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INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING LPG FUELS

1 The Maritime Safety Committee, at its 107th session (31 May to 9 June 2023), having considered a proposal by the Sub-Committee on Carriage of Cargoes and Containers, at its eighth session, recognizing the importance of providing criteria for the use of LPG fuels on board ships so as to provide at least the same level of safety and reliability as new and comparable conventional oil-fuelled main and auxiliary machinery installations, approved the *Interim guidelines for the safety of ships using LPG fuels*, as set out in the annex.

2 Member States are invited to bring the Interim Guidelines to the attention of shipbuilders, manufacturers, shipowners, ship managers, masters and ship crews, bareboat charterers and all other parties concerned.

3 Member States are also invited to recount their experience gained through the use of these Interim Guidelines to the Organization, for the Committee to keep them under review.

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ANNEX

INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING LPG FUELS

1 INTRODUCTION

1.1 The purpose of these *Interim guidelines for the safety of ships using LPG fuels* (Interim Guidelines) is to provide an international standard for ships using LPG as fuel.

1.2 The basic philosophy of these Interim Guidelines is to provide provisions for the arrangement, installation, control and monitoring of machinery, equipment and systems using LPG as fuel to minimize the risk to the ship, its crew and the environment, having regard to the nature of the fuels involved.

1.3 Throughout the development of these Interim Guidelines it was recognized that the provisions therein must be based on sound naval architectural and engineering principles and the best understanding available of current operational experience, field data and research and development. These Interim Guidelines address all areas that need special consideration for the use of LPG as fuel.

1.4 These Interim Guidelines follow the *Generic guidelines for developing IMO goal-based standards* (MSC.1/Circ.1394/Rev.2) by specifying goals and functional requirements for each section forming the basis for the design, construction and operation of ships using LPG as fuel.

1.5 The current version of these Interim Guidelines includes provisions to meet the functional requirements for LPG as fuel.

1.6 These Interim Guidelines have been closely aligned with the International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels (IGF Code), adopted by resolution MSC 391(95), as amended, in particular section 3 which is mainly text taken from chapter 3 of the IGF Code, albeit modified to reflect the recommendatory nature of these Interim Guidelines.

1.7 Wherever in these Interim Guidelines reference is made to "gas supply" as contained in the IGF Code, it should be read as "LPG supply".

2 GENERAL

2.1 Application

Unless expressly provided otherwise, these Interim Guidelines apply to ships using LPG as fuel to which part G of SOLAS chapter II-1 applies.

2.2 Definitions

For the purpose of these Interim Guidelines, the terms used have the meanings defined in the following paragraphs. Terms not defined have the same meaning as in SOLAS chapter II-2 and the IGF Code.

2.2.1 *LPG* means liquefied petroleum gas. It is mainly composed of a mixture of propane (C_3H_8) and butane (C_4H_{10}) and may contain small amounts of other hydrocarbons and impurities. In these Interim Guidelines, petroleum gas either in its liquefied or gaseous state is referred to as LPG. When it is necessary to distinguish between the liquefied state and the gas state, LPG in the liquefied state is referred to as LPG liquid, and LPG in the gaseous state is referred to as LPG gas.

2.2.2 *Fuel* in these Interim Guidelines means LPG.

2.2.3 *Auto-ignition temperature* means the lowest temperature at which the fuel spontaneously ignites in normal atmosphere without an external source of ignition, such as a flame or spark.

2.2.4 *Gas dispersion analysis* means the analysis of the dispersion behaviour of gases using appropriate modelling techniques such as computational fluid dynamics (CFD) analysis.

2.2.5 *Ventilation analysis* means the analysis of the ventilation efficiency of a space using appropriate modelling techniques such as CFD analysis.

2.2.6 *Effectiveness of ventilation* refers to the effect of ventilation to control the diffusion and persistence of an explosive gas atmosphere due to gas leakage, depending on the degree and efficiency of ventilation (refer to IEC 60079-10-1).

2.2.7 *Degree of dilution* means a measure of the ability of ventilation or atmospheric conditions to dilute a release to a safe level. The degree of dilution is defined as high, medium and low (refer to IEC 60079-10-1, 6.5.4).

2.3 Alternative design

2.3.1 These Interim Guidelines contain functional requirements for all appliances and arrangements related to the usage of LPG fuels.

2.3.2 Appliances and arrangements of LPG fuel systems may deviate from those set out in these Interim Guidelines, provided such appliances and arrangements meet the intent of the goal and functional requirements concerned and provide an equivalent level of safety to the relevant sections.

2.3.3 The equivalence of the alternative design should be demonstrated as specified in SOLAS regulation II-1/55 and approved by the Administration. However, the Administration should not allow operational methods or procedures to be applied as an alternative to a particular fitting, material, appliance, apparatus, item of equipment or type thereof which is prescribed by these Interim Guidelines.

3 GOAL AND FUNCTIONAL REQUIREMENTS

3.1 Goal

The goal of these Interim Guidelines is to provide for safe and environmentally friendly design, construction and operation of ships and in particular their installations of systems for propulsion machinery, auxiliary power generation machinery and/or other purpose machinery using LPG as fuel.

3.2 Functional requirements

3.2.1 The safety, reliability and dependability of the systems should be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery.

3.2.2 The probability and consequences of fuel-related hazards should be limited to a minimum through arrangement and system design, such as ventilation, detection and safety actions. In the event of gas leakage or failure of the risk-reducing measures, necessary safety actions should be initiated.

3.2.3 The design philosophy should ensure that risk-reducing measures and safety actions for the gas fuel installation do not lead to an unacceptable loss of power.

3.2.4 Hazardous areas should be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board and equipment.

3.2.5 Equipment installed in hazardous areas should be minimized to that required for operational purposes and should be suitably and appropriately certified.

3.2.6 Unintended accumulation of explosive, flammable or toxic gas concentrations should be prevented.

3.2.7 System components should be protected against external damage.

3.2.8 Sources of ignition in hazardous areas should be minimized to reduce the probability of explosions.

3.2.9 Safe and suitable fuel supply, storage and bunkering arrangements should be made capable of receiving and containing the fuel in the required state without leakage. Other than when necessary for safety reasons, the system should be designed to prevent venting under all normal operating conditions including idle periods.

3.2.10 Piping systems, containment and over-pressure relief arrangements that are of suitable design, construction and installation for their intended application should be provided.

3.2.11 Machinery, systems and components should be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation.

3.2.12 Fuel containment system and machinery spaces containing source that might release gas into the space should be arranged and located such that a fire or explosion in either will not lead to an unacceptable loss of power or render equipment in other compartments inoperable.

3.2.13 Suitable control, alarm, monitoring and shutdown systems should be provided to ensure safe and reliable operation.

3.2.14 Fixed gas detection suitable for all spaces and areas concerned should be arranged.

3.2.15 Fire detection, protection and extinction measures appropriate to the hazards concerned should be provided.

3.2.16 Commissioning, trials and maintenance of fuel systems and gas utilization machinery should satisfy the goal in terms of safety, availability and reliability.

3.2.17 The technical documentation should permit an assessment of the compliance of the system and its components with the applicable rules, guidelines, design standards used and the principles related to safety, availability, maintainability and reliability.

3.2.18 A single failure in a technical system or component should not lead to an unsafe or unreliable situation.

4 GENERAL PROVISIONS

4.1 Goal

The goal of this section is to ensure that the necessary assessments of the risks involved are carried out in order to eliminate or mitigate any adverse effect on the persons on board, the environment or the ship.

4.2 Risk assessment

4.2.1 Unless expressly provided otherwise, the requirements of 4.2 of the IGF Code apply.

4.2.2 In addition to the requirements listed in 4.2.2 of the IGF Code, risk assessment should also address paragraphs 5.3.6, 6.3.3, 10.3.2, 13.3.4 and 15.2.2 of these Interim Guidelines.

4.3 Limitation of explosion consequences

An explosion in any space containing any potential sources of release[1] and potential ignition sources should not:

.1 cause damage to or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs;

.2 damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;

.3 damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured;

.4 disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution;

.5 damage life-saving equipment or associated launching arrangements;

.6 disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space;

.7 affect other areas of the ship in such a way that chain reactions involving, inter alia, cargo, gas and bunker oil may arise; or

.8 prevent persons access to life-saving appliances or impede escape routes.

5 SHIP DESIGN AND ARRANGEMENT

5.1 Goal

The goal of this section is to provide for safe location, space arrangements and mechanical protection of power generation equipment, fuel storage systems, fuel supply equipment and refuelling systems.

[1] Double wall fuel pipes are not considered as potential sources of release.

5.2 Functional requirements

This chapter is related to functional requirements in 3.2.1 to 3.2.3, 3.2.5, 3.2.6, 3.2.8, 3.2.12 to 3.2.15 and 3.2.17. In particular, the following applies:

.1 the fuel tank(s) should be located in such a way that the probability for the tank(s) to be damaged following a collision or grounding is reduced to a minimum taking into account the safe operation of the ship and other hazards that may be relevant to the ship;

.2 fuel containment systems, fuel piping and other fuel sources of release should be so located and arranged that released gas is led to a safe location in the open air. Locations of the release should be determined taking into consideration the surrounding arrangement so as to minimize the possibility of accumulation of the gas released on the open space and to facilitate dispersion into the atmosphere;

.3 the access or other openings to spaces containing fuel sources of release should be so arranged that flammable, asphyxiating or toxic gas cannot escape to spaces that are not designed for the presence of such gases taking into account the specific gravity and dispersion characteristics of LPG gas;

.4 fuel piping should be protected against mechanical damage;

.5 the propulsion and fuel supply system should be so designed that safety actions after any LPG leakage do not lead to an unacceptable loss of power; and

.6 the probability of a gas explosion in a machinery space with gas or low-flashpoint fuelled machinery should be minimized.

5.3 General provisions

5.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 5 apply.

5.3.2 In addition to 5.4 of the IGF Code, a single failure of fuel systems should not lead to a gas release in the machinery space, i.e. only gas-safe machinery space concept in accordance with the IGF Code should be accepted.

5.3.3 The requirements of 5.6 of the IGF Code do not apply to ships using LPG as fuel. ESD-protected machinery spaces may be permitted, provided that the requirements of alternative design (SOLAS II-1/55) are met to the satisfaction of the Administration.

5.3.4 In addition to the requirements in 5.7 of the IGF Code, double barrier around fuel piping systems should be continuous and not have openings in machinery spaces.[2]

5.3.5 In addition to the requirements in 5.9 of the IGF Code, the bilge systems in the hazardous area should be arranged separately for each space and discharged overboard or to an enclosed tank fitted with a gas detector. Where bilge piping of two or more hazardous areas is connected, means should be provided to prevent the gas in one area from entering into other areas through the connected bilge pipes.

[2] Refer to IGF Code paragraph 5.5.

5.3.6 In addition to the requirements in 5.10.1 of the IGF Code, drip trays identified by the risk assessment in accordance with 4.2 should be equipped with means to detect leakage and shut off the fuel if required. However, 5.10.3 of the IGF Code does not apply to ships using LPG as fuel.

5.3.7 In addition to the requirements of chapter 5 of the IGF Code, the following provisions on pipe vents and pressure relief devices apply:

.1 LPG gas line from the following should be led to a vent mast:

.1 the pressure relief valve of the tank; and

.2 vent lines and bleed lines for gas fuel systems; and

.2 LPG liquid line from the following should be led to a fuel tank. Where it is not practicable, the line may be led to a vent mast but liquid release from the outlet of vent is not acceptable:

.1 the pressure relief valve of the liquid fuel supply pipe;

.2 vent line and bleed line of liquid fuel supply piping; and

.3 pressure relief valve in bunkering line.

6 FUEL CONTAINMENT SYSTEM

6.1 Goal

The goal of this section is to provide that LPG storage is adequate so as to minimize the risk to personnel, the ship and the environment to a level that is equivalent to a conventional oil-fuelled ship.

6.2 Functional requirements

This section relates to functional requirements 3.2.1, 3.2.2, 3.2.5 and 3.2.8 to 3.2.17. In particular, the following applies:

.1 the fuel containment system should be so designed that a leak from the tank or its connections does not endanger the ship, persons on board or the environment. Potential dangers to be avoided include:

.1 exposure of ship materials to temperatures below acceptable limits;

.2 flammable fuels spreading to locations with ignition sources;

.3 toxicity potential and risk of oxygen deficiency due to fuels and inert gases;

.4 restriction of access to muster stations, escape routes and life-saving appliances (LSA);

.5 reduction in availability of LSA; and

.2 the pressure and temperature in the fuel tank should be kept within the design limits of the containment system and possible carriage requirements of the fuel;

.3 the fuel containment arrangement should be so designed that safety actions after any LPG leakage do not lead to an unacceptable loss of power;

.4 if portable tanks are used for fuel storage, the design of the fuel containment system should be equivalent to permanent installed tanks as described in this section; and

.5 the fuel containment system should be designed considering various characteristics of all possible compositions of the LPG.

6.3 GENERAL PROVISIONS

6.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 6 apply.

6.3.2 The provision of 6.3.1 of the IGF Code does not apply to ships using LPG as fuel.

6.3.3 In addition to 6.3.4 of the IGF Code, the following applies: For the fuel tank located in enclosed space, a tank connection space should be provided separately from fuel storage hold space. For the fuel tank located on an open deck, a tank connection space should also be provided where escaped gas may accumulate on the open deck or enter in non-hazardous space such as accommodation space and machinery space based on the risk assessment.

6.3.4 In addition to 6.4.2.1 of the IGF Code, no secondary barrier should be required where the fuel temperature at atmospheric pressure is at or above -10°C. Where the fuel temperature at atmospheric pressure is not below -55°C, the hull structure may act as a secondary barrier.

6.3.5 The provision of 6.6 of the IGF Code does not apply to ships using LPG as fuel.

6.3.6 In addition to 6.7.2.7 of the IGF Code, vent exits should be so located that the following are ensured:[3]

.1 escaped LPG gas does not escape to non-hazardous areas through the opening around the vent exit;

.2 escaped LPG gas is not trapped by any structure on an open deck; and

.3 escaped LPG gas does not form a flammable atmosphere in the way of exhaust gas outlets and other ignition sources.

6.3.7 In addition to 6.7.2 of the IGF Code, the vent piping system should be fitted with an inert gas purging interface.

7 MATERIAL AND GENERAL PIPE DESIGN

Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 7 apply.

[3] According to a gas dispersion analysis, if required by the risk assessment.

8 BUNKERING

8.1 Goal

The goal of this section is to provide for suitable systems on board the ship to ensure that bunkering can be conducted without causing danger to persons, the environment or the ship.

8.2 Functional requirements

8.2.1 This section relates to functional requirements 3.2.1 to 3.2.11 and 3.2.13 to 3.2.17. In particular, the following applies:

8.2.2 The piping system for transfer of fuel to the storage tank should be designed such that any leakage from the piping system cannot cause danger to personnel, the environment or the ship.

8.2.3 Bunkering systems should be suitable for temperature, pressure and all compositions of LPG used on board.

8.2.4 Means should be provided to manage vapour generated in the tank during bunker transfer. Where means of vapour managements are not provided on ship, vapour return connection should be fitted at bunkering manifold.

8.3 Provisions

8.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 8 apply.

8.3.2 For ships using LPG as fuel, 8.3.1.6 of the IGF Code is not applicable.

9 FUEL SUPPLY TO CONSUMERS

9.1 Goal

The goal of this section is to ensure safe and reliable distribution of fuel to the consumers.

9.2 Functional requirements

This section is related to functional requirements 3.2.1 to 3.2.6, 3.2.8 to 3.2.11 and 3.2.13 to 3.2.17. In particular, the following applies:

.1 the fuel supply system should be so arranged that the consequences of any release of fuel will be minimized, while providing safe access for operation and inspection;

.2 the piping system for fuel transfer to the consumers should be designed in a way that a failure of one barrier cannot lead to a leak from the piping system into the surrounding area causing danger to the persons on board, the environment or the ship;

.3 fuel lines outside the machinery spaces should be installed and protected so as to minimize the risk of injury to personnel and damage to the ship in case of leakage;

.4 fuel supply systems should be able to supply fuel at the required pressure, temperature and flow rate; and

.5 where fuel supply systems supply LPG in the liquid state, purging, drain, vent and leakage should be subject to special consideration to provide an equivalent level of safety of fuel in the gas state.

9.3 Provisions

9.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 9 apply.

9.3.2 Notwithstanding 9.4.4 of the IGF Code, where fuel supply systems supply LPG in the liquid state, relevant bleed lines should be led to the fuel tank or gas-liquid separator or similar device to prevent LPG liquid from being released to the atmosphere.

9.3.3 In addition to 9.4.7 of the IGF Code, where fuel supply systems supply LPG in the liquid state, vent lines should be led to the fuel tank or gas-liquid separator or similar device.

9.3.4 The provision of 9.4.10 of the IGF Code does not apply to ships using LPG as fuel.

9.3.5 The provision of 9.7 of the IGF Code does not apply to ships using LPG as fuel.

9.3.6 In addition to 9.8.2 of the IGF Code, the most conservative value of *k* should be selected for considering expected composition of fuel (propane: 1.13, butane: 1.096)

10 POWER GENERATION INCLUDING PROPULSION AND OTHER GAS CONSUMERS

10.1 Goal

The goal of this section is to provide safe and reliable delivery of mechanical, electrical or thermal energy.

10.2 Functional requirements

This section is related to functional requirements 3.2.1, 3.2.11, 3.2.13, 3.2.16 and 3.2.17. In particular, the following applies:

.1 the exhaust systems should be configured to prevent any accumulation of unburnt gaseous fuel;

.2 unless designed with the strength to withstand the worst case over pressure due to ignited gas leaks, engine components or systems containing or likely to contain an ignitable gas and air mixture should be fitted with suitable pressure relief systems. Dependent on the particular engine design, this may include the air inlet manifolds and scavenge spaces;

.3 the explosion venting should be led away from where personnel may normally be present;

.4 all gas consumers should have a separate exhaust system; and

.5 fuel consumers should be suitably designed for operation with possible compositions of LPG fuel.

10.3 Provisions

10.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 10 apply.

10.3.2 Notwithstanding 10.5.2 of the IGF Code, the gas turbine should be fitted in a gastight enclosure arranged in accordance with 10.5.3 of the IGF Code. Gas leakage in the gastight enclosure and the consequence should be evaluated based on the risk assessment in accordance with 4.2 and to the satisfaction of the Administration.

10.3.4 Notwithstanding 10.3.1.7 of the IGF Code, if combustion has not been detected by the engine monitoring system within an engine-specific time after the opening of the fuel supply valve, the fuel supply valve should be automatically shut off. Means to ensure that any unburnt fuel mixture is purged away from the exhaust system should be provided.

11 FIRE SAFETY

11.1 Goal

The goal of this section is to provide for fire protection, detection and fighting for all system components related to the storage, conditioning, transfer and use of LPG as ship fuel.

11.2 Functional requirements

This section is related to functional requirements 3.2.2, 3.2.4, 3.2.5, 3.2.7, 3.2.12, 3.2.14, 3.2.15 and 3.2.17.

11.3 Provisions

11.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 11 apply.

11.3.2 In addition to 11.3.1 of the IGF Code, the fuel preparation room should be separated from a machinery space of category A and rooms with high fire risks. The separation is to be done by a cofferdam of at least 900 mm with insulation of A-60 class.

11.3.3 In addition to the requirements of IGF Code chapter 11, a fuel preparation room should be provided with a fixed fire-extinguishing system complying with the provisions of the FSS Code and taking into account the necessary concentrations/application rate required for extinguishing LPG gas fires.

12 EXPLOSION PREVENTION

12.1 Goal

The goal of this section is to provide for fire protection, detection and fighting for all system components related to the storage, conditioning, transfer and use of LPG as ship fuel.

12.2 Functional requirements

This section is related to functional requirements 3.2.2 to 3.2.5, 3.2.7, 3.2.8, 3.2.12 to 3.2.14 and 3.2.17. In particular, the following applies:

The probability of explosions should be reduced to a minimum by:

.1 reducing number of sources of ignition; and

.2 reducing the probability of formation of ignitable mixtures.

12.3 Provisions

12.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 12 apply.

12.3.2 The classification of a hazardous area should be subject to special consideration to characteristics of LPG (e.g. density, LEL). IEC 60079-10-1 may be referred, if necessary, to determine hazardous areas.

13 VENTILATION

13.1 Goal

The goal of this section is to provide for the ventilation required for safe operation of LPG-fuelled machinery and equipment.

13.2 Functional requirements

This section is related to functional requirements 3.2.2, 3.2.5, 3.2.8, 3.2.10, 3.2.12 to 3.2.14 and 3.2.17. In particular, the capacity and layout of ventilation system should be so designed that efficiency of ventilation is ensured considering the density of LPG gas.

13.3 Provisions

13.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 13 apply.

13.3.2 In addition to 13.3.5 of the IGF Code, air outlets and air inlets for hazardous enclosed spaces should be arranged to prevent exhausted gas from re-entering the space through air inlets, based on the risk assessment in accordance with 4.2 and to the satisfaction of the Administration.

13.3.3 In addition to 13.3.8 of the IGF Code, when determining the required ventilation capacity, special consideration should be given to the density and lower explosion limit (LEL) of LPG gas, which should be supported by numerical calculations such as CFD analysis.

13.3.4 In addition to 13.4.2 of the IGF Code, approved automatic fail-safe fire dampers should be fitted in the ventilation trunk for the tank connection space, fuel preparation room or any other space as deemed necessary by a risk assessment in accordance with 4.2 and to the satisfaction of the Administration.

13.3.5 The number and location of the extraction points of the ventilation in each space should be considered taking into account the size and layout of the space. Where bottom arrangements are complicated, it should be demonstrated based on ventilation analysis that capacity and duct arrangements of ventilation are adequate for the space.

13.3.6 The provisions in 13.5.2, 13.5.3 and 13.5.4 of the IGF Code do not apply to ships using LPG as fuel.

13.3.7 Notwithstanding 13.8.3 of the IGF Code, the ventilation inlet for the double wall piping or duct should always be located in an open area away from ignition sources. The inlet opening should be fitted with a suitable wire mesh guard and protected from ingress of water.

14 ELECTRICAL INSTALLATIONS

14.1 Goal

The goal of this section is to provide for electrical installations that minimize the risk of ignition in the presence of a flammable atmosphere.

14.2 Functional requirements

This section is related to functional requirements 3.2.1, 3.2.2, 3.2.4, 3.2.7, 3.2.8, 3.2.11, 3.2.13 and 3.2.16 to 3.2.18. In particular, the following applies:

Electrical generation and distribution systems, and associated control systems, should be designed such that a single fault will not result in the loss of ability to maintain fuel tank pressures and hull structure temperature within normal operating limits.

14.3 Provisions

14.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 14 apply.

14.3.2 In addition to 14.3.3 of the IGF Code, equipment for hazardous areas should be of a certified safe type appropriate for compositions of LPG in accordance with IEC 60079-20. IEC 60079-20 classifies the temperature class and equipment groups for propane and butane as the following:

	Temperature class	Equipment group
Propane	T2	IIA
Butane	T2	IIA

Equipment should be certified to IEC temperature class T2 and equipment group IIA.

15 CONTROL, MONITORING AND SAFETY SYSTEMS

15.1 Goal

15.1.1 The goal of this section is to provide for the arrangement of control, monitoring and safety systems that support an efficient and safe operation of the LPG-fuelled installation as covered in the other sections of these Interim Guidelines.

15.2 Functional requirements

This section is related to functional requirements 3.2.1, 3.2.2, 3.2.11, 3.2.13 to 3.2.15, 3.2.17 and 3.2.18. In particular, the following applies:

.1 the control, monitoring and safety systems of the LPG-fuelled installation should be so arranged that the remaining power for propulsion and power generation is in accordance with 9.3.1 of the IGF Code in the event of single failure;

.2 a safety system should be arranged to close down the fuel supply system automatically, upon failure in systems as described in table 1 (Monitoring of gas supply system to engines) in chapter 15 of the IGF Code and upon other fault conditions which may develop too fast for manual intervention;

.3 for ESD protected machinery configurations, where allowed by alternative design, the safety system should shut down LPG supply upon LPG leakage and, in addition, disconnect all non-certified safe type electrical equipment in the machinery space;

.4 the safety functions should be arranged in a dedicated safety system that is independent of the control system in order to avoid possible common cause failures. This includes the power supply and input and output signal;

.5 the safety systems including the field instrumentation should be arranged to avoid spurious shutdown, e.g. as a result of a faulty gas detector or a wire break in a sensor loop; and

.6 where two or more fuel supply systems are required to meet the provisions, each system should be fitted with its own set of independent control and safety systems.

15.3 Provisions

15.3.1 Unless expressly provided otherwise, the requirements of IGF Code part A-1 chapter 15 apply.

15.3.2 In addition to 15.8.1 of the IGF Code, permanently installed gas detectors should be fitted at ventilation inlets of accommodation and machinery spaces and other rooms with high fire risk,[4] unless an Administration deems it unnecessary based on a risk assessment in accordance with 4.2, as well as at the bunkering station as required in section 8 of these Interim Guidelines.

15.3.3 In addition to 8.3.1 of the IGF Code, bunkering manifolds should be continuously monitored by the ship's crew from a safe area in direct line of sight of the manifold or by CCTV during bunker transfer.

16 ADDITIONAL PROVISIONS

Unless expressly provided otherwise, the IGF Code parts B-1, C-1 and D apply to ships using LPG as fuel.

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[4] Other rooms with high fire risk, as defined in section 2 of the annex to MSC.1/Circ.1591.