

## **Part B - Prevention of Fire and Explosion**

### **Regulation 4 - Probability of Ignition**

#### **1. Purpose**

*The purpose of this regulation is to prevent the ignition of combustible materials or flammable liquids. For this purpose, the following functional requirements shall be met:*

- 1.1 means shall be provided to control leaks of flammable liquids;*
- 1.2 means shall be provided to limit the accumulation of flammable vapours;*
- 1.3 the ignitability of combustible materials shall be restricted;*
- 1.4 ignition sources shall be restricted;*
- 1.5 ignition sources shall be separated from combustible materials and flammable liquids;  
and*
- 1.6 the atmosphere in cargo tanks shall be maintained out of the explosive range.*

#### **2. Arrangements for oil fuel, lubrication oil and other flammable oils**

##### *2.1 Limitations in the use of oils as fuel*

*The following limitations shall apply to the use of oil as fuel:*

- 2.1.1 except as otherwise permitted by this paragraph, no oil fuel with a flashpoint of less than 60°C shall be used;\**

*\* Refer to the Recommended procedures to prevent the illegal or accidental use of low flashpoint cargo oil as fuel adopted by the Organization by resolution A.565(14).*

- 2.1.2 in emergency generators, oil fuel with a flashpoint of not less than 43°C may be used;*
- 2.1.3 the use of oil fuel having a flashpoint of less than 60°C but not less than 43°C may be permitted (e.g., for feeding the emergency fire pump's engines and the auxiliary machines which are not located in the machinery spaces of category A) subject to the following:*
  - 2.1.3.1 fuel oil tanks except those arranged in double bottom compartments shall be located outside of machinery spaces of category A;*
  - 2.1.3.2 provisions for the measurement of oil temperature are provided on the suction pipe of the oil fuel pump;*
  - 2.1.3.3 stop valves and/or cocks are provided on the inlet side and outlet side of the oil fuel strainers; and*
  - 2.1.3.4 pipe joints of welded construction or of circular cone type or spherical type union joint are applied as much as possible; and*

- 2.1.4 *in cargo ships the use of fuel having a lower flashpoint than otherwise specified in paragraph 2.1, for example crude oil, may be permitted provided that such fuel is not stored in any machinery space and subject to the approval by the Administration of the complete installation.*

## *2.2 Arrangements for oil fuel*

*In a ship in which oil fuel is used, the arrangements for the storage, distribution and utilisation of the oil fuel shall be such as to ensure the safety of the ship and persons on board and shall at least comply with the following provisions.*

### *2.2.1 Location of oil fuel systems*

*As far as practicable, parts of the oil fuel system containing heated oil under pressure exceeding 0.18 N/mm<sup>2</sup> shall not be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system shall be adequately illuminated.*

### *2.2.2 Ventilation of machinery spaces*

*The ventilation of machinery spaces shall be sufficient under normal conditions to prevent accumulation of oil vapour.*

### *2.2.3 Oil fuel tanks*

- 2.2.3.1 *Fuel oil, lubrication oil and other flammable oils shall not be carried in forepeak tanks.*

- 2.2.3.2 *As far as practicable, oil fuel tanks shall be part of the ship's structure and shall be located outside machinery spaces of category A. Where oil fuel tanks, other than double bottom tanks, are necessarily located adjacent to or within machinery spaces of category A, at least one of their vertical sides shall be contiguous to the machinery space boundaries, and shall preferably have a common boundary with the double bottom tanks, and the area of the tank boundary common with the machinery spaces shall be kept to a minimum. Where such tanks are situated within the boundaries of machinery spaces of category A they shall not contain oil fuel having a flashpoint of less than 60°C. In general, the use of free-standing oil fuel tanks shall be avoided. When such tanks are employed their use shall be prohibited in category A machinery spaces on passenger ships. Where permitted, they shall be placed in an oil-tight spill tray of ample size having a suitable drain pipe leading to a suitably sized spill oil tank.*

- 2.2.3.3 *No oil fuel tank shall be situated where spillage or leakage therefrom can constitute a fire or explosion hazard by falling on heated surfaces.*

- 2.2.3.4 *Oil fuel pipes, which, if damaged, would allow oil to escape from a storage, settling or daily service tank having a capacity of 500 l and above situated above the double bottom, shall be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel or similar space, valves on the tank shall be fitted, but control in the event of fire may be effected by means of an additional valve on the pipe or pipes outside the tunnel or similar space. If such an additional valve is fitted in the machinery space it shall be operated from a position outside this space. The controls for remote operation of the valve for the emergency*

*generator fuel tank shall be in a separate location from the controls for remote operation of other valves for tanks located in machinery spaces.*

*2.2.3.5 Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank shall be provided.*

*2.2.3.5.1 Where sounding pipes are used, they shall not terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they shall not terminate in passenger or crew spaces. As a general rule, they shall not terminate in machinery spaces. However, where the Administration considers that these latter requirements are impracticable, it may permit termination of sounding pipes in machinery spaces on condition that all of the following requirements are met:*

*2.2.3.5.1.1 an oil-level gauge is provided meeting the requirements of paragraph 2.2.3.5.2;*

*2.2.3.5.1.2 the sounding pipes terminate in locations remote from ignition hazards unless precautions are taken, such as the fitting of effective screens, to prevent the oil fuel in the case of spillage through the terminations of the sounding pipes from coming into contact with a source of ignition; and*

*2.2.3.5.1.3 the terminations of sounding pipes are fitted with self-closing blanking devices and with a small-diameter self-closing control cock located below the blanking device for the purpose of ascertaining before the blanking device is opened that oil fuel is not present. Provisions shall be made so as to ensure that any spillage of oil fuel through the control cock involves no ignition hazard.*

*2.2.3.5.2 Other oil-level gauges may be used in place of sounding pipes subject to the following conditions:*

*2.2.3.5.2.1 in passenger ships, such gauges shall not require penetration below the top of the tank and their failure or overfilling of the tanks shall not permit release of fuel; and*

*2.2.3.5.2.2 in cargo ships, the failure of such gauges or overfilling of the tank shall not permit release of fuel into the space. The use of cylindrical gauge glasses is prohibited. The Administration may permit the use of oil-level gauges with flat glasses and self-closing valves between the gauges and fuel tanks.*

*2.2.3.5.3 The means prescribed in paragraph 2.2.3.5.2 which are acceptable to the Administration shall be maintained in the proper condition to ensure their continued accurate functioning in service.*

#### *2.2.4 Prevention of overpressure*

*Provisions shall be made to prevent overpressure in any oil tank or in any part of the oil fuel system, including the filling pipes served by pumps on board. Air and overflow pipes and relief valves shall discharge to a position where there is no risk of fire or explosion from the emergence of oils and vapour and shall not lead into crew spaces, passenger spaces nor into special category spaces, closed ro-ro spaces, machinery spaces or similar spaces.*

#### *2.2.5 Oil fuel piping*

*2.2.5.1 Oil fuel pipes and their valves and fittings shall be of steel or other approved material, except that restricted use of flexible pipes shall be permissible in positions*

where the Administration is satisfied that they are necessary.\* Such flexible pipes and end attachments shall be of approved fire-resisting materials of adequate strength and shall be constructed to the satisfaction of the Administration. For valves fitted to oil fuel tanks and are under static pressure, steel or spheroidal-graphite cast iron may be accepted. However, ordinary cast iron valves may be used in piping systems where the design pressure is lower than 7 bar and the design temperature is below 60°C.

\* Refer to recommendations published by the International Organization for Standardization, in particular publications ISO 15540:1999, Test methods for fire resistance of hose assemblies and ISO 15541:1999, Requirements for the test bench of fire resistance of hose assemblies.

2.2.5.2 External high-pressure fuel delivery lines between the high-pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high-pressure line failure. A jacketed pipe incorporates an outer pipe into which the high-pressure fuel pipe is placed, forming a permanent assembly. The jacketed piping system shall include a means for collection of leakages and arrangements shall be provided with an alarm in case of a fuel line failure.

2.2.5.2 Oil fuel lines shall not be located immediately above or near units of high temperature, including boilers, steam pipelines, exhaust manifolds, silencers or other equipment required to be insulated by paragraph 2.2.6. As far as practicable, oil fuel lines shall be arranged far apart from hot surfaces, electrical installations or other sources of ignition and shall be screened or otherwise suitably protected to avoid oil spray or oil leakage onto the sources of ignition. The number of joints in such piping systems shall be kept to a minimum.

2.2.5.3 Components of a diesel engine fuel system shall be designed considering the maximum peak pressure which will be experienced in service, including any high-pressure pulses which are generated and transmitted back into the fuel supply and spill lines by the action of fuel injection pumps. Connections within the fuel supply and spill lines shall be constructed having regard to their ability to prevent pressurised oil fuel leaks while in service and after maintenance.

2.2.5.4 In multi-engine installations which are supplied from the same fuel source, means of isolating the fuel supply and spill piping to individual engines, shall be provided. The means of isolation shall not affect the operation of the other engines and shall be operable from a position not rendered inaccessible by a fire on any of the engines.

2.2.5.5 Where the Administration may permit the conveying of oil and combustible liquids through accommodation and service spaces, the pipes conveying oil or combustible liquids shall be of a material approved by the Administration having regard to the fire risk.

## 2.2.6 Protection of high-temperature surfaces

2.2.6.1 Surfaces with temperatures above 220°C which may be impinged as a result of a fuel system failure shall be properly insulated.

2.2.6.2 Precautions shall be taken to prevent any oil that may escape under pressure from any pump, filter or heater from coming into contact with heated surfaces.

## 2.3 Arrangements for lubricating oil

2.3.1 *The arrangements for the storage, distribution and utilisation of oil used in pressure lubrication systems shall be such as to ensure the safety of the ship and persons on board. The arrangements made in machinery spaces of category A, and whenever practicable in other machinery spaces, shall at least comply with the provisions of paragraphs 2.2.1, 2.2.3.3, 2.2.3.4, 2.2.3.5, 2.2.4, 2.2.5.1, 2.2.5.3 and 2.2.6, except that:*

2.3.1.1 *this does not preclude the use of sight flow glasses in lubricating systems provided that they are shown by testing to have a suitable degree of fire resistance; and*

2.3.1.2 *sounding pipes may be authorized in machinery spaces; however, the requirements of paragraphs 2.2.3.5.1.1 and 2.2.3.5.1.3 need not be applied on condition that the sounding pipes are fitted with appropriate means of closure.*

2.3.2 *The provisions of paragraph 2.2.3.4 shall also apply to lubricating oil tanks except those having a capacity less than 500 l, storage tanks on which valves are closed during the normal operation mode of the ship, or where it is determined that an unintended operation of a quick-closing valve on the oil lubricating tank would endanger the safe operation of the main propulsion and essential auxiliary machinery.*

#### **2.4 Arrangements for other flammable oils**

*The arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems shall be such as to ensure the safety of the ship and persons on board. Suitable oil collecting arrangements for leaks shall be fitted below hydraulic valves and cylinders. In locations where means of ignition are present, such arrangements shall at least comply with the provisions of paragraphs 2.2.3.3, 2.2.3.5, 2.2.5.3 and 2.2.6 and with the provisions of paragraphs 2.2.4 and 2.2.5.1 in respect of strength and construction.*

#### **2.5 Arrangements for oil fuel in periodically unattended machinery spaces**

*In addition to the requirements of paragraphs 2.1 to 2.4, the oil fuel and lubricating oil systems in a periodically unattended machinery space shall comply with the following:*

2.5.1 *where daily service oil fuel tanks are filled automatically, or by remote control, means shall be provided to prevent overflow spillages. Other equipment which treats flammable liquids automatically (e.g., oil fuel purifiers) which, whenever practicable, shall be installed in a special space reserved for purifiers and their heaters, shall have arrangements to prevent overflow spillages; and*

2.5.2 *where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high temperature alarm shall be provided if the flashpoint of the oil fuel can be exceeded.*

### **3. Arrangements for gaseous fuel for domestic purposes**

*Gaseous fuel systems used for domestic purposes shall be approved by the Administration. Storage of gas bottles shall be located on the open deck or in a well ventilated space which opens only to the open deck.*

### **4. Miscellaneous items of ignition sources and ignitability**

#### **4.1 Electric radiators**

*Electric radiators, if used, shall be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators shall be fitted with an element so exposed that clothing, curtains, or other similar materials can be scorched or set on fire by heat from the element.*

#### **4.2 Waste receptacles**

*Waste receptacles shall be constructed of non-combustible materials with no openings in the sides or bottom.*

#### **4.3 Insulation surfaces protected against oil penetration**

*In spaces where penetration of oil products is possible, the surface of insulation shall be impervious to oil or oil vapours.*

#### **4.4 Primary deck coverings**

*Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not readily ignite, this being determined in accordance with the Fire Test Procedures Code.*

### **5. Cargo areas of tankers**

#### **5.1 Separation of cargo oil tanks**

*5.1.1 Cargo pump-rooms, cargo tanks, slop tanks and cofferdams shall be positioned forward of machinery spaces. However, oil fuel bunker tanks need not be forward of machinery spaces. Cargo tanks and slop tanks shall be isolated from machinery spaces by cofferdams, cargo pump-rooms, oil bunker tanks or ballast tanks. Pump-rooms containing pumps and their accessories for ballasting those spaces situated adjacent to cargo tanks and slop tanks and pumps for oil fuel transfer, shall be considered as equivalent to a cargo pump-room within the context of this regulation provided that such pump-rooms have the same safety standard as that required for cargo pump-rooms. Pump-rooms intended solely for ballast or oil fuel transfer, however, need not comply with the requirements of regulation 10.9. The lower portion of the pump-room may be recessed into machinery spaces of category A to accommodate pumps, provided that the deck head of the recess is in general not more than one third of the moulded depth above the keel, except that in the case of ships of not more than 25,000 tonnes deadweight, where it can be demonstrated that for reasons of access and satisfactory piping arrangements this is impracticable, the Administration may permit a recess in excess of such height, but not exceeding one half of the moulded depth above the keel.*

*5.1.2 Main cargo control stations, control stations, accommodation and service spaces (excluding isolated cargo handling gear lockers) shall be positioned aft of cargo tanks, slop tanks, and spaces which isolate cargo or slop tanks from machinery spaces, but not necessarily aft of the oil fuel bunker tanks and ballast tanks, and shall be arranged in such a way that a single failure of a deck or bulkhead shall not permit the entry of gas or fumes from the cargo tanks into main cargo control stations, control stations, or accommodation and service spaces. A recess provided in accordance with paragraph 5.1.1 need not be taken into account when the position of these spaces is being determined.*

*5.1.3 However, where deemed necessary, the Administration may permit main cargo control stations, control stations, accommodation and service spaces forward of*

*the cargo tanks, slop tanks and spaces which isolate cargo and slop tanks from machinery spaces, but not necessarily forward of oil fuel bunker tanks or ballast tanks. Machinery spaces, other than those of category A, may be permitted forward of the cargo tanks and slop tanks provided they are isolated from the cargo tanks and slop tanks by cofferdams, cargo pump-rooms, oil fuel bunker tanks or ballast tanks, and have at least one portable fire extinguisher. In cases where they contain internal combustion machinery, one approved foam type extinguisher of at least 45 l capacity or equivalent shall be arranged in addition to portable fire extinguishers. If operation of a semi portable fire extinguisher is impracticable, this fire extinguisher may be replaced by two additional portable fire extinguishers. Main cargo control stations, control stations and accommodation and service spaces shall be arranged in such a way that a single failure of a deck or bulkhead shall not permit the entry of gas or fumes from the cargo tanks into such spaces. In addition, where deemed necessary for the safety or navigation of the ship, the Administration may permit machinery spaces containing internal combustion machinery not being main propulsion machinery having an output greater than 375 kW to be located forward of the cargo area provided the arrangements are in accordance with the provisions of this paragraph.*

*5.1.4 In combination carriers only:*

- 5.1.4.1 The slop tanks shall be surrounded by cofferdams except where the boundaries of the slop tanks, are part of the hull, main cargo deck, cargo pump-room bulkhead or oil fuel bunker tank. These cofferdams shall not be open to a double bottom, pipe tunnel, pump-room or other enclosed space, nor shall they be used for cargo or ballast and shall not be connected to piping systems serving oil cargo or ballast. Means shall be provided for filling the cofferdams with water and for draining them. Where the boundary of a slop tank is part of the cargo pump-room bulkhead, the pump-room shall not be open to the double bottom, pipe tunnel or other enclosed space; however, openings provided with gastight bolted covers may be permitted;*
- 5.1.4.2 Means shall be provided for isolating the piping connecting the pump-room with the slop tanks referred to in paragraph 5.1.4.1. The means of isolation shall consist of a valve followed by a spectacle flange or a spool piece with appropriate blank flanges. This arrangement shall be located adjacent to the slop tanks, but where this is unreasonable or impracticable, it may be located within the pump-room directly after the piping penetrates the bulkhead. A separate permanently installed pumping and piping arrangement incorporating a manifold, provided with a shut-off valve and a blank flange, shall be provided for discharging the contents of the slop tanks directly to the open deck for disposal to shore reception facilities when the ship is in the dry cargo mode. When the transfer system is used for slop transfer in the dry cargo mode, it shall have no connection to other systems. Separation from other systems by means of removal of spool pieces may be accepted;*
- 5.1.4.3 Hatches and tank cleaning openings to slop tanks shall only be permitted on the open deck and shall be fitted with closing arrangements. Except where they consist of bolted plates with bolts at watertight spacing, these closing arrangements shall be provided with locking arrangements under the control of the responsible ship's officer; and*
- 5.1.4.4 Where cargo wing tanks are provided, cargo oil lines below deck shall be installed inside these tanks. However, the Administration may permit cargo oil lines to be placed in special ducts provided these are capable of being adequately cleaned and ventilated to the satisfaction of the Administration. Where cargo wing tanks are not provided, cargo oil lines below deck shall be placed in special ducts.*

- 5.1.5 *Where the fitting of a navigation position above the cargo area is shown to be necessary, it shall be for navigation purposes only and it shall be separated from the cargo tank deck by means of an open space with a height of at least 2 m. The fire protection requirements for such a navigation position shall be those required for control stations, as specified in regulation 9.2.4.2 and other provisions for tankers, as applicable.*
- 5.1.6 *Means shall be provided to keep deck spills away from the accommodation and service areas. This may be accomplished by provision of a permanent continuous coaming of a height of at least 300 mm, extending from side to side. Special consideration shall be given to the arrangements associated with stern loading.*

## *5.2 Restriction on boundary openings*

- 5.2.1 *Except as permitted in paragraph 5.2.2, access doors, air inlets and openings to accommodation spaces, service spaces, control stations and machinery spaces shall not face the cargo area. They shall be located on the transverse bulkhead not facing the cargo area or on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship, but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance need not exceed 5 m.*
- 5.2.2 *The Administration may permit access doors in boundary bulkheads facing the cargo area or within the 5 m limits specified in paragraph 5.2.1, to main cargo control stations and to such service spaces used as provision rooms, store-rooms and lockers, provided they do not give access directly or indirectly to any other space containing or providing for accommodation, control stations or service spaces such as galleys, pantries or workshops, or similar spaces containing sources of vapour ignition. The boundary of such a space shall be insulated to "A-60" class standard, with the exception of the boundary facing the cargo area. Bolted plates for the removal of machinery may be fitted within the limits specified in paragraph 5.2.1. Wheelhouse doors and windows may be located within the limits specified in paragraph 5.2.1 so long as they are designed to ensure that the wheelhouse can be made rapidly and efficiently gastight and vapourtight.*
- 5.2.3 *Windows and sidescuttles facing the cargo area and on the sides of the superstructures and deckhouses within the limits specified in paragraph 5.2.1 shall be of the fixed (non opening) type. Such windows and sidescuttles, except wheelhouse windows, shall be constructed to "A 60" class standard.*
- 5.2.4 *Where there is permanent access from a pipe tunnel to the main pump-room, a watertight door shall be fitted complying with the requirements of regulation II-1/25-9.2 and, in addition, with the following:*
- 5.2.4.1 *in addition to the bridge operation, the watertight door shall be capable of being manually closed from outside the main pump-room entrance; and*
- 5.2.4.2 *the watertight door shall be kept closed during normal operations of the ship except when access to the pipe tunnel is required.*
- 5.2.5 *Permanent approved gastight lighting enclosures for illuminating cargo pump-rooms may be permitted in bulkheads and decks separating cargo pump-rooms*



*and other spaces provided they are of adequate strength and the integrity and gastightness of the bulkhead or deck is maintained.*

- 5.2.6 The arrangement of ventilation inlets and outlets and other deckhouse and superstructure boundary space openings shall be such as to complement the provisions of paragraph 5.3 and regulation 11.6. Such vents, especially for machinery spaces, shall be situated as far aft as practicable. Due consideration in this regard shall be given when the ship is equipped to load or discharge at the stern. Sources of ignition such as electrical equipment shall be so arranged as to avoid an explosion hazard.*

### *5.3 Cargo tank venting*

#### *5.3.1 General requirements*

*The venting systems of cargo tanks shall be entirely distinct from the air pipes of the other compartments of the ship. The arrangements and position of openings in the cargo tank deck from which emission of flammable vapours can occur shall be such as to minimize the possibility of flammable vapours being admitted to enclosed spaces containing a source of ignition, or collecting in the vicinity of deck machinery and equipment which may constitute an ignition hazard. In accordance with this general principle, the criteria in paragraphs 5.3.2 to 5.3.5 and regulation 11.6 will apply.*

#### *5.3.2 Venting arrangements*

- 5.3.2.1 The venting arrangements in each cargo tank may be independent or combined with other cargo tanks and may be incorporated into the inert gas piping.*

*5.3.2.2 Where the arrangements are combined with other cargo tanks, either stop valves or other acceptable means shall be provided to isolate each cargo tank. Where stop valves are fitted, they shall be provided with locking arrangements which shall be under the control of the responsible ship's officer. There shall be a clear visual indication of the operational status of the valves or other acceptable means. Where tanks have been isolated, it shall be ensured that relevant isolating valves are opened before cargo loading or ballasting or discharging of those tanks is commenced. Any isolation must continue to permit the flow caused by thermal variations in a cargo tank in accordance with regulation 11.6.1.1.*

*5.3.2.3 If cargo loading and ballasting or discharging of a cargo tank or cargo tank group which is isolated from a common venting system is intended, that cargo tank or cargo tank group shall be fitted with a means for over pressure or under pressure protection as required in regulation 11.6.3.2.*

*5.3.2.4 The venting arrangements shall be connected to the top of each cargo tank and shall be self draining to the cargo tanks under all normal conditions of trim and list of the ship. Where it may not be possible to provide self draining lines, permanent arrangements shall be provided to drain the vent lines to a cargo tank.*

#### *5.3.3 Safety devices in venting systems*

*The venting system shall be provided with devices to prevent the passage of flame into the cargo tanks. The design, testing and locating of these devices shall comply with the requirements established by the Administration based on the guidelines developed by the Organization.\* Ullage openings shall not be used for pressure equalisation. They shall be*

*provided with self closing and tightly sealing covers. Flame arresters and screens are not permitted in these openings.*

*\* Refer to MSC/Circ.677, Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers, and to MSC/Circ.450/Rev.1, Revised factors to be taken into consideration when designing cargo tank venting and gas-freeing arrangements.*

#### *5.3.4 Vent outlets for cargo handling and ballasting*

##### *5.3.4.1 Vent outlets for cargo loading, discharging and ballasting required by regulation 11.6.1.2 shall:*

*5.3.4.1.1.1 permit the free flow of vapour mixtures; or*

*5.3.4.1.1.2 permit the throttling of the discharge of the vapour mixtures to achieve a velocity of not less than 30 m/s;*

*5.3.4.1.2 be so arranged that the vapour mixture is discharged vertically upwards;*

*5.3.4.1.3 where the method is by free flow of vapour mixtures, be such that the outlet shall be not less than 6 m above the cargo tank deck or fore and aft gangway if situated within 4 m of the gangway and located not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard; and*

*5.3.4.1.4 where the method is by high velocity discharge, be located at a height not less than 2 m above the cargo tank deck and not less than 10 m measured horizontally from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard. These outlets shall be provided with high-velocity devices of an approved type.*

*5.3.4.2 The arrangements for the venting of vapours displaced from the cargo tanks during loading and ballasting shall comply with paragraph 5.3 and regulation 11.6 and shall consist of either one or more mast risers, or a number of high velocity vents. The inert gas supply main may be used for such venting.*

#### *5.3.5 Isolation of slop tanks in combination carriers*

*In combination carriers, the arrangements for isolating slop tanks containing oil or oil residues from other cargo tanks shall consist of blank flanges which will remain in position at all times when cargoes other than liquid cargoes referred to in regulation 1.6.1 are carried.*

#### *5.4 Ventilation*

##### *5.4.1 Ventilation systems in cargo pump-rooms*

*Cargo pump-rooms shall be mechanically ventilated and discharges from the exhaust fans shall be led to a safe place on the open deck. The ventilation of these rooms shall have sufficient capacity to minimise the possibility of accumulation of flammable vapours. The number of air changes shall be at least 20 per hour, based upon the gross volume of the*

space. The air ducts shall be arranged so that all of the space is effectively ventilated. The ventilation shall be of the suction type using fans of the non sparking type.

#### *5.4.2 Ventilation systems in combination carriers*

*In combination carriers, cargo spaces and any enclosed spaces adjacent to cargo spaces shall be capable of being mechanically ventilated. The mechanical ventilation may be provided by portable fans. An approved fixed gas warning system capable of monitoring flammable vapours shall be provided in cargo pump-rooms, pipe ducts and cofferdams, as referred to in paragraph 5.1.4, adjacent to slop tanks. Suitable arrangements shall be made to facilitate measurement of flammable vapours in all other spaces within the cargo area. Such measurements shall be made possible from the open deck or easily accessible positions.*

#### *5.5 Inert gas systems*

##### *5.5.1 Application*

*5.5.1.1 For tankers of 20,000 tonnes deadweight and upwards, the protection of the cargo tanks shall be achieved by a fixed inert gas system in accordance with the requirements of the Fire Safety Systems Code, except that, in lieu of the above, the Administration, after having given consideration to the ship's arrangement and equipment, may accept other fixed installations if they afford protection equivalent to the above, in accordance with regulation 1/5. The requirements for alternative fixed installations shall comply with the requirements in paragraph 5.5.4.*

*5.5.1.2 Tankers operating with a cargo tank cleaning procedure using crude oil washing shall be fitted with an inert gas system complying with the Fire Safety Systems Code and with fixed tank washing machines.*

*5.5.1.3 Tankers required to be fitted with inert gas systems shall comply with the following provisions:*

*5.5.1.3.1 double hull spaces shall be fitted with suitable connections for the supply of inert gas;*

*5.5.1.3.2 where hull spaces are connected to a permanently fitted inert gas distribution system, means shall be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system; and*

*5.5.1.3.3 where such spaces are not permanently connected to an inert gas distribution system, appropriate means shall be provided to allow connection to the inert gas main.*

##### *5.5.2 Inert gas systems of chemical tankers and gas carriers*

*The requirements for inert gas systems contained in the Fire Safety Systems Code need not be applied to:*

*5.5.2.1 chemical tankers and gas carriers when carrying cargoes described in regulation 1.6.1, provided that they comply with the requirements for inert gas systems on chemical tankers established by the Administration, based on the guidelines developed by the Organization;\* or*

*\* Refer to the Regulation for inert gas systems on chemical tankers adopted by the Organization by resolution A.567(14).*

5.5.2.2 *chemical tankers and gas carriers when carrying flammable cargoes other than crude oil or petroleum products such as cargoes listed in chapters 17 and 18 of the International Bulk Chemical Code, provided that the capacity of tanks used for their carriage does not exceed 3,000 m<sup>3</sup> and the individual nozzle capacities of tank washing machines do not exceed 17.5 m<sup>3</sup>/h and the total combined throughput from the number of machines in use in a cargo tank at any one time does not exceed 110 m<sup>3</sup>/h.*

### 5.5.3 *General requirements for inert gas systems*

5.5.3.1 *The inert gas system shall be capable of inerting, purging and gas-freeing empty tanks and maintaining the atmosphere in cargo tanks with the required oxygen content.*

5.5.3.2 *The inert gas system referred to in paragraph 5.5.3.1 shall be designed, constructed and tested in accordance with the Fire Safety Systems Code.*

5.5.3.3 *Tankers fitted with a fixed inert gas system shall be provided with a closed ullage system.*

### 5.5.4 *Requirements for equivalent systems*

5.5.4.1 *Where an installation equivalent to a fixed inert gas system is installed, it shall:*

5.5.4.1.1 *be capable of preventing dangerous accumulations of explosive mixtures in intact cargo tanks during normal service throughout the ballast voyage and necessary in tank operations; and*

5.5.4.1.2 *be so designed as to minimize the risk of ignition from the generation of static electricity by the system itself.*

### 5.6 *Inerting, purging and gas-freeing*

5.6.1 *Arrangements for purging and/or gas-freeing shall be such as to minimize the hazards due to dispersal of flammable vapours in the atmosphere and to flammable mixtures in a cargo tank.*

5.6.2 *The procedure for cargo tank purging and/or gas-freeing shall be carried out in accordance with regulation 16.3.2.*

5.6.3 *The arrangements for inerting, purging or gas freeing of empty tanks as required in paragraph 5.5.3.1 shall be to the satisfaction of the Administration and shall be such that the accumulation of hydrocarbon vapours in pockets formed by the internal structural members in a tank is minimized and that:*

5.6.3.1 *on individual cargo tanks, the gas outlet pipe, if fitted, shall be positioned as far as practicable from the inert gas/air inlet and in accordance with paragraph 5.3 and regulation 11.6. The inlet of such outlet pipes may be located either at deck level or at not more than 1 m above the bottom of the tank;*

5.6.3.2 *the cross sectional area of such gas outlet pipe referred to in paragraph 5.6.3.1 shall be such that an exit velocity of at least 20 m/s can be maintained when any three tanks are being simultaneously supplied with inert gas. Their outlets shall extend not less than 2 m above deck level; and*

5.6.3.3 each gas outlet referred to in paragraph 5.6.3.2 shall be fitted with suitable blanking arrangements.

## 5.7 Gas measurement

### 5.7.1 Portable instrument

Tankers shall be equipped with at least one portable instrument for measuring flammable vapour concentrations, together with a sufficient set of spares. Suitable means shall be provided for the calibration of such instruments.

### 5.7.2 Arrangements for gas measurement in double hull spaces and double bottom spaces

5.7.2.1 Suitable portable instruments for measuring oxygen and flammable vapour concentrations shall be provided. In selecting these instruments, due attention shall be given to their use in combination with the fixed gas sampling line systems referred to in paragraph 5.7.2.2.

5.7.2.2 Where the atmosphere in double hull spaces cannot be reliably measured using flexible gas sampling hoses, such spaces shall be fitted with permanent gas sampling lines. The configuration of gas sampling lines shall be adapted to the design of such spaces.

5.7.2.3 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where plastic materials are used, they shall be electrically conductive.

### 5.8 Air supply to double hull spaces and double bottom spaces

Double hull spaces and double bottom spaces shall be fitted with suitable connections for the supply of air.

### 5.9 Protection of cargo area

Drip pans for collecting cargo residues in cargo lines and hoses shall be provided in the area of pipe and hose connections under the manifold area. Cargo hoses and tank washing hoses shall have electrical continuity over their entire lengths including couplings and flanges (except shore connections), and shall be earthed for removal of electrostatic charges.

### 5.10 Protection of cargo pump-rooms

#### 5.10.1 In tankers:

5.10.1.1 cargo pumps, ballast pumps and stripping pumps, installed in cargo pump-rooms and driven by shafts passing through pump-room bulkheads shall be fitted with temperature sensing devices for bulkhead shaft glands, bearings and pump casings. A continuous audible and visual alarm signal shall be automatically effected in the cargo control room or the pump control station;

5.10.1.2 lighting in cargo pump-rooms, except emergency lighting, shall be interlocked with ventilation such that the ventilation shall be in operation when switching on the lighting. Failure of the ventilation system shall not cause the lighting to go out;

5.10.1.3 a system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted. Sampling points or detector heads shall be located in suitable positions in order that potentially dangerous leakages are readily detected. When the hydrocarbon gas concentration reaches a pre-set level, which shall not be higher than 10% of the lower flammable limit, a continuous audible and visual alarm signal shall be automatically effected in the pump-room, engine control room, cargo control room and navigation bridge to alert personnel to the potential hazard; and

5.10.1.4 all pump-rooms shall be provided with bilge level monitoring devices together with appropriately located alarms.

## **MCA Guidance**

### **G1 Electric space heaters**

G1.1 In this Regulation 'similar materials' includes free standing furniture, particularly those items with upholstered parts, which should not be placed near to the heater.

### **G2 Oil and vapour barriers**

#### **G2.1 Flexible vapour barriers**

G2.1.1 Any joint in a flexible oil and oil vapour barrier should be sealed with tape of the same material as the vapour barrier or a compatible material having a minimum width of 50mm using an adhesive which is also compatible. The advice of the manufacturer of the insulation or vapour barrier should be sought where there is doubt as to the compatibility of materials.

G2.1.2 It should be noted that in no case where a vapour barrier is fitted should the wire netting securing an 'A' Class insulation be dispensed with.

G2.1.3 Where there is a risk of an 'A' Class insulation becoming damaged by the shipping or unshipping of items of machinery or similar operations, then a metal oil and oil vapour barrier referred to in the following paragraph will afford some protection to the insulation. See also regulation 5.3.1.1.

#### **G2.2 Metal vapour barriers**

G2.2.1 In no case must a metal vapour barrier be fitted directly on the face of an 'A' Class insulation in lieu of the wire netting or otherwise, because fire casualties have revealed that the restraint afforded by the steel pins against expansion has buckled the metal vapour barrier causing serious damage to the insulation and forcing the spring washers off the pins resulting in the falling down of the barrier and insulation.

G2.2.2 Metal oil and oil vapour barriers should be attached to the ship's structure independently of an 'A' Class insulation with a gap of at least 20mm between the exposed face of the insulation and the vapour barrier. The number and size of the means of securing the vapour barrier to the structure should be kept to a minimum in order to ensure that heat transfer through the insulation is minimal. A penetration should not exceed 100mm<sup>2</sup> in cross sectional area, nor should it be spaced less than 500mm from another penetration. The metal should be unperforated.

### **G3 Deck coverings**

#### **G3.1 Primary deck coverings**

G3.1.1 Each primary deck covering which is to be used in accommodation spaces, service spaces and control stations should also comply with regulation 6.3.

G3.1.2 See regulation 5.3.2.1 for information relating to approved deck coverings incorporating 'A' Class overdeck insulations.

## **G4 Openings**

G4.1 The 4% of the length of the ship, referred to in paragraph 5.2.1, should be measured from the line at which the superstructure or deckhouse ceases to have any forward projection when the superstructure or deckhouse is situated aft of the cargo area as illustrated in figure 9.8 in guidance to regulation 9.2 insulation of exterior boundaries of tankers. When the superstructure or deckhouse is situated forward of the cargo area, the method of measurement should be a 'mirror image' of that used for a superstructure or deckhouse situated aft of the cargo area.

## **G5 Doors**

G5.1 Paragraph 5.2.2 does not permit doors to be fitted in the exterior boundaries of superstructures or deckhouses indicated in paragraph 5.2.1, to which the previous paragraph refers, except doors giving access to cargo control stations, provision rooms or store rooms provided that such a space does not give access to accommodation spaces, service spaces or control stations. The Regulation further indicates that when such a door gives access to any such space situated aft of the cargo area, the boundaries of the space, including the deckhead, but excluding the boundary facing the cargo area, should be insulated with an A-60 insulation. This requirement should also apply to any such door giving access to cargo control stations, provision rooms or store rooms situated forward of the cargo area in a superstructure or deckhouse enclosing accommodation, even though paragraph 5.2.2 may be interpreted as implying that the boundaries of such a space situated forward of the cargo area need not be insulated. The boundaries of such a space situated forward of the cargo area need not be insulated when it is in a superstructure or deckhouse which does not enclose accommodation and the space does not give access to any service space or control station. Furthermore, the requirement to insulate the boundaries of a cargo control station, provision room or store room with an A-60 insulation as indicated in paragraph 5.2.2 is illogical if applied literally to such spaces situated at the corners or sides of a superstructure or deckhouse and such spaces should be insulated as illustrated in figure 9.10 in guidance to regulation 9.2 on insulation of exterior boundaries of tankers.

G5.2 Surveyors should ensure that when bolted plates for the removal of machinery are fitted in the portions of the exterior boundaries of superstructures and deckhouses referred to in paragraph 5.2.1, the plates are insulated with an A-60 insulation in such a manner that the insulation is not likely to be damaged when the plates are removed and replaced. In the circumstances a board type insulation approved for A-60 general application may be less susceptible to damage than any other type of insulation, particularly if it were faced with sheet steel and its edges protected by flats welded to the plates.

## **G6 Gastightness test for the navigation bridge external doors and windows**

G6.1 The navigation bridge external doors and windows which are located within the limits stated in paragraph 5.2.1 should be tested for gastightness. If a water hose test is to be used, then the following may be taken as a guide:

G6.1.1 nozzle diameter, 12mm;

G6.1.2 water pressure just before the nozzle, not less than 2 bar; and

G6.1.3 distance between the nozzle and the doors or windows; maximum 1.5m.

### **G7 Windows and sidescuttles**

G7.1 The frames of windows and sidescuttles situated in the portions of the exterior boundaries of superstructures and deckhouses referred to in paragraph 5.2.1 should be constructed of steel and such windows should be fitted with an approved fire resisting glass except that such glass should not be fitted in windows situated in the boundaries of the wheelhouse. The fire resisting glass should be fitted in accordance with the conditions in the approval certificate. Note, the maximum size of window which may be used in association with a fire resisting glass is also stipulated in the approval certificate.

G7.2 The fire resisting glass should be of a type which has been accepted for use in A60 divisions.

G7.3 Such glass or glass assemblies should be toughened safety glass as required by British Standard MA24:1974.

### **G8 Lighting enclosures for illuminating cargo pump-rooms**

G8.1 When light enclosures are intended to be fitted in boundary bulkheads and decks of cargo pump-rooms as allowed in paragraph 5.2.5 details of their construction should be submitted to MCA Headquarters for consideration and approval.

G8.2 Electric cable transits which have been approved for use in watertight 'A' Class divisions should be used when the cables to the light enclosures pass through such boundary bulkheads and decks. See guidance G9.48.2 on electric cables penetrating watertight 'A' class divisions.