily be tested. Testing and calibration shall be carried out at regular intervals. Suitable equipment for this purpose shall be carried on board and be used in accordance with the manufacturer's recommendations. Permanent connections for such test equipment shall be fitted.	13.6.6 Gas detection equipment should be so designed that it may readily be tested. Testing and calibration should be carried out at regular intervals. Suitable equipment and span gas for this purpose should be carried on board. Where practicable, permanent connections for such equipment should be fitted.	Editorial modification
13.6.19	Every ship shall be provided with at least two sets of portable gas detection equipment that meet the requirement of 13.6.3 or an acceptable national or international standard.	13.6.13 Every ship should be provided with at least two sets of portable gas detection equipment acceptable to the Administration and suitable for the products to be carried.	Editorial modification
13.6.20	A suitable instrument for the measurement of oxygen levels in inert atmospheres shall be provided.	13.6.14 A suitable instrument for the measurement of oxygen levels in inert atmospheres should be provided.	Editorial modification
13.7	**Additional requirements for containment systems requiring a secondary barrier**		
13.7.1	**Integrity of barriers** Where a secondary barrier is required, permanently installed instrumentation shall be provided to detect when the primary barrier fails to be liquid-tight at any location or when liquid cargo is in contact with the secondary barrier at any location. This instrumentation shall consist of appropriate gas detecting devices according to 13.6. However, the instrumentation need not be capable of locating the area where liquid cargo leaks through the primary barrier or where liquid cargo is in contact with the secondary barrier	13.1.2 Where a secondary barrier is required, permanently installed instrumentation should be provided to detect when the primary barrier fails to be liquid tight at any location or when liquid cargo is in contact with the secondary barrier at any location. This instrumentation should consist of appropriate gas detecting devices according to 13.6. However, the instrumentation need not be capable of locating the area where liquid cargo leaks through the primary barrier or where liquid cargo is in contact with the secondary barrier.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
13.7.2	**Temperature indication devices**		
13.7.2.1	The number and position of temperature-indicating devices shall be appropriate to the design of the containment system and cargo operation requirements.	13.5.4 The number and position of temperature indicating devices should be to the satisfaction of the Administration.	Editorial modification
13.7.2.2	When cargo is carried in a cargo containment system with a secondary barrier, at a temperature lower than -55°C, temperature-indicating devices shall be provided within the insulation or on the hull structure adjacent to cargo containment systems. The devices shall give readings at regular intervals and, where applicable, alarm of temperatures approaching the lowest for which the hull steel is suitable.	13.5.2 When a cargo is carried in a cargo containment system with a secondary barrier at a temperature lower than -55°C, temperature indicating devices should be provided within the insulation or on the hull structure adjacent to cargo containment systems. The devices should give readings at regular intervals and, where applicable, audible warning of temperatures approaching the lowest for which the hull steel is suitable.	Editorial modification
13.7.2.3	If cargo is to be carried at temperatures lower than -55°C, the cargo tank boundaries, if appropriate for the design of the cargo containment system, shall be fitted with a sufficient number of temperature-indicating devices to verify that unsatisfactory temperature gradients do not occur.	13.5.3 If cargo is to be carried at temperatures lower than -55°C, the cargo tank boundaries, if appropriate for the design of the cargo containment system, should be fitted with temperature indicating devices as follows : .1 A sufficient number of devices to establish that an unsatisfactory temperature gradient does not occur. .2 On one tank a number of devices in excess of those required in 13.5.3.1 in order to verify that the initial cool down procedure is satisfactory. These devices may be either temporary or permanent. When a series of similar ships is built, the second and successive ships need not comply with the requirements of this sub-paragraph.	Editorial modification
13.7.2.4	For the purposes of design verification and determining the		

	New IGC Code	Old IGC Code	Remarks
	effectiveness of the initial cooldown procedure on a single or series of similar ships, one tank shall be fitted with devices in excess of those required in 13.7.2.1. These devices may be temporary or permanent and only need to be fitted to the first ship, when a series of similar ships is built.		
13.8	**Automation systems**		New Section
13.8.1	The requirements of this section shall apply where automation systems are used to provide instrumented control, monitoring/alarm or safety functions required by this Code		New requirement
13.8.2	Automation systems shall be designed, installed and tested in accordance with recognized standards.		New requirement
13.8.3	Hardware shall be capable of being demonstrated to be suitable for use in the marine environment by type approval or other means.		New requirement
13.8.4	Software shall be designed and documented for ease of use, including testing, operation and maintenance.		New requirement
13.8.5	The user interface shall be designed such that the equipment under control can be operated in a safe and effective manner at all times.		New requirement
13.8.6	Automation systems shall be arranged such that a hardware failure or an error by the operator does not lead to an unsafe condition. Adequate safeguards against incorrect operation shall be provided.		New requirement
13.8.7	Appropriate segregation shall be maintained between control, monitoring/alarm and safety functions to limit the effect of single failures. This shall be taken to include all parts of the automation systems that are required to provide specified functions, including		New requirement

	New IGC Code	Old IGC Code	Remarks
	connected devices and power supplies.		
13.8.8	Automation systems shall be arranged such that the software configuration and parameters are protected against unauthorized or unintended change.		New requirement
13.8.9	A management of change process shall be applied to safeguard against unexpected consequences of modification. Records of configuration changes and approvals shall be maintained on board.		New requirement
13.8.10	Processes for the development and maintenance of integrated systems shall be in accordance with recognized standards. These processes shall include appropriate risk identification and management.		New requirement
13.9	**System integration**		New Section
13.9.1	Essential safety functions shall be designed such that risks of harm to personnel or damage to the installation or the environment are reduced to a level acceptable to the Administration, both in normal operation and under fault conditions. Functions shall be designed to fail-safe. Roles and responsibilities for integration of systems shall be clearly defined and agreed by relevant parties.		New requirement
13.9.2	Functional requirements of each component subsystem shall be clearly defined to ensure that the integrated system meets the functional and specified safety requirements and takes account of any limitations of the equipment under control.		New requirement
13.9.3	Key hazards of the integrated system shall be identified using appropriate risk-based techniques.		New requirement
13.9.4	The integrated system shall have a suitable means of		New requirement

	New IGC Code	Old IGC Code	Remarks
	reversionary control.		
13.9.5	Failure of one part of the integrated system shall not affect the functionality of other parts, except for those functions directly dependent on the defective part.		New requirement
13.9.6	Operation with an integrated system shall be at least as effective as it would be with individual stand-alone equipment or systems.		New requirement
13.9.7	The integrity of essential machinery or systems, during normal operation and fault conditions, shall be demonstrated.		New requirement
CHAPTER 14 PERSONNEL PROTECTION			
Goal	To ensure that protective equipment is provided for ship staff, considering both routine operations or emergency situations and possible short or long term effects of the product being handled.		Clarify the goal of requirements mentioned in this chapter.
14.1	**Protective equipment**		
14.1.1	Suitable protective equipment, including eye protection to a recognized national or international standard, shall be provided for protection of crew members engaged in normal cargo operations, taking into account the characteristics of the products being carried.	14.1 Protective equipment For protection of crew members engaged in loading and discharging operations, suitable protective equipment including eye protection should be provided, taking into account the character of the products.	Editorial modification
14.1.2	Personal protective and safety equipment required in this chapter shall be kept in suitable, clearly marked lockers located in readily accessible places.	14.2.5 Protective equipment required in 14.1 and safety equipment required in 14.2.1 should be kept in suitable, clearly marked lockers located in readily accessible places.	Editorial modification
14.1.3	The compressed air equipment shall be inspected at least once a month by a responsible officer and the inspection logged in the ship's records. This equipment shall also be inspected and tested by a competent person at least once a year.	14.2.6 The compressed air equipment should be inspected at least once a month by a responsible officer and the inspection recorded in the ship's log-book, and inspected and tested by an expert at least once a year.	Editorial modification
14.2	**First-aid equipment**		
14.2.1	A stretcher that is suitable for hoisting an injured person from	14.3.1 A stretcher which is suitable for hoisting an injured	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	spaces below deck shall be kept in a readily accessible location.	person from spaces below deck should be kept in a readily accessible location.	
14.2.2	The ship shall have on board medical first aid equipment, including oxygen resuscitation equipment, based on the requirements of the Medical First Aid Guide (MFAG) for the cargoes listed on the Certificate of Fitness.	14.3.2 The ship should 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*.	Editorial modification
14.3.1	Sufficient, but not less than three complete sets of safety equipment shall be provided in addition to the firefighter's outfits required by 11.6.1. Each set shall provide adequate personal protection to permit entry and work in a gas-filled space. This equipment shall take into account the nature of the cargoes, as listed on the Certificate of Fitness in appendix 2.	14.2.1 Sufficient, but not less than two complete sets of safety equipment in addition to the firmen's outfits required by 11.6.1 each permitting personnel to enter and work in a gas-filled space, should be provided.	**Old** two complete sets of safety equipment ⇩ **New** three complete sets of safety equipment
14.3.2	Each complete set of safety equipment shall consist of: .1 one self-contained positive pressure air breathing apparatus incorporating full face mask, not using stored oxygen and having a capacity of at least 1,200 litres of free air. Each set shall be compatible with that required by 11.6.1; .2 protective clothing, boots and gloves to a recognized standard; .3 steel cored rescue line with belt; and .4 explosion proof lamp.	14.2.2 One complete set of safety equipment should consist of: .1 oneself-contained air-breathing apparatus not using stored oxygen, having a capacity of at least 1,200 l of free air; .2 protective clothing, boots, gloves and tight fitting goggles ; .3 steel-cored rescue line with belt; and .4 explosion-proof lamp.	Editorial modification
14.3.3	An adequate supply of compressed air shall be provided and shall consist of: .1 at least one fully charged spare air bottle for each breathing apparatus required by 14.3.1, in accordance with the requirements of 11.6.1; .2 an air compressor of adequate capacity capable of continuous	14.2.3 An adequate supply of compressed air should be provided and should consist either of : .1 one set of fully charged spare air bottles for each breathing apparatus required by 14.2.1; a special air compressor suitable for the supply of high-pressure air of the required purity; and a charging manifold capable of dealing with sufficient spare	1. Editorial modification 2. Delete '6,000 L'

	New IGC Code	Old IGC Code	Remarks
	operation, suitable for the supply of high pressure air of breathable quality, and .3 a charging manifold capable of dealing with sufficient spare breathing apparatus air bottles for the breathing apparatus required by 14.3.1.	breathing apparatus air bottles for the breathing apparatus required by 14.2.1; or .2 fully charged spare air bottles with a total free air capacity of at least 6,000 l for each breathing apparatus required by 14.2.1.	
14.4	Personal protection requirements for individual products		
14.4.1	Provisions of 14.4 shall apply to ships carrying products for which those paragraphs are listed in column 'i' in the table of chapter 19.	14.4.1 Provisions of 14.4 are applicable to ships carrying products for which those paragraphs are listed in column "i" in the table of Chapter 19.	Editorial modification
14.4.2	Suitable respiratory and eye protection for emergency escape purposes shall be provided for every person on board, 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; and .3 emergency escape respiratory protection shall not be used for firefighting or cargo-handling purposes and shall be marked to that effect.	14.4.2 Respiratory and eye protection suitable for emergency escape purposes should be provided for every person on board subject to the following : .1.1 filter type respiratory protection should be accepted, only when one filter is suitable for all designated cargoes that the ship is certified to carry; .1.2 self-contained breathing apparatus should normally have a duration of service of at least 15 min ; .2 emergency escape respiratory protection should not be used for fire-fighting or cargo handling purposes and should be marked to that effect ; .3 two additional sets of the above respiratory and eye protection should be permanently located in the navigating bridge.	Editorial modification
14.4.3	One or more suitably marked decontamination showers and eyewash stations shall be available on deck, taking into account the size and layout of vessel. The showers and eyewashes shall be operable in all ambient conditions.	14.4.3 Suitably marked decontamination showers and an eyewash should be available on deck in convenient locations.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
14.4.4	The protective suits required under 14.3.2.2 shall be gastight.		New requirement
		14.4.4 In ships of a cargo capacity of 2,000 m³ and over, two complete sets of safety equipment should be provided in addition to the equipment required by 11.6.1 and 14.2.1. At least three spare charged air bottles should be provided for each self-contained air breathing apparatus required in this paragraph.	Delete
		14.4.5 Personnel should be protected against the effects of a major cargo release by the provision of a space within the accommodation area designed and equipped to the satisfaction of the Administration.	Delete
		14.4.6 For certain highly dangerous products, cargo control rooms should be of the gas-safe type only.	Delete
CHAPTER 15 FILLING LIMITS FOR CARGO TANKS			
Goal	To determine the maximum quantity of cargo that can be loaded.		Clarify the goal of requirements mentioned in this chapter.
15.1	Definitions		
15.1.1	*Filling limit (FL)* means the maximum liquid volume in a cargo tank relative to the total tank volume when the liquid cargo has reached the reference temperature.		1. Add the definition of filling limit.
15.1.2	*Loading limit (LL)* means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded.		1. Add the definition of loading limit.
15.1.3	*Reference temperature* means (for the purposes of this chapter only): .1 when no cargo vapour pressure/temperature control, as referred to in chapter 7, is provided, the temperature	15.1.4 For the purpose of this chapter only, "reference temperature" means: .1 The temperature corresponding to the vapour pressure of the cargo at the set pressure of the pressure relief valves when no cargo vapour pressure/temperature control	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	corresponding to the vapour pressure of the cargo at the set pressure of the PRVs; and .2 when a cargo vapour pressure/temperature control, as referred to in chapter 7, is provided, the temperature of the cargo upon termination of loading, during transport or at unloading, whichever is the greatest.	as referred to in Chapter 7 is provided; .2 the temperature of the cargo upon termination of loading, during transport, or at unloading, whichever is the greatest, when a cargo vapour pressure/temperature control as referred to in Chapter 7 is provided. If this reference temperature would result in the cargo tank becoming liquid full before the cargo reaches a temperature corresponding to the vapour pressure of the cargo at the set pressure of the relief valves required in 8.2, an additional pressure relieving system complying with 8.3 should be fitted	
15.1.4	*Ambient design temperature for unrestricted service* means sea temperature of 32°C and air temperature of 45°C. However, lesser values of these temperatures may be accepted by the Administration for ships operating in restricted areas or on voyages of restricted duration, and account may be taken in such cases of any insulation of the tanks. Conversely, higher values of these temperatures may be required for ships permanently operating in areas of high ambient temperature.		1. Add the definition of ambient temperature.
15.2	General requirements The maximum filling limit of cargo tanks shall be so determined that the vapour space has a minimum volume at reference temperature allowing for: .1 tolerance of instrumentation such as level and temperature gauges; .2 volumetric expansion of the cargo between the PRV set pressure and the maximum allowable rise stated in 8.4; and		

	New IGC Code	Old IGC Code	Remarks
	.3 an operational margin to account for liquid drained back to cargo tanks after completion of loading, operator reaction time and closing time of valves, see 5.5 and 18.10.2.1.4.		
15.3	Default filling limit The default value for the filling limit (*FL*) of cargo tanks is 98 per cent at the reference temperature. Exceptions to this value shall meet the requirements of 15.4.	15.1.1 No cargo tanks may have a higher filling limit (FL) than 98% at the reference temperature, except as permitted by 15.1.3.	Editorial modification
15.4	Determination of increased filling limit		
15.4.1	A filling limit greater than the limit of 98 per cent specified in 15.3 on condition that, under the trim and list conditions specified in 8.2.17 may be permitted, providing: .1 no isolated vapour pockets are created within the cargo tank; .2 the PRV inlet arrangement shall remain in the vapour space; and .3 allowances need to be provided for: .1 volumetric expansion of the liquid cargo due to the pressure increase from the MARVS to full flow relieving pressure in accordance with 8.4.1; .2 an operational margin of minimum 0.1% of tank volume; and .3 tolerances of instrumentation such as level and temperature gauges.		1. Specify the conditions for increased filling limit
15.4.2	In no case shall a filling limit exceeding 99.5 per cent at reference temperature be permitted.	15.1.3 The Administration may allow a higher filling limit (FL) than the limit of 98% specified in 15.1.1 at the reference temperature, taking into account the shape of the tank, arrangements of pressure relief valves, accuracy of level and temperature gauging and the	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		difference between the loading temperature and the temperature corresponding to the vapour pressure of the cargo at the set pressure of the pressure relief valves, provided the conditions specified in 8.2.17 are maintained.	
15.5	Maximum loading limit		
15.5.1	The maximum loading limit (*LL*) to which a cargo tank may be loaded shall be determined by the following formula: $LL = FL\frac{\rho_R}{\rho_L}$ where: *LL* = loading limit as defined in 15.1.2 expressed in percentage; *FL* = filling limit as specified in 15.3 or 15.4 expressed in percentage; ρ_R = relative density of cargo at the reference temperature; and ρ_L = relative density of cargo at the loading temperature.	15.1.2 The maximum loading limit (LL) to which a cargo tank may be loaded should be determined by the following formula : $LL = FL\frac{\rho_R}{\rho_L}$ where : LL = loading limit expressed in percent which means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded FL = filling limits as specified in 15.1.1 or 15.1.3 ρ_R = relative density of cargo at the reference temperature; and ρ_L = relative density of cargo at the loading temperature and pressure.	Editorial modification
15.5.2	The Administration may allow type C tanks to be loaded according to the formula in 15.5.1 with the relative density ρ_R as defined below, provided that the tank vent system has been approved in accordance with 8.2.18. ρ_R = relative density of cargo at the highest temperature that	15.1.5 The Administration may allow type C tanks to be loaded according to the following formula provided that the tank vent system has been approved in accordance with 8.2.18: $LL = FL\frac{\rho_R}{\rho_L}$ where :	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	the cargo may reach upon termination of loading, during transport, or at unloading, under the ambient design temperature conditions described in 15.1.4. This paragraph does not apply to products requiring a type 1G ship.	LL= loading limit as specified in 15.1.2; FL = filling limits as specified in 15.1.1 or 15.1.3; ρ_R= relative density of cargo at the highest temperature which the cargo may reach upon termination of loading, during transport, or at unloading, under the ambient design temperature conditions described in 7.1.2; and ρ_L= as specified in 15.1.2. This paragraph does not apply to products requiring a type 1G ship	
15.6	Information to be provided to the master		
15.6.1	A document shall be provided to the vessel specifying the maximum allowable loading limits for each cargo tank and product, at each applicable loading temperature and maximum reference temperature. The information in this document shall be approved by the Administration or recognized organization acting on its behalf.	15.2 Information to be provided to the master The maximum allowable loading limits for each cargo tank should be indicated for each product which may be carried, for each loading temperature which may be applied and for the applicable maximum reference temperature, on a list to be approved by the Administration. Pressures at which the pressure relief valves, including those valves required by 8.3, have been set should also be stated on the list. A copy of the list should be permanently kept on board by the master.	
15.6.2	Pressures at which the PRVs have been set shall also be stated in the document.		New requirement
15.6.3	A copy of the above document shall be permanently kept on board by the master.		New requirement
CHAPTER 16 USE OF CARGO AS FUEL			
Goal	To ensure the safe use of cargo as fuel		Clarify the goal of requirements mentioned

	New IGC Code	Old IGC Code	Remarks
			in this chapter.
16.1	**General** Except as provided for in 16.9, methane (LNG) is the only cargo whose vapour or boil-off gas may be utilized in machinery spaces of category A, and in these spaces it may be utilized only in systems such as boilers, inert gas generators, internal combustion engines, gas combustion unit (GCU) and gas turbines.	16.1.1 Methane (LNG) is the only cargo whose vapour or boil-off gas may be utilized in machinery spaces of category A and in such spaces may be utilized only in boilers, inert gas generators, and combustion engines and gas turbines. 16.1.2 The provisions do not preclude the use of gas fuel for auxiliary services in other locations, provided that such other services and locations should be subject to special consideration by the Administration.	
16.2	**Use of cargo vapour as fuel** This section addresses the use of cargo vapour as fuel in systems such as boilers, inert gas generators, internal combustion engines, GCUs and gas turbines.		
16.2.1	For vaporized LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2 and 16.4.3		New requirement
16.2.2	For vaporized LNG, gas consumers shall exhibit no visible flame and shall maintain the uptake exhaust temperature below 535°C.		New requirement
16.3	**Arrangement of spaces containing gas consumers**	16.2 Arrangement of machinery spaces of category A	
16.3.1	Spaces in which gas consumers are located shall be fitted with a mechanical ventilation system that is arranged to avoid areas where gas may accumulate, taking into account the density of the vapour and potential ignition sources. The ventilation system shall be separated from those serving other spaces.	16.2.1 Spaces in which gas fuel is utilized should be fitted with a mechanical ventilation system and should be arranged in such a way as to prevent the formation of dead spaces. Such ventilation should be particularly effective in the vicinity of electrical equipment and machinery or of other equipment and machinery which may generate sparks. Such a ventilation system should be separated from those intended for other spaces.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
16.3.2	Gas detectors shall be fitted in these spaces, particularly where air circulation is reduced. The gas detection system shall comply with the requirements of chapter 13.	16.2.2 Gas detectors should be fitted in these spaces, particularly in the zones where air circulation is reduced. The gas detection system should comply with the requirements of chapter 13	Editorial modification
16.3.3	Electrical equipment located in the double wall pipe or duct specified in 16.4.3 shall comply with the requirements of chapter 10.	16.2.3 Electrical equipment located in the double wall pipe or duct specified in 16.3.1 should be of the intrinsically safe type	Editorial modification
16.3.4	All vents and bleed lines that may contain or be contaminated by gas fuel shall be routed to a safe location external to the machinery space and be fitted with a flame screen.		New requirement
16.4	**Gas fuel supply**		
16.4.1	General .1 The requirements of 16.4 shall apply to gas fuel supply piping outside of the cargo area. Fuel piping shall not pass through accommodation spaces, service spaces, electrical equipment rooms or control stations. The routeing of the pipeline shall take into account potential hazards due to mechanical damage, such as stores or machinery handling areas. .2 Provision shall be made for inerting and gas-freeing that portion of the gas fuel piping systems located in the machinery space.	16.3.1 Gas fuel piping should not pass through accommodation spaces, service spaces or control stations. Gas fuel piping may pass through or extend into other spaces provided they fulfil one of the following : .1 the gas fuel piping should be a double wall piping system with the gas fuel contained in the inner pipe. The space between the concentric pipes should be pressurized with inert gas at a pressure greater than the gas fuel pressure. Suitable alarms should be provided to indicate a loss of inert gas pressure between the pipes ; or .2 the gas fuel piping should be installed within a ventilated pipe or duct. The air space between the gas fuel piping and the inner wall of this pipe or duct should be equipped with mechanical exhaust ventilation having a capacity of at least 30 air changes per hour. The	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		ventilation system should be arranged to maintain a pressure less than the atmospheric pressure. The fan motors should be placed outside the ventilated pipe or duct. The ventilation outlet should be placed in a position where no flammable gas-air mixture may be ignited. The ventilation should always be in operation when there is gas fuel in the piping. Continuous gas detection should be provided to indicate leaks and to shut down the gas fuel supply to the machinery space in accordance with 16.3.10 The master gas fuel valve required by 16.3.7 should close automatically, if the required air flow is not established and maintained by the exhaust ventilation system.	
16.4.2	Leak detection Continuous monitoring and alarms shall be provided to indicate a leak in the piping system in enclosed spaces and shut down the relevant gas fuel supply.	16.3.2 If a gas leak occurs, the gas fuel supply should not be restored until the leak has been found and repaired. Instructions to this effect should be placed in a prominent position in the machinery spaces.	Editorial modification
16.4.3	Routeing of fuel supply pipes Fuel piping may pass through or extend into enclosed spaces other than those mentioned in 16.4.1, provided it fulfils one of the following conditions: .1 a double wall design with the space between the concentric pipes pressurized with inert gas at a pressure greater than the gas fuel pressure. The isolating valve, as required by 16.4.5, closes automatically upon loss of inert gas pressure; or .2 installed in a pipe or duct equipped with mechanical exhaust	16.3.3 The double wall piping system or the ventilated pipe or duct provided for the gas fuel piping should terminate at the ventilation hood or casing required by 16.3.4. 16.3.4 A ventilation hood or casing should be provided for the areas occupied by flanges, valves, etc., and for the gas fuel piping, at gas fuel utilization units, such as boilers, diesel engines and gas turbines. If this ventilation hood or casing is not served by the exhaust ventilation fan serving the ventilated pipe or duct as specified in 16.3.1.2, then it should be equipped with an exhaust ventilation	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	ventilation having a capacity of at least 30 air changes per hour, and be arranged to maintain a pressure less than the atmospheric pressure. The mechanical ventilation is in accordance with chapter, 12 as applicable. The ventilation is always in operation when there is fuel in the piping and the isolating valve, as required by 16.4.5, closes automatically if the required air flow is not established and maintained by the exhaust ventilation system. The inlet or the duct may be from a non-hazardous machinery space, the ventilation outlet is in a safe location.	system and continuous gas detection should be provided to indicate leaks and to shut down the gas fuel supply to the machinery space in accordance with 16.3.10. The master gas fuel valve required by 16.3.7 should close automatically if the required air flow is not established and maintained by the exhaust ventilation system. The ventilation hood or casing should be installed or mounted to permit the ventilating air to sweep across the gas utilization unit and be exhausted at the top of the ventilation hood or casing. 16.3.5 The ventilation inlet and discharge for the required ventilation systems should be respectively from and to a safe location.	
16.4.4	Requirements for gas fuel with pressure greater than 1 MPa		
16.4.4.1	Fuel delivery lines between the high pressure fuel pumps/compressor and consumers shall be protected with a double-walled piping system capable of containing a high pressure line failure, taking into account the effects of both pressure and low temperature. A single walled pipe in the cargo area up to the isolating valve(s) required by 16.4.6 is acceptable.		New requirement
16.4.4.2	The arrangement in 16.4.3.2 may also be acceptable providing the pipe or trunk is capable of containing a high pressure line failure, according to the requirements of 16.4.7 and taking into account the effects of both pressure and possible low temperature and providing both inlet and exhaust of the outer		New requirement

	New IGC Code	Old IGC Code	Remarks
	pipe or trunk are in the cargo area.		
16.4.5	Gas consumer isolation The supply piping of each gas consumer unit shall be provided with gas fuel isolation by automatic double block and bleed, vented to a safe location, under both normal and emergency operation. The automatic valves shall be arranged to fail to the closed position on loss of actuating power. In a space containing multiple consumers, the shutdown of one shall not affect the gas supply to the others.	16.3.6 Each gas utilization unit should be provided with a set of three automatic valves. Two of these valves should be in series in the gas fuel pipe to the consuming equipment. The third valve should be in a pipe that vents, to a safe location in the open air, that portion of the gas fuel piping that is between the two valves in series. These valves should be so arranged that failure of the necessary forced draft, loss of flame on boiler burners, abnormal pressure in the gas fuel supply line, or failure of the valve control actuating medium will cause the two gas fuel valves which are in series to close automatically and cause the vent valve to open automatically. Alternatively, the function of one of the valves in series and of the valve in the vent line can be incorporated into one valve body so arranged that, when one of the above conditions occurs, flow to the gas utilization unit will be blocked and the vent opened. The three shut-off valves should be arranged for manual reset.	
16.4.6	Spaces containing gas consumers		
16.4.6.1	If the double barrier around the gas supply system is not continuous due to air inlets or other openings, or if there is any point where single failure will cause leakage into the space, it shall be possible to isolate the gas fuel supply to each individual space with an individual master gas fuel valve, which shall be located within the cargo area. It shall operate under the following circumstances:		New requirement

	New IGC Code	Old IGC Code	Remarks
	.1 automatically by: .1.1 gas detection within the space; .1.2 leak detection in the annular space of a double walled pipe; .1.3 leak detection in other compartments inside the space, containing single walled gas piping; .1.4 loss of ventilation in the annular space of a double walled pipe; .1.5 loss of ventilation in other compartments inside the space, containing single walled gas piping; .2 manually from within the space, and at least one remote location. The isolation of gas fuel supply to a space shall not affect the gas supply to other spaces containing gas consumers and shall not cause loss of propulsion or electrical power.		
16.4.6.2	If the double barrier around the gas supply system is continuous, an individual master valve located in the cargo area may be provided for each gas consumer inside the space. The individual master valve shall operate under the following circumstances: .1 automatically by: .1.1 leak detection in the annular space of a double walled pipe served by that individual master valve; .1.2 leak detection in other compartments containing single-walled gas piping that is part of the supply system served by that individual master valve; .1.3 loss of ventilation or loss of pressure in the annular space		New requirement

	New IGC Code	Old IGC Code	Remarks
	of a double walled pipe; .2 manually from within the space, and at least one remote location.		
16.4.6.3	It shall be possible to isolate the gas fuel supply to each individual space containing a gas consumer(s) with an individual master gas fuel valve, which is located within the cargo area. It shall operate under the following circumstances: .1 automatically by: .1.1 gas detection within the space; .1.2 leak detection in the annular space of a double walled space; .1.3 loss of ventilation in the annular space of the double walled pipe; .2 manually from within the space, and at least one remote location.	16.3.7 A master gas fuel valve that can be closed from within the machinery space should be provided within the cargo area. The valve should be arranged so as to close automatically if leakage of gas is detected, or loss of ventilation for the duct or casing or loss of pressurization of the double wall gas fuel piping occurs.	Editorial modification
16.4.6.4	The isolation of gas fuel supply to a space shall not affect the gas supply to other spaces containing gas consumers.		New requirement
16.4.7	Piping and ducting construction Gas fuel piping in machinery spaces shall comply with 5.1 to 5.9, as applicable. The piping shall, as far as practicable, have welded joints. Those parts of the gas fuel piping that are not enclosed in a ventilated pipe or duct according to 16.4.3, and are on the weather decks outside the cargo area, shall have full penetration butt-welded joints and shall be fully radiographed.	16.3.8 Gas fuel piping in machinery spaces should comply with 5.2 - 5.5 as far as found applicable. The piping should, as far as practicable, have welded joints. Those parts of the gas fuel piping, which are not enclosed in a ventilated pipe or duct according to 16.3.1 and are on the open deck outside the cargo area should have full penetration butt-welded joints and should be fully radiographed. 16.3.9 Provision should be made for inerting and gas-freeing that portion of the gas fuel piping system	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		located in the machinery space.	
16.4.8	Gas detection systems provided in accordance with the requirements of this chapter shall activate the alarm at 30 per cent LFL and shut down the master gas fuel valve required by 16.4.6 at not more than 60 per cent LFL. See also 13.6.17.	16.3.10 Gas detection systems provided in accordance with the requirements of 16.3.1 and 16.3.4 should comply with 13.6.2 and 13.6.4 through 13.6.8 as applicable; they should activate the alarm at 30% of the lower flammable limit and shut down the master gas fuel valve referred to in 16.3.7 before the gas concentration reaches 60% of the lower flammable limit.	Editorial modification
16.5	**Gas fuel plant and related storage tanks**	16.4 Gas make-up plant and related storage tanks	
16.5.1	Provision of gas fuel All equipment (heaters, compressors, vaporizers, filters, etc.) for conditioning the cargo and/or cargo boil off vapour for its use as fuel, and any related storage tanks, shall be located in the cargo area. If the equipment is in an enclosed space, the space shall be ventilated according to 12.1 and be equipped with a fixed fire-extinguishing system, according to 11.5, and with a gas detection system according to 13.6, as applicable	16.4.1 All equipment (heaters, compressors, filters, etc.) for making up the gas for its use as fuel, and the related storage tanks should be located in the cargo area in accordance with the requirement of 3.1.5.4. If the equipment is in an enclosed space, the space should be ventilated according to 12.1 of the Code and be equipped with a fixed fire-extinguishing system according to 11.5 and with a gas detection system according to 13.6, as applicable.	Editorial modification
16.5.2	Remote stops		
16.5.2.1	All equipment (heaters, compressors, vaporizers, filters, etc.) for conditioning the cargo and/or cargo boil off vapour for its use as fuel, and any related storage tanks, shall be located in the cargo area. If the equipment is in an enclosed space, the space shall be ventilated according to 12.1 and be equipped with a fixed fire-extinguishing system, according to 11.5, and with a gas detection system according to 13.6, as applicable.	16.4.2 The compressors should be capable of being remotely stopped from a position which is always and easily accessible, and also from the engine-room. In addition, the compressors should be capable of automatically stopping when the suction pressure reaches a certain value depending on the set pressure of the vacuum relief valves of the cargo tanks. The automatic shut-down device of the compressors should have a manual resetting. Volumetric compressors should be fitted	Editorial modification

	New IGC Code	Old IGC Code	Remarks
		with pressure relief valves discharging into the suction line of the compressor. The size of the pressure relief valves should be determined in such a way that, with the delivery valve kept closed, the maximum pressure does not exceed by more than 10% the maximum working pressure, The requirements of 5.6.1.3 apply to these compressors.	
16.5.2.2	The fuel supply equipment shall be automatically stopped in the case of low suction pressure or fire detection. The requirements of 18.10.1.1 need not apply to gas fuel compressors or pumps when used to supply gas consumers.		New requirement
16.5.3	Heating and cooling mediums If the heating or cooling medium for the gas fuel conditioning system is returned to spaces outside the cargo area, provisions shall be made to detect and alarm the presence of cargo/cargo vapour in the medium. Any vent outlet shall be in a safe position and fitted with an effective flame screen of an approved type.	16.4.3 If the heating medium for the gas fuel evaporator or heater is returned to spaces outside the cargo area it should first go through a degassing tank. The degassing tank should be located in the cargo area. Provisions should be made to detect and alarm the presence of gas in the tank. The vent outlet should be in a safe position and fitted with a flame screen.	Editorial modification
16.5.4	Piping and pressure vessels Piping or pressure vessels fitted in the gas fuel supply system shall comply with chapter 5.	16.4.4 Piping and pressure vessels in the gas fuel conditioning system should comply with chapter 5.	Editorial modification
16.6	**Special requirements for main boilers**	16.5 Special requirements for main boilers	
16.6.1	Arrangements		
16.6.1.1	Each boiler shall have a separate exhaust uptake.	16.5.1 Each boiler should have a separate uptake.	Editorial modification
16.6.1.2	Each boiler shall have a dedicated forced draught system. A crossover between boiler force draught systems may be fitted for emergency use providing that any relevant safety functions are	16.5.2 A system suitable to ensure the forced draught in the boilers should be provided. The particulars of such a system should be to the satisfaction of the Administration.	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	maintained.		
16.6.1.3	Combustion chambers and uptakes of boilers shall be designed to prevent any accumulation of gaseous fuel.	16.5.3 Combustion chambers of boilers should be of suitable form such as not to present pockets where gas may accumulate	Editorial modification
16.6.2	Combustion equipment		
16.6.2.1	The burner systems shall be of dual type suitable to burn either: .1 oil fuel; or .2 gas fuel; or .3 oil and gas fuel simultaneously.	16.5.4 The burner systems should be of dual type, suitable to burn either oil fuel or gas fuel alone or oil and gas fuel simultaneously. Only oil fuel should be used during manoeuvring and port operations unless automatic transfer from gas to oil burning is provided in which case the burning of a combination of oil and gas or gas alone may be permitted provided the system is demonstrated to the satisfaction of the Society. It should be possible to change over easily and quickly from gas fuel operation to oil fuel operation. Gas nozzles should be fitted in such a way that gas fuel is ignited by the flame of the oil fuel burner. A flame scanner should be installed and arranged to assure that gas flow to the burner is cut off unless satisfactory ignition has been established and maintained. On the pipe of each gas burner a manually operated shut-off valve should be fitted. An installation should be provided for purging the gas supply piping to the burners by means of inert gas or steam, after the extinguishing of these burners.	Editorial modification
16.6.2.2	Burners shall be designed to maintain stable combustion under all firing conditions.		
16.6.2.3	In the event of loss of gas fuel supply an automatic system shall be fitted to change over from gas fuel operation to oil fuel operation without interruption of the boiler firing.		
16.6.2.4	Gas nozzles and the burner control system shall be configured such that gas fuel can only be ignited by an established oil fuel flame, unless the boiler and combustion equipment is designed and approved by recognized organization to light on gas fuel.		
16.6.3	Safety		
16.6.3.1	There shall be arrangements to ensure that gas fuel flow to the burner is automatically cut-off, unless satisfactory ignition has been established and maintained.		
16.6.3.2	On the pipe of each gas burner a manually operated shut-off valve shall be fitted.		
16.6.3.3	Provisions shall be made for automatically purging the gas supply piping to the burners, by means of an inert gas, after the extinguishing of these burners.		
16.6.3.4	The automatic fuel changeover system required by 16.6.2.3 shall	16.5.5 Alarm devices should be fitted in order to monitor a	Editorial modification

	New IGC Code	Old IGC Code	Remarks
	be monitored with alarms to ensure continuous availability.	possible decrease in liquid fuel oil pressure or a possible failure of the related pumps.	
16.6.3.5	Arrangements shall be made that, in case of flame failure of all operating burners, the combustion chambers of the boilers are automatically purged before relighting.	16.5.6 Arrangements should be made that, in case of flame failure of all operating burners for gas or oil or for a combination thereof, the combustion chambers of the boilers are automatically purged before relighting. Arrangements should also be made to enable the boilers to be manually purged.	Editorial modification
16.6.3.6	Arrangements shall be made to enable the boilers to be manually purged.		
16.7	**Special requirements for gas-fired internal combustion engines** Dual fuel engines are those that employ gas fuel (with pilot oil) and oil fuel. Oil fuels may include distillate and residual fuels. Gas only engines are those that employ gas fuel only.	**16.6 Special requirements for gas-fired internal combustion engines and gas-fired turbines** Special provisions for gas-fuelled internal combustion engines and for gas turbines will be considered by the Society in each case.	New requirement
16.7.1	Arrangements		
16.7.1.1	When gas is supplied in a mixture with air through a common manifold, flame arrestors shall be installed before each cylinder head.		New requirement
16.7.1.2	Each engine shall have its own separate exhaust.		New requirement
16.7.1.3	The exhausts shall be configured to prevent any accumulation of un-burnt gaseous fuel.		New requirement
16.7.1.4	Unless designed with the strength to withstand the worst case over pressure due to ignited gas leaks, then air inlet manifolds, scavenge spaces, exhaust system and crank cases shall be fitted with suitable pressure relief systems. Pressure relief systems shall lead to a safe location, away from personnel.		New requirement
16.7.1.5	Each engine shall be fitted with vent systems independent of		New requirement

	New IGC Code	Old IGC Code	Remarks
	other engines for crankcases, sumps and cooling systems.		
16.7.2	Combustion equipment		New requirement
16.7.2.1	Prior to admission of gas fuel, correct operation of the pilot oil injection system on each unit shall be verified.		New requirement
16.7.2.2	For a spark ignition engine, if ignition has not been detected by the engine monitoring system within an engine specific time after opening of the gas supply valve, this shall be automatically shut-off and the starting sequence terminated. It shall be ensured that any unburned gas mixture is purged from the exhaust system.		New requirement
16.7.2.3	For dual fuel engines fitted with a pilot oil injection system an automatic system shall be fitted to change over from gas fuel operation to oil fuel operation with minimum fluctuation of the engine power.		New requirement
16.7.2.4	In the case of unstable operation on engines with the arrangement in 16.7.2.3 when gas firing, the engine shall automatically change to oil fuel mode.		New requirement
16.7.3	Safety		
16.7.3.1	During stopping of the engine the gas fuel shall be automatically shut-off before the ignition source.		New requirement
16.7.3.2	Arrangements shall be provided to ensure that there is no unburnt gas fuel in the exhaust gas system prior to ignition.		New requirement
16.7.3.3	Crankcases, sumps, scavenge spaces and cooling system vents shall be provided with gas detection; see 13.6.17.		New requirement
16.7.3.4	Provision shall be made within the design of the engine to permit continuous monitoring of possible sources of ignition within the crank case. Instrumentation fitted inside the crankcase shall be in		New requirement

	New IGC Code	Old IGC Code	Remarks
	accordance with the requirements of chapter 10.		
16.7.3.5	A means shall be provided to monitor and detect poor combustion or mis-firing that may lead to unburnt gas fuel in the exhaust system during operation. In the event that it is detected, the gas fuel supply shall be shut down. Instrumentation fitted inside the exhaust system shall be in accordance with the requirements of chapter 10.		New requirement
16.8	**Special requirements for gas turbine**		
16.8.1	Arrangements		
16.8.1.1	Each turbine shall have its own separate exhaust.		New requirement
16.8.1.2	The exhausts shall be appropriately configured to prevent any accumulation of un-burnt gas fuel.		New requirement
16.8.1.3	Unless designed with the strength to withstand the worst case over pressure due to ignited gas leaks, pressure relief systems shall be suitably designed and fitted to the exhaust system, taking into consideration of explosions due to gas leaks. Pressure relief systems within the exhaust uptakes shall be lead to a non-hazardous location, away from personnel.		New requirement
16.8.2	Combustion equipment		
16.8.2.1	An automatic system shall be fitted to change over easily and quickly from gas fuel operation to oil fuel operation with minimum fluctuation of the engine power.		New requirement
16.8.3	Safety		
16.8.3.1	Means shall be provided to monitor and detect poor combustion that may lead to unburnt gas fuel in the exhaust system during operation. In the event that it is detected, the gas fuel supply shall be shut down.		New requirement

	New IGC Code	Old IGC Code	Remarks
16.8.3.2	Means shall be provided to monitor and detect poor combustion that may lead to unburnt gas fuel in the exhaust system during operation. In the event that it is detected, the gas fuel supply shall be shut down.		New requirement
16.9	**Alternative fuels and technologies** If acceptable to the Administration, other cargo gases may be used as fuel, providing that the same level of safety as natural gas in this Code is ensured. The use of cargoes identified as toxic in chapter 19 shall not be permitted.		New requirement
16.9.1	For cargoes other than LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2, 16.4.3 and 16.5, as applicable, and shall include means for preventing condensation of vapour in the system.		New requirement
16.9.2	Liquefied gas fuel supply systems shall comply with 16.4.5.		
16.9.3	In addition to the requirements of 16.4.3.2, both ventilation inlet and outlet shall be in a non-hazardous area external to the machinery space.		New requirement
CHAPTER 17 FIRE PROTECTION AND EXTINCTION			
17.1	**General** 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.	17.1 General The provisions of this Section are applicable where reference is made in column "i" in the table of Chapter 19. These are requirements additional to the general requirements of this Code.	
17.2	**Materials of construction** Materials that may be exposed to cargo during normal operations	17.2 Materials of construction Materials which may be exposed to cargo during normal	

	New IGC Code	Old IGC Code	Remarks
	shall 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 normally in direct contact with the cargo liquid or vapour, shall not be used for certain products as specified in column 'i' in the table at chapter 19: .1 mercury, copper and copper-bearing alloys, and zinc; .2 copper, silver, mercury, magnesium and other acetylide-forming metals; .3 aluminium and aluminium-bearing alloys; .4 copper, copper alloys, zinc and galvanized steel; .5 aluminium, copper and alloys of either; and .6 copper and copper-bearing alloys with greater than 1% copper.	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 : .1 mercury, copper and copper-bearing alloys, and zinc ; .2 copper, silver, mercury, magnesium and other acetylide-forming metals ; .3 aluminium and aluminium-bearing alloys ; .4 copper, copper alloys, zinc and galvanized steel ; .5 aluminium, copper and alloys of either; .6 copper and copper-bearing alloys with greater than 1% copper.	
17.3	**Independent tanks** 17.3.1 Products shall be carried in independent tanks only. 17.3.2 Products shall be carried in type C independent tanks and the provisions of 7.1.2 apply. The design pressure of the cargo tank shall take into account any padding pressure or vapour discharge unloading pressure.	17.3 Independent tanks 17.3.1 Products should be carried in independent tanks only. 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.	
17.4	**Refrigeration systems**	17.4 Refrigeration systems	
17.4.1	Only the indirect system described in 7.3.1.2 shall be used.	17.4.1 Only the indirect system described in 7.2.4.2 should be used.	
17.4.2	For a ship engaged in the carriage of products that readily form dangerous peroxides, recondensed cargo shall not be allowed to form stagnant pockets of uninhibited liquid. This may be achieved	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 :	

	New IGC Code	Old IGC Code	Remarks
	either by: .1 using the indirect system described in 7.3.1.2, with the condenser inside the cargo tank; or .2 using the direct system or combined system described in 7.3.1.1 and .3 respectively, or the indirect system described in 7.3.1.2 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 shall be added upstream of such a place.	.1 using the indirect systemdescribed in 7.2.4.2 with the condenser inside the cargo tank ; or .2 using the direct system or combined system described in 7.2.4.1 and .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.	
17.4.3	If the ship is to consecutively carry products as specified in 17.4.2 with a ballast passage between, all uninhibited liquid shall be removed prior to the ballast voyage. If a second cargo is to be carried between such consecutive cargoes, the reliquefaction system shall be thoroughly drained and purged before loading the second cargo. Purging shall be carried out using either inert gas or vapour from the second cargo, if compatible. Practical steps shall be taken to ensure that polymers or peroxides do not accumulate in the cargo system.	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 ship's system.	
17.5	**Cargoes requiring type 1G ship**	17.5 Deck cargo piping One hundred per cent radiographyof all butt-welded joints in cargo piping exceeding 75 mm in diameter is required.	
17.5.1	All butt-welded joints in cargo piping exceeding 75 mm in diameter shall be subject to 100 per cent radiography.		
17.5.2	Gas sampling lines shall not be led into or through non-hazardous areas. Alarms referred to in 13.6.2 shall be activated when the vapour concentration reaches the threshold		

	New IGC Code	Old IGC Code	Remarks
	limiting value.		
17.5.3	The alternative of using portable gas detection equipment in accordance with 13.6.5 shall not be permitted.		
17.5.4	Cargo control rooms shall be located in a non-hazardous area and, additionally, all instrumentation shall be of the indirect type.		
17.5.5	Personnel shall be protected against the effects of a major cargo release by the provision of a space within the accommodation area that is designed and equipped to the satisfaction of the Administration.		
17.5.6	Notwithstanding the provision in 3.2.4.3, access to forecastle spaces shall not be permitted through a door facing the cargo area unless airlock in accordance with 3.6 is provided.		
17.5.7	Notwithstanding the provision in 3.2.7, access to control rooms and machinery spaces of turret systems shall not be permitted through doors facing the cargo area.		
17.6	**Exclusion of air from vapour spaces** Air shall be removed from cargo tanks and associated piping before loading and then subsequently excluded by: .1 introducing inert gas to maintain a positive pressure. Storage or production capacity of the inert gas shall be sufficient to meet normal operating requirements and relief valve leakage. The oxygen content of inert gas shall at no time be greater than 0.2% by volume; or .2 control of cargo temperatures such that a positive pressure is maintained at all times.	17.6 Exclusion of air from vapour spaces Air should be removed from the cargo tanks and associated piping before loading and then subsequently excluded by : .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 .2 control of cargo temperatures such that a positive pressure is maintained at all times.	
17.7	**Moisture control**	17.7 Moisture control For gases which are non-flammable and may become	

	New IGC Code	Old IGC Code	Remarks
	For gases that are non-flammable and may become corrosive or react dangerously with water, moisture control shall 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 that has a dew point of -45°C or below at atmospheric pressure.	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 dew point of -45°C or below at atmospheric pressure.	
17.8	**Inhibition** Care shall be taken to ensure that the cargo is sufficiently inhibited to prevent self-reaction (e.g. polymerization or dimerization) at all times during the voyage. Ships shall be provided with a certificate from the manufacturer stating: .1 name and amount of inhibitor added; .2 date inhibitor was added and the normally expected duration of its effectiveness; .3 any temperature limitations affecting the inhibitor; and .4 the action to be taken shall the length of the voyage exceed the effective lifetime of the inhibitors.	17.8 Inhibition 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 : .1 name and amount of inhibitor added ; .2 date inhibitor was added and the normally expected duration of its effectiveness ; .3 any temperature limitations affecting the inhibitor ; .4 the action to be taken should be length of the voyage exceed the effective lifetime of the inhibitors.	
17.9	**Flame screens on vent outlets** When carrying a cargo referenced to this section, cargo tank vent outlets shall be provided with readily renewable and effective flame screens or safety heads of an approved type. Due attention shall be paid to 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	17.9 Permanently installed toxic gas detectors 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. 17.9.2 The alternative of using portable equipment in accordance with 13.6.9 should not be permitted.	

	New IGC Code	Old IGC Code	Remarks
	conditions. Flame screens shall be removed and replaced by protection screens in accordance with 8.2.15 when carrying cargoes not referenced to this section.		
17.10	**Maximum allowable quantity of cargo per tank** When carrying a cargo referenced to in this section, the quantity of the cargo shall not exceed 3,000 m3 in any one tank.	17.10 Flame screens on vent outlets 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 Article. 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.	
17.11	**Cargo pumps and discharge arrangements**		
17.11.1	The vapour space of cargo tanks equipped with submerged electric motor pumps shall be inerted to a positive pressure prior to loading, during carriage and during unloading of flammable liquids.	17.11 Maximum allowable quantity of cargo per tank When carrying a cargo referenced to this section the quantity of the cargo should not exceed 3,000 m³ in any one tank.	
17.11.2	The cargo shall be discharged only by deepwell pumps or by hydraulically operated submerged pumps. These pumps shall be of a type designed to avoid liquid pressure against the shaft gland.	17.12 Submerged electric cargo pumps 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.	
17.11.3	Inert gas displacement may be used for discharging cargo from type C independent tanks provided the cargo system is designed for the expected pressure.		
17.12	**Ammonia**	17.13 Ammonia	
17.12.1	Anhydrous ammonia may cause stress corrosion cracking in	17.13.1 Anhydrous ammonia may cause stress corrosion	

	New IGC Code	Old IGC Code	Remarks
	containment and process systems made of carbon-manganese steel or nickel steel. To minimize the risk of this occurring, measures detailed in 17.12.2 to 17.12.8 shall be taken, as appropriate.	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.	
17.12.2	Where carbon-manganese steel is used, cargo tanks, process pressure vessels and cargo piping shall be made of fine-grained steel with a specified minimum yield strength not exceeding 355 N/mm2, and with an actual yield strength not exceeding 440 N/mm2. One of the following constructional or operational measures shall also be taken: .1 lower strength material with a specified minimum tensile strength not exceeding 410 N/mm2 shall be used; or .2 cargo tanks, etc., shall be post-weld stress relief heat treated; or .3 carriage temperature shall 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 .4 the ammonia shall contain not less than 0.1% w/w water and the master shall be provided with documentation confirming this.	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/mm²and with an actual yield strength not exceeding 440 N/mm². One of the following constructional or operational measures should also be taken: .1 lower strength material with a specified minimum tensile strength not exceeding 410 N/mm²should be used; or .2 cargo tanks, etc., should be post weld stress relief heat treated: or .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 .4 the ammonia should contain not less than 0.1% w/w water.	
17.12.3	If carbon-manganese steels with higher yield properties are used other than those specified in 17.12.2, the completed cargo tanks, piping, etc., shall be given a post-weld stress relief heat treatment.	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.	
17.12.4	Process pressure vessels and piping of the condensate part of the refrigeration system shall be given a post-weld stress relief heat treatment when made of materials mentioned in 17.12.1.	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	

	New IGC Code	Old IGC Code	Remarks
		of materials mentioned in 17.13.1.	
17.12.5	The tensile and yield properties of the welding consumables shall exceed those of the tank or piping material by the smallest practical amount.	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.	
17.12.6	Nickel steel containing more than 5 per cent nickel and carbon-manganese steel, not complying with the requirements of 17.12.2 and 17.12.3, are particularly susceptible to ammonia stress corrosion cracking and shall not be used in containment and piping systems for the carriage of this product.	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.	
17.12.7	Nickel steel containing not more than 5 per cent nickel may be used provided the carriage temperature complies with the requirements specified in 17.12.2.3.	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.	
17.12.8	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:	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 the carriage temperature T in the table below: T (°C) / 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 Oxygen percentages for intermediate temperatures may be obtained by direct interpolation.	

	New IGC Code	Old IGC Code	Remarks
	<table><tr><th>T (°C)</th><th>O_2 (% v/v)</th></tr><tr><td>-30 and below -20 -10 0 +10 +20 +30</td><td>0.90 0.50 0.28 0.16 0.10 0.05 0.03</td></tr></table>		
17.12.9	Oxygen percentages for intermediate temperatures may be obtained by direct interpolation.		
17.13	**Chlorine**	17.14 Chlorine	
17.13.1	*Cargo containment system*	17.14.1 Cargo containment system	
17.13.1.1	The capacity of each tank shall not exceed 600 m3 and the total capacity of all cargo tanks shall not exceed 1,200 m3.	17.14.1.1 The capacity of each tank should not exceed 600m³ and the total capacity of all cargo tanks should not exceed 1,200m³.	
17.13.1.2	The tank design vapour pressure shall not be less than 1.35 MPa (see also 7.1.2 and 17.3.2).	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).	
17.13.1.3	Parts of tanks protruding above the upper deck shall be provided with protection against thermal radiation, taking into account total engulfment by fire.	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.	
17.13.1.4	Each tank shall be provided with two PRVs. A bursting disc of appropriate material shall be installed between the tank and the PRVs. The rupture pressure of the bursting disc shall be 1 bar lower than the opening pressure of the pressure relief valve, which shall be set at the design vapour pressure of the tank but	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	

	New IGC Code	Old IGC Code	Remarks
	not less than 1.35 MPa bar gauge. The space between the bursting disc and the relief valve shall be connected through an excess flow valve to a pressure gauge and a gas detection system. Provision shall be made to keep this space at or near the atmospheric pressure during normal operation.	pressure of the tank but not less than 13.5 bar. 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.	
17.13.1.5	Outlets from PRVs shall 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 shall be led through the absorption plant to reduce the gas concentration as far as possible. The relief valve exhaust line shall 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.	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.	
17.13.1.6	The Administration and the port Administration may require that chlorine is carried in a refrigerated state at a specified maximum pressure.	17.14.1.6 The Administration and the port Administration may require that chlorine is carried in refrigerated state at a specified maximum pressure.	
17.13.2	*Cargo piping systems*	17.14.2 Cargo piping systems	
17.13.2.1	Cargo discharge shall be performed by means of compressed chlorine vapour from shore, dry air or another acceptable gas, or fully submerged pumps. Cargo discharge compressors on board ships shall not be used for this. The pressure in the vapour space of the tank during discharging shall not exceed 1.05 MPa.	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.	
17.13.2.2	The design pressure of the cargo piping system shall be not less	17.14.2.2 The design pressure of the cargo piping system	

	New IGC Code	Old IGC Code	Remarks
	than 2.1 MPa. The internal diameter of the cargo pipes shall not exceed 100 mm. Only pipe bends shall be accepted for compensation of pipeline thermal movement. The use of flanged joints shall be restricted to a minimum and, when used the flanges, shall be of the welding neck type with tongue and groove.	should be not less than 21 bar. 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.	
17.13.2.3	Relief valves of the cargo piping system shall discharge to the absorption plant, and the flow restriction created by this unit shall be taken into account when designing the relief valve system (see also 8.2.18).	17.14.2.3 Relief valves of the cargo piping system should discharge to the absorption plant (see also 8.2.16).	
17.13.3	*Materials*		
17.13.3.1	The tanks shall be thermally stress relieved. Mechanical stress relief shall not be accepted as an equivalent.	17.14.3 Materials 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. 17.14.3.2 The tanks should be thermally stress-relieved. Mechanical stress relief should not be accepted as an equivalent.	
17.13.4	*Instrumentation – safety devices*	17.14.4 Instrumentation - safety devices	
17.13.4.1	The ship shall be provided with a chlorine absorbing plant with a connection to the cargo piping system and the cargo tanks. The absorbing plant shall be capable of neutralizing at least 2 per cent of the total cargo capacity at a reasonable absorption rate.	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.	
17.13.4.2	During the gas-freeing of cargo tanks, vapours shall not be discharged to the atmosphere.	17.14.4.2 During the gas-freeing of cargo tanks, vapours should not be discharged to the atmosphere.	

	New IGC Code	Old IGC Code	Remarks
17.13.4.3	A gas detecting system shall be provided that is capable of monitoring chlorine concentrations of at least 1 ppm by volume. Sample points shall be located: .1 near the bottom of the hold spaces; .2 in the pipes from the safety relief valves; .3 at the outlet from the gas absorbing plant; .4 at the inlet to the ventilation systems for the accommodation, service and machinery spaces and control stations; and .5 on deck – at the forward end, midships and the after end of the cargo area. This is only required to be used during cargo handling and gas-freeing operations. The gas detection system shall be provided with an audible and visual alarm with a set point of 5 ppm	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 : .1 near the bottom of the hold spaces ; .2 in the pipes from the safety relief valves ; .3 at the outlet from the gas absorbing plant ; .4 at the inlet to the ventilation systems for the accommodation, service and machinery spaces and control stations ; .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). The gas detection system should be provided with an audible and visual alarm with a set point of 5 ppm.	
17.13.4.4	Each cargo tank shall be fitted with a high-pressure alarm giving an audible alarm at a pressure equal to 1.05 MPa.	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.	
17.13.5	*Personnel protection* The enclosed space required by 17.5.5 shall meet the following requirements: .1 the space shall be easily and quickly accessible from the weather decks and from accommodation spaces by means of air locks and shall be capable of being rapidly closed gastight; .2 one of the decontamination showers required by 14.4.2 shall be located near the weather decks airlock to the space; .3 the space shall be so designed to accommodate the entire crew of the ship and be provided with a source of	17.14.5 Personnel Protection In addition to the requirements given in Chapter 14 the following requirements should be met : .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	

	New IGC Code	Old IGC Code	Remarks
	uncontaminated air for a period of not less than 4 hours; and .4 one set of oxygen therapy equipment shall be carried in the space.	less than 4 hours. One of the decontamination showers required by 14.4.3 should be located near the air lock to the space. .2 A compressor and the necessary equipment for filling the air bottles should be provided. .3 One set of oxygen therapy equipment should be carried in the space referred to in 17.14.5.1.	
17.13.6	Filling limits for cargo tanks	17.14.6 Filling limits for cargo tanks	
17.13.6.1	The requirements of 15.1.3.2 do not apply when it is intended to carry chlorine.	17.14.6.1 The requirements of 15.1.4.2 do not apply when it is intended to carry chlorine.	
17.13.6.2	The chlorine content of the gas in the vapour space of the cargo tank after loading shall be greater than 80 per cent by volume.	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.	
17.14	**Ethylene oxide**	17.16 Ethylene oxide	
17.14.1	For the carriage of ethylene oxide the requirements of 17.18 shall apply, with the additions and modifications as given in this section.	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.	
17.14.2	Deck tanks shall not be used for the carriage of ethylene oxide.	17.16.2 Deck tanks should not be used for the carriage of ethylene oxide.	
17.14.3	Stainless steels types 416 and 442, as well as cast iron, shall not be used in ethylene oxide cargo containment and piping systems.	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.	
17.14.4	Before loading, tanks shall be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate prior cargo has been ethylene oxide, propylene oxide or mixtures of these products. Particular care shall be taken in the case of ammonia in tanks made of steel other than stainless steel.	17.16.4 Before loading, tanks should be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate prior cargo has been ethylene oxide, propylene oxide or mixtures of these products. Particular care should be taken in the case of ammonia in tanks	

	New IGC Code	Old IGC Code	Remarks
		made of steel other than stainless steel tanks.	
17.14.5	Ethylene oxide shall be discharged only by deepwell pumps or inert gas displacement. The arrangement of pumps shall comply with 17.18.15.	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.	
17.14.6	Ethylene oxide shall be carried refrigerated only and maintained at temperatures of less than 30°C.	17.16.6 Ethylene oxide should be carried refrigerated only and maintained at temperatures of less than 30°C.	
17.14.7	PRVs shall be set at a pressure of not less than 0.55 MPa. The maximum set pressure shall be specially approved by the Administration.	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.	
17.14.8	The protective padding of nitrogen gas, as required by 17.18.27, shall be such that the nitrogen concentration in the vapour space of the cargo tank will at no time be less than 45 per cent by volume.	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.	
17.14.9	Before loading, and at all times when the cargo tank contains ethylene oxide liquid or vapour, the cargo tank shall be inerted with nitrogen.	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.	
17.14.10	The water-spray system required by 17.18.29 and that are required by 11.3 shall operate automatically in a fire involving the cargo containment system.	17.16.10 The water spray system required by 17.20.17 and that required by 11.3 should operate automatically in a fire involving the cargo containment system.	
17.14.11	A jettisoning arrangement shall be provided to allow the emergency discharge of ethylene oxide in the event of uncontrollable self-reaction.	17.16.11 A jettisoning arrangement should be provided to allow the emergency discharge of ethylene oxide in the event of uncontrollable self-reaction.	
17.15	***Separate piping systems*** Separate piping systems, as defined in 1.2.48 shall be provided.		
17.16	**Methyl acetylene-propadiene mixtures**	17.18 Methyl acetylene-propadiene mixtures	
17.16.1	Methyl acetylene-propadiene mixtures shall be suitably stabilized for transport. Additionally, upper limits of temperatures and	17.18.1 Methyl acetylene-propadiene mixtures should be suitable stabilized for transport. Additionally, upper limits	

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	pressure during the refrigeration shall be specified for the mixtures.	of temperature and pressure during the refrigeration should be specified for the mixtures.	
17.16.2	Examples of acceptable, stabilized compositions are: .1 *Composition 1;* .1.1 maximum methyl acetylene to propadiene molar ratio of 3 to 1; .1.2 maximum combined concentration of methyl acetylene and propadiene of 65 mol per cent; .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) shall be butanes and one third propane; .1.4 maximum combined concentration of propylene and butadiene of 10 mol per cent; .2 *Composition 2;* .2.1 maximum methyl acetylene and propadiene combined concentration of 30 mol per cent; .2.2 maximum methyl acetylene concentration of 20 mol per cent; .2.3 maximum propadiene concentration of 20 mol per cent; .2.4 maximum propylene concentration of 45 mol per cent; .2.5 maximum butadiene and butylenes combined concentration of 2 mol per cent; .2.6 minimum saturated C4 hydrocarbon concentration of 4 mol per cent; and .2.7 minimum propane concentration of 25 mol per cent.	17.18.2 Examples of acceptable, stabilized compositions are : .1 Composition 1 .1.1 maximum methyl acetylene to propadiene molar ratio of 3 to 1 ; .1.2 maximum combined concentration of methyl acetylene and propadiene of 65 mol percent, .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 .1.4 maximum combined concentration of propylene and butadiene of 10 mol percent. .2 Composition 2 .2.1 maximum methyl acetylene and propadiene combined concentration of 30 mol percent ; .2.2 maximum methyl acetylene concentration of 20 mol percent ; .2.3 maximum propadiene concentration of 20 mol percent ; .2.4 maximum propylene concentration of 45 mol percent ; .2.5 maximum butadiene and butylenes combined concentration of 2 mol percent ; .2.6 minimum saturated C4 hydrocarbon concentration of 4 mol percent ; and .2.7 minimum propane concentration of 25 mol percent.	

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17.16.3	17.16.3 Other compositions may be accepted provided the stability of the mixture is demonstrated to the satisfaction of the Administration.	17.18.3 Other compositions may be accepted provided the stabilityof the mixture is demonstrated to the satisfaction of the Administration.	
17.16.4	If a ship has a direct vapour compression refrigeration system this shall comply with the following requirements, subject to pressure and temperature limitations depending on the composition. For the example, the compositions given in 17.16.2, the following features shall be provided: .1 a vapour compressor that does not raise the temperature and pressure of the vapour above 60oC and 1.75 MPa during its operation, and that does not allow vapour to stagnate in the compressor while it continues to run; .2 discharge piping from each compressor stage or each cylinder in the same stage of a reciprocating compressor shall have: .2.1 two temperature-actuated shutdown switches set to operate at 60oC or less; .2.2 a pressure-actuated shutdown switch set to operate at 1.75 MPa bar gauge or less; .2.3 a safety relief valve set to relieve at 1.8 MPa bar gauge or less; .3 the relief valve required by 17.16.4.2.3 shall vent to a mast meeting the requirements of 8.2.10, 8.2.11 and 8.2.15 and shall not relieve into the compressor suction line; and .4 an alarm that sounds in the cargo control position and in the navigating bridge when a high-pressure switch, or a	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 17.18.4.2, the following features should be provided : .1 A vapour compressor that does not raise the temperatureand 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. .2 Discharge piping from each compressor stage or each cylinder in the same stage of a reciprocating compressor should have: .2.1 two temperature-actuated shutdown switches set to operate at 60°C or less ; .2.2 a pressure-actuated shutdown switch set to operate at 17.5 bar gauge or less ; and .2.3 a safety relief valve set to relieve at 18.0 bar gauge or less. .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 .14 and should not relieve into the	

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	high-temperature switch, operates.	compressor suction line. .4 An alarm that sounds inthe cargo control position and in the navigating bridge when a high pressure switch, or a high-temperature switch operates.	
17.16.5	The piping system, including the cargo refrigeration system, for tanks to be loaded with methyl acetylene-propadiene mixtures shall be either independent (as defined in 1.2.28) or separate (as defined in 1.2.48) from piping and refrigeration systems for other tanks. This segregation shall apply to all liquid and vapour vent lines and any other possible connections, such as common inert gas supply lines.	17.18.5 The piping system, including the cargo refrigeration system, for tanks to be loaded with methyl acetylene-propadiene mixtures should be completely separate from piping and refrigeration systems for other tanks. If the piping system for the tanks to be loaded with methyl acetylene-propadiene mixture is not independent, 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 vent lines and any other possible connexions such as common inert gas supply lines.	
17.17	**Nitrogen** Materials of construction and ancillary equipment such as insulation shall 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 shall be given to ventilation in such areas, where condensation might occur, to avoid the stratification of oxygen-enriched atmosphere.	17.19 Mitrogen Materials of construction and ancillary equipmentsuch 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.	
17.18	**Propylene oxide and mixtures of ethylene oxide-propylene oxide with ethylene oxide content of not more than 30% by weight**	17.20 Propylene oxide and mixtures of ethylene oxide/propylene oxide with ethylene oxide content of not more than 30 per cent by volume	

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		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.	
17.18.1	Products transported under the provisions of this section shall be acetylene-free.	17.20.1 Products transported under the provisions of this section should be acetylene-free	
17.18.2	Unless cargo tanks are properly cleaned, these products shall not be carried in tanks that have contained as one of the three previous cargoes any product known to catalyse polymerization,	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	

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	such as: .1 anhydrous ammonia and ammonia solutions; .2 amines and amine solutions; and .3 oxidizing substances (e.g. chlorine).	product known to catalyse polymerization, such as : .1 anhydrous ammonia and ammonia solutions ; .2 amines and amine solutions ; .3 oxidizing substances (e.g. chlorine).	
17.18.3	Before loading, tanks shall be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate 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.	17.20.2.2 Before loading, tanks should be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate prior cargo has been propylene oxide 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 tanks.	
17.18.4	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.	17.20.2.3 In all cases, the effectiveness of cleaning procedures for tanks and associated pipework should be checked by suitable testing or inspection to ascertain that no traces of acidic or alkaline materials remain that might create a hazardous situation in the presence of these products.	
17.18.5	Tanks shall 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 shall be performed at intervals of not more than two years.	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.	
17.18.6	Tanks for the carriage of these products shall be of steel or stainless steel construction.	17.20.2.5 Tanks for the carriage of these products should be of steel or strainless steel construction.	
17.18.7	Tanks that have contained these products may be used for other cargoes after thorough cleaning of tanks and associated pipework	17.20.2.6 Tanks which have contained these products may be used for other cargoes after thorough cleaning of	

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	systems by washing or purging.	tanks and associated pipework systems by washing or purging.	
17.18.8	All valves, flanges, fittings and accessory equipment shall be of a type suitable for use with these products and shall be constructed of steel or stainless steel in accordance with recognized standards. Disc or disc faces, seats and other wearing parts of valves shall be made of stainless steel containing not less than 11 per cent chromium.	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.	
17.18.9	Gaskets shall be constructed of materials which do not react with, dissolve in, or lower the autoignition temperature of these products and which are fire-resistant and possess adequate mechanical behaviour. The surface presented to the cargo shall be polytetrafluoroethylene (PTFE) or materials giving a similar degree of safety by their inertness. Spirally-wound stainless steel with a filler of PTFE or similar fluorinated polymer may be accepted if approved by the Administration or recognized organization acting on its behalf.	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 polytetrafluorethylene (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.	
17.18.10	Insulation and packing if used shall be of a material which does not react with, dissolve in, or lower the auto-ignition temperature of these products.	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.	
17.18.11	The following materials are generally found unsatisfactory for use in gaskets, packing and similar uses in containment systems for these products and would require testing before being approved: .1 neoprene or natural rubber it if comes into contact with the products; .2 asbestos or binders used with asbestos; and	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. .1 Neoprene or natural rubber if it comes into contact with	

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	.3 materials containing oxides of magnesium, such as mineral wools.	the products ; .2 Asbestos or binders used with asbestos ; .3 Materials containing oxides of magnesium, such as mineral wools.	
17.18.12	Filling and discharge piping shall extend to within 100 mm of the bottom of the tank or any sump.	17.20.4 Filling and discharge piping should extend to within 100mmof the bottom of the tank or any sump.	
17.18.13	The products shall be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a containment system for the product shall be independent of all other containment systems.	17.20.5.1 The products should be loaded and discharge 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.	
17.18.14	During discharging operations, the pressure in the cargo tank shall be maintained above 0.007 MPa.	17.20.5.2 During discharging operations, the pressure in the cargo tank should be maintained above 0.07 bar.	
17.18.15	The cargo shall be discharged only by deepwell pumps, hydraulically operated submerged pumps, or inert gas displacement. Each cargo pump shall be arranged to ensure that the product does not heat significantly if the discharge line from the pump is shut off or otherwise blocked.	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.	
17.18.16	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.	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.	
17.18.17	Cargo hoses used for transfer of these products shall be marked "FOR ALKYLENE OXIDE TRANSFER ONLY".	17.20.7 Cargo hoses used for transfer of these products should be marked "FOR ALKYLENE OXIDE TRANSFER ONLY"	

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17.18.18	Hold spaces shall be monitored for these products. Hold spaces surrounding type A and B independent tanks shall also be inerted and monitored for oxygen. The oxygen content of these spaces shall be maintained below 2 per cent by volume. Portable sampling equipment is satisfactory.	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.	
17.18.19	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.	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.	
17.18.20	Tanks shall be designed for the maximum pressure expected to be encountered during loading, carriage or unloading of cargo.	17.20.10 Tanks should be designed for the maximum pressure expected to be encountered during loading, carriage or unloading of cargo.	
17.18.21	Tanks for the carriage of propylene oxide with a design vapour pressure of less than 0.06 MPa, and tanks for the carriage of ethylene oxide-propylene oxide mixtures with a design vapour pressure of less than 0.12 MPa, shall have a cooling system to maintain the cargo below the reference temperature. For reference temperatures see 15.1.3.	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 temperaturesee 15.1.4.1.	
17.18.22	Pressure relief valve settings shall not be less than 0.02 MPa; for type C independent cargo tanks not greater than 0.7 MPa for the carriage of propylene oxide and not greater than 0.53 MPa for the carriage of ethylene oxide-propylene oxide mixtures.	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.	
17.18.23	The piping system for tanks to be loaded with these products shall be completely separate from piping systems for all other	17.20.13.1 The piping system for tanks to be loaded with these products should be completely separate from	

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	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 1.2.28, the required piping separation shall 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.	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 17.3.20 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.	
17.18.24	The products shall be transported only in accordance with cargo handling plans approved by the Administration. Each intended loading arrangement shall be shown on a separate cargo handling plan. Cargo handling plans shall show the entire cargo piping system and the locations for installation of the blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan shall be kept on board the ship. The International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk shall be endorsed to include references to the approved cargo handling plans.	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.	
17.18.25	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	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	

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	and carried on board the ship. Each connection between a blank flange and pipeline flange shall be fitted with a wire and seal by the responsible person to ensure that inadvertent removal of the blank flange is impossible.	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.	
17.18.26	The maximum allowable loading limits for each tank shall be indicated for each loading temperature that may be applied, in accordance with 15.5.	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.	
17.18.27	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 0.07 MPa in the event of product temperature fall due to ambient conditions or malfunctioning of refrigeration system. 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.	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.	
17.18.28	The cargo tank vapour space shall be tested prior to and after loading to ensure that the oxygen content is 2 per cent by volume or less.		

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17.18.29	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 //m2 per minute. The arrangement shall ensure that any spilled cargo is washed away.	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 10ℓ/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 operation.	
17.18.30	The water spray system shall be capable of local and remote manual operation in case of a fire involving the cargo containment system. Remote manual operation shall be arranged such that the 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		

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	readily accessible and operable in the event of fire in the areas protected.		
17.18.31	When ambient temperatures permit, a pressurized water hose ready for immediate use shall be available during loading and unloading operations, in addition to the water spray requirements above.		
17.19	**Vinyl chloride** In cases where polymerization of vinyl chloride is prevented by addition of an inhibitor, 17.8 is applicable. In cases where no inhibitor has been added, or the inhibitor concentration is insufficient, any inert gas used for the purposes of 17.6 shall contain no more oxygen	17.21 Vinyl chloride 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 analysed. When vinyl chloride is carried, a positive pressure should always be maintained in the tanks, also during ballast voyages between successive carriages.	
17.20	**17.20 Mixed C4 cargoes**		
17.20.1	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 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		

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	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.		
17.20.2	If the mixed C4 cargo shipped under the terms of this section contains more than 50 per cent (mole) of butadiene, the inhibitor precautions in 17.8 shall apply.		
17.20.3	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 per cent concentration of the component with the highest expansion ratio.		
17.21	**17.21 Carbon dioxide – high purity**		
17.21.1	Uncontrolled pressure loss from the cargo can cause 'sublimation' and the cargo will change from the liquid to the solid state. The precise 'triple point' temperature of a particular carbon dioxide cargo shall be supplied before loading the cargo, and will depend on the purity of that cargo, and this shall be taken into account when cargo instrumentation is adjusted. The set pressure for the alarms and automatic actions described in this section shall be set to at least 0.05 MPa above the triple point for the specific cargo being carried. The 'triple point' for pure carbon dioxide occurs at 0.05 MPa and -54.4°C.		
17.21.2	There is a potential for the cargo to solidify in the event that a cargo tank relief valve, fitted in accordance with 8.2, fails in the open position. To avoid this, a means of isolating the cargo tank safety valves shall be provided and the requirements of 8.2.9.2 of this Code do not apply when carrying this carbon dioxide.		

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	Discharge piping from safety relief valves shall be designed so they remain free from obstructions that could cause clogging. Protective screens shall not be fitted to the outlets of relief valve discharge piping, so the requirements of 8.2.15 of this Code do not apply.		
17.21.3	Discharge piping from safety relief valves are not required to comply with 8.2.10, but shall be designed so they remain free from obstructions that could cause clogging. Protective screens shall not be fitted to the outlets of relief valve discharge piping, so the requirements of 8.2.15 of this Code do not apply.		
17.21.4	Cargo tanks shall be continuously monitoring for low pressure when a carbon dioxide cargo is carried. An audible and visual alarm shall be given at the cargo control position and on the bridge. If the cargo tank pressure continues to fall to within 0.05 MPa of the 'triple point' for the particular cargo, the monitoring system shall automatically close all cargo manifold liquid and vapour valves and stop all cargo compressors and cargo pumps. The emergency shutdown system required by 18.10 of this Code may be used for this purpose.		
17.21.5	All materials used in cargo tanks and cargo piping system shall be suitable for the lowest temperature that may occur in service, which is defined as the saturation temperature of the carbon dioxide cargo at the set pressure of the automatic safety system described in 17.21.1 above.		
17.21.6	Cargo hold spaces, cargo compressor rooms and other enclosed spaces where carbon dioxide could accumulate shall be fitted		

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	with continuous monitoring for carbon dioxide build-up. This fixed gas detection system replaces the requirements of 13.6 of this Code, and hold spaces shall be monitored permanently even if the ship has type C cargo containment.		
17.22	**Carbon dioxide – reclaimed quality**		
17.22.1	The requirements of 17.21 also apply to this cargo. In addition, the materials of construction used in the cargo system shall also take account of the possibility of corrosion in case the Reclaimed Quality Carbon Dioxide cargo contains impurities such as water, Sulphur Dioxide, etc., which can cause acidic corrosion or other problems.		