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AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR LOW-FLASHPOINT FUELS

Draft safety requirements of the LPG fuelled vessel and proposal on a work plan

Submitted by the Republic of Korea

SUMMARY

Executive summary:	This document suggests amendments to the draft safety requirements for the LPG fuelled vessel based on document CCC 5/INF.27 and proposes a work plan for this agenda item
Strategic direction, if applicable:	2
Output:	2.3
Action to be taken:	Paragraph 19
Related documents:	BLG 17/8/1; CCC 5/INF.27 and CCC 5/INF.28

Introduction

1 The Ministry of Oceans and Fisheries, Republic of Korea is currently receiving enquiries from the shipping industry regarding the possibilities of building various types of vessels equipped with LPG fuelled engines.

2 This document is submitted in view of the availability of the use of low-flashpoint fuels in the context of SOLAS regulation II-1/56 and the IGF Code (resolution MSC.391(95)).

3 The annex to this document provides safety requirements for ships using LPG fuels. The safety measures have been reviewed in comparison with respective provisions of the IGF Code part A-1 applied to LNG fuelled vessels. The annex contains a summary of safety measures for which the IGF Code requirements should be changed and applied.

Background

4 The first session of the Sub-Committee on Carriage of Cargoes and Containers in September 2014 was invited to consider the item based on the report of the Correspondence Group on Development of the IGF Code (CCC 1/4) established at BLG 17, considering any other comments and proposals by Member States and international organizations.

5 At the time of its approval, the draft IGF Code focused, as the first step, on the specific requirements for ships using LNG as fuel. Furthermore, a work plan was agreed upon by CCC 1 for the next phase of development of the IGF Code, taking into account the need to consider future proposals for the use of additional fuels including LPG (propane).

6 The IGF Code, which was adopted by resolution MSC.391(95), provides an international standard for ships using low-flashpoint fuel, other than ships covered by the IGC Code. Part A-1 of the IGF Code addresses specific requirements for ships using natural gas as fuel.

7 From the third to the fifth session of CCC, technical provisions for the safety of ships using methyl/ethyl alcohol as fuel and fuel-cell as a second step have been developed. These drafts for the technical requirements have been sufficiently developed to be prioritized and finalized in this session.

8 CCC 5 noted the information in document CCC 5/INF.27 (Republic of Korea), providing information on the result of a research project regarding LPG-fuelled ships, with a view to identifying additional risks associated with the use of LPG fuel prior to the construction of LPG-fuelled ships, and to identify additional safety measures required against the LNG fuel requirements as specified in the IGF Code (CCC 5/13, paragraph 3.24).

Current status

9 The use of LPG as fuel has been restricted because LPG is heavier than air and the ventilation and dilution of leaked gas are disadvantageous. Nevertheless, shipowners chose liquefied petroleum gas (LPG) as a marine fuel for its two LPG carriers in 2017. Reflecting this trend, engines using LPG as fuel have been developed.

10 The marine industry of the Republic of Korea performed a HAZID for LPG fueled Ro-Pax and has conducted reviews of the studies on the safety of LPG fuels, and documents CCC 5/INF.27 and CCC 5/INF.28 were submitted on its result. The reviews were conducted in terms of economic feasibility considering shipbuilding order of LPG fueled vessels, LPG bunkering methods, potential infrastructures for LPG bunkering and international oil price.

Development of safety requirements for using LPG as fuel

11 In the first step of development of this annex, properties and hazards of LPG in comparison to LNG were studied. Then safety measurements of land-based LPG facilities based on the Korean Gas Safety Code (KGS Code) were investigated and LPG engines and LPG fuel supply systems were studied.

12 Typical differences between the properties of LPG and LNG are shown in table 1, but not limited to:

Table 1: Typical properties of LPG and LNG and related risks

Properties	LNG	LPG	Related risk (LPG)
Vapour SG at 15℃ and atmospheric pressure	0.55	1.52 (Propane) 2 (Butane)	Unfavourable for exhaust/dispersion of leaked gas
Flammable limits in air by volume (%)	5 ~ 15	2.2~9.5 (Propane) 1.8~8.4 (Butane)	Formation of flammable atmosphere at lower concentrations
Autoignition temperature (℃)	595	459 (Propane) 405 (Butane)	Hazard of autoignition at lower temperatures
Vapour pressure at 45℃ (bar)	-	15 (Propane) 4 (Butane)	Various boundaries of the phase change according to the composition ratio
Variety of composition ratio	Methane	Butane and propane	Change of properties on the basis of composition ratio

13 The technical provisions to be replaced or added to the requirements of the IGF Code to eliminate or reduce the identified inherent hazards of LPG have also been developed.

14 On the basis of these safety requirements, the results of the risk assessment for the LPG fuelled vessel were used. CFD analysis was performed to ascertain differences of dispersion and ventilation characteristics between LPG and LNG for hazards related to heavy density of LPG. From the result of the analysis, it has been confirmed that LPG gas is unfavourable in dispersion and ventilation. In this regard, IEC 60079-10-1 has been reviewed to assess if the hazardous areas developed for LNG are also valid for LPG. The representative methods used in this study are as follows:

.1 review of safety measurements of land-based LPG facilities;

.2 review of LPG engines and LPG fuel supply systems;

.3 performing CFD analysis for LPG leak scenarios;

.4 review of IEC 60079-10; and

.5 review of HAZID Reports of LPG RO-Pax.

15 The requirements for ships using LPG as fuel developed on the basis of these studies specify the requirements to be replaced or added to the requirements of the IGF Code. Except where specially required in this annex, the relevant requirements in the IGF Code are to be applied. (The terms "LNG" and "natural gas" are to be construed as "LPG" and "PG" respectively.)

Establishment of a correspondence group

16 To assist the work of the Sub-Committee, the Republic of Korea suggests the establishment of a correspondence group, so that the Sub-Committee deliberates the draft in detail.

17 The Republic of Korea also proposes the following terms of reference for the correspondence group to:

.1 further develop the draft guidelines for the LPG fueled vessels; and

.2 submit a written report to CCC 7.

Inclusion of this output in the list of working/drafting groups at the next session

18 The Republic of Korea invites the Sub-Committee to agree, in principle, to establish a working or drafting group on this output at the next session.

Action requested of the Sub-Committee

19 The Sub-Committee is invited to:

.1 consider the draft guidelines set out in the annex, with a view to establishing a correspondence group with the terms of reference set out in paragraph 17;

.2 agree, in principle, to establish a working or drafting group on this output at the next session; and

.3 take action as appropriate.

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ANNEX

DRAFT TECHNICAL PROVISIONS FOR THE SAFETY OF SHIPS USING LPG

1 Introduction

The purpose of these guidelines is to provide an international standard for ships using LPG as fuel.

The basic philosophy of these 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 of the ships, their crews and the environment, having regard to the nature of the fuels involved.

These guidelines consider the goal-based approach (MSC.1/Circ.1394). Therefore, goals and functional requirements were specified for each section forming the basis for the design, construction and operation. Unless otherwise noted in this annex, it is the same as the IGF Code.

Additionally, unless otherwise specified in these guidelines, the requirements of the IGF Code are applied.

2 General

2.1 Application

2.1.1 Unless expressly provided otherwise these guidelines apply to ships to which part G of SOLAS chapter II-1 applies.

2.1.2 LPG fuel includes liquefied petroleum in a gaseous or liquid state, and the requirements for gas referred in the IGF Code apply to liquefied petroleum gas and liquefied petroleum liquid equally as far as practicable.

2.1.3 Unless otherwise specified in the guidelines, the requirements of the IGF Code are applied.

2.2 Definitions

Definitions are to be in compliance with the requirements in the IGF Code unless otherwise specified in this paragraph.

2.2.1 **LPG** means liquefied petroleum gas. It is mainly composed of a mixture of propane (C3H8) and butane (C4H10) and contains small amounts of propylene and butylene. In this annex, both liquid and gaseous petroleum gas are referred to as LPG. However, when it is necessary to distinguish between the liquid state and the gas state, the liquid state of LPG is referred to as LP and the LPG.

2.2.2 **Fuel** in this annex means LPG.

2.2.3 **Critical temperature** means the highest temperature at which a gas can be changed into a liquid.

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

2.2.5 **Gas dispersion analysis** means the analysis of the dispersion behavior of gases using appropriate modeling techniques such as computational fluid dynamics (CFD) analysis.

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

2.2.7 **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.)

2.2.8 **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. (See IEC 60079-10-1, 6.5.4.)

2.2.9 **Leakage** means leaking out of gas or liquid from the tank or equipment to the outside.

2.2.10 **Relief** refers to the release of gas into the atmosphere through a pressure relief valve for the purpose of pressure control within the tank or equipment.

2.2.11 **Exhaust** means exhausting the leaked gas in the dangerous area to the outside through a forced ventilation system.

2.2.12 **Flash gas** means to the vapour generated from LPG in a liquid state as the LPG is depressurized or heated during the process of bunkering propane and butane into the tank.

3 GOAL AND FUNCTIONAL REQUIREMENTS

3.1 Goal

3.1.1 The goal of these guidelines is to provide for the 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.

4 GENERAL REQUIREMENTS

4.1 Goal

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

4.2 Risk assessment

4.2.1 A risk assessment is to be conducted to ensure that risks arising from use of LPG fuel affecting ships, persons on board and the environment are addressed. Consideration is to be given to the hazards associated with physical layout, operation and maintenance, following any reasonably foreseeable failure.

4.2.2 The risk assessment is to address the possible leakage of the fuel and the consequences thereof. In particular, taking into account the properties of LPG gas heavier than air, consideration is to be given to the possibility of gas accumulation at the bottom and escape of gas into other space.

4.2.3 In addition to risk assessment item of the IGF Code, provision 4.2, at least the following risk assessment should be performed, but not limited to:

.1 leakage potential of LPG and its consequence;

.2 dispersion characteristics of leaked LPG in ships;

.3 for the following areas/spaces, but not limited to, the HAZID is to be performed to address the possibility of leakage gas entering the non-hazardous area and its consequence. If necessary, analysis of dispersion and/or ventilation is to be conducted to demonstrate the dispersion characteristics and ventilation characteristics of the leakage gas in the area/space;

- tank connection space
- fuel tank
- fuel preparation room
- bunkering station
- a space where single walled fuel pipes are installed
- gas valve unit room
- in the way of vent mast

.4 the risk of LPG properties;

.5 leakage detection in the drip tray;

.6 ignition of unburned gas in the exhaust system;

.7 the gas leakage in the gas turbine space;

.8 possibility of the LPG fuel staying in the vent pipe;

.9 the purging and venting of the LPG liquid in the fuel pipe where high pressure liquid fuel is supplied to the engine;

.10 the pressure rise inside the tank due to the generation of flash gas where propane and butane are filled into the fuel tank respectively;

.11 possibility of recirculation of hazardous gas;

.12 the effectiveness of ventilation in hazardous spaces;

.13 installation of gas detectors; and

.14 hazards for passenger ships.

5 SHIP DESIGN AND ARRANGEMENT

5.1 Functional requirements

In addition to the item of the IGF Code contained in provision 5.2, at least the following functional requirements should be considered, but not limited to:

.1 locations of the vent mast and the ventilation outlet of the hazardous area are to 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; and

.2 in applying the IGF Code, provision 5.2.3, openings are to be arranged so that gas cannot escape to the openings of non-hazardous spaces, taking into account the specific gravity and dispersion characteristics of LPG gas.

5.2 Machinery space concepts

In addition to the item of the IGF Code contained in provision 5.4, at least the following requirements should be considered.

5.2.1 A single failure of fuel systems shall not lead to a gas release in the machinery space. i.e. only gas safe machinery space concept shall be accepted.

5.2.2 In the case of gas turbines installed in an enclosed space of independent gas-tight, the concept of ESD protected machinery space is acceptable. In this case, in addition to the IGF Code, provision 5.6, a pressure sensor is to be installed in the space to ensure that the negative pressure in the space is maintained. Additionally, when the negative pressure is not maintained in the space, an audible and visual alarm are to be provided to the navigation bridge, continuously manned central control station or onboard safety centre.

5.3 Location and protection of fuel piping

In addition to item of the IGF Code, provision 5.7, at least the following requirements should be considered.

5.3.1 In applying the IGF Code, provision 5.7.3, where leaked or spilled LPG gas is likely to accumulate or escape to non-hazardous areas such as accommodation areas, machinery spaces, etc. based on the risk assessment in accordance with provision 4.2 of this annex, all LPG fuel pipes on open decks are to be protected by double pipes. However, double pipes are not required when it is demonstrated that LPG neither accumulate nor escape into non-hazardous areas.

5.3.2 Outer pipes or ducts of fuel systems are not to have openings in non-hazardous spaces. Where a gas valve unit is located in a gas safety machinery space, the means of access to the gas valve unit is permissible only through a bolted hatch which can withstand the maximum leakage pressure.

5.4 Bilge systems

In addition to item of the IGF Code, provision 5.9, at least the following requirements should be considered.

5.4.1 Bilge systems in hazardous areas are not to be led to machinery spaces or other non-hazardous areas.

5.4.2 The bilge systems in the hazardous area are to 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 are to be provided to prevent the gas in one area from entering into other areas through the connected bilge pipes.

5.5 Drip tray

In addition to item of the IGF Code, provision 5.10, at least the following requirements should be considered.

5.5.1 Drip trays containing fuel spills are to be equipped with means to detect leakage and shut off the fuel if required by the risk assessment.

5.5.2 Drip trays which may be exposed to low temperature due to fuel leakage are to be made of materials suitable for low temperatures.

5.6 Outlets of vent pipe and pressure relieving systems

5.6.1 LPG gas line from the followings is to 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.

5.6.2 LPG liquid line from the followings is to be led to a fuel tank. However, where it is not practicable, the line may be led to a vent mast:

.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 Regulations – General

To be in compliance with the requirements in the IGF Code, provision6.3 unless otherwise specified in this paragraph.

6.1.1 Notwithstanding the requirements of the IGF Code, provision 6.3.1, LPG in a liquid state may be stored with a maximum allowable relief valve setting (MARVS) of 1.0 MPa or higher.

6.1.2 In applying the IGF Code, provision 6.3.4, for the fuel tank located in enclosed space, a tank connection space is to be provided separately from fuel storage hold space. For the fuel tank located on an open deck, a tank connection space is also to be provided where escaped gas may accumulate on the open deck or enter in non-hazardous area such as accommodation space and machinery space based on the risk assessment required in paragraph 4.2 of this annex.

6.1.3 The IGF Code, provision 6.6 is not applied.

6.2 Liquefied gas fuel containment

To be in compliance with the requirements in the IGF Code, provision 6.4 unless otherwise specified in these paragraphs.

6.2.1 In applying the IGF Code, provision 6.4.2.1, no secondary barrier is 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.

6.2.2 In applying the IGF Code, provision 6.4.9.3.3.1.2, design vapour pressure P_0 is not to be less than the gauge vapour pressure corresponding to a maximum temperature of fuel that may be increased due to heat ingress from the upper ambient design temperatures.

6.3 Pressure relief system

To be in compliance with the requirements in the IGF Code, provision 6.7 unless otherwise specified in this paragraph.

6.3.1 In applying the IGF Code, provision 6.7.2.7.1., the vapour discharge is to be directed vertically upwards in the form of unimpeded jets. Vent exits are to be arranged based on the gas dispersion analysis required in provision 4.2 of this annex and the following are to be confirmed:

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

.2 escaped gas does not accumulate on an open deck; and

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

6.3.2 In applying the IGF Code, provision 6.7.2.10, the drain line is to be fitted with two self-closing valves near the vent line, and these valves are to be opened sequentially to prevent gas from escaping through the drain line.

6.3.3 In applying the IGF Code, provision 6.7.2, vent lines from fuel tank relief valves are to be fitted with means of purging with inert gas when gas is detected.

6.4 Maintaining of fuel storage condition

In addition to item of the IGF Code, provision 6.9, at least the following requirements should be considered.

6.4.1 In applying the IGF Code, provision 6.9.1, for the pressurized tank, "the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature" is to apply the gauge vapour pressure corresponding to a maximum temperature of fuel that may be increased due to heat ingress from the upper ambient design temperatures.

6.4.2 With the exception of paragraph 1, control means of tank pressure and temperature in accordance with the IGF Code, provision 6.9.1.1 are to be provided.

7 BUNKERING

7.1 Functional Requirements

In addition to item of the IGF Code, provision 8.2, the following should be applied;

7.1.1 Bunkering systems are to be suitable for temperature, pressure and composition of all expected LPG.

7.1.2 Means are to be provided to manage vapour generated during bunker transfer. Where means of vapour managements are not provided in accordance with the IGF Code, provision 6.9.1.1, vapour return connection is to be fitted at bunkering manifold.

7.2 Regulations for bunkering station

7.2.1 In applying the IGF Code, provision 8.3.1, gas detectors are to be fitted below bunkering manifolds even though manifolds are located in open spaces, and to be fitted under 30 cm height from the bottom at a proper interval. Where gas is detected, gas detectors are to activate an alarm and emergency shutdown.

7.2.2 Bunkering manifolds are to be observable from bunkering control station by providing permanent watch or CCTV during bunker transfer.

8 FUEL SUPPLY TO CONSUMERS

8.1 Functional requirements

In addition to item of the IGF Code, provision 9.2, at least the following requirements should be considered.

8.1.1 Fuel supply systems are to be able to supply fuel at the required pressure, temperature and flow rate.

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

8.1.3 Fuel supply systems are designed to prevent unintended phase changes in processing of fuel supply to consumers considering vapour pressure at the working temperature as the followings:

.1 where a fuel is supplied in the gaseous state, measures are to be taken so that the temperature of the fuel is not lowered to the dew point at the working pressure; and

.2 where a fuel is supplied in the liquid state, measures are to be taken so that the pressure of the fuel is not lowered to the vapour pressure at the working temperature.

8.2 Regulations on safety functions of gas supply system

In addition to item of the IGF Code, provision 9.4, at least the following requirements should be considered.

8.2.1 In applying the IGF Code, provision 9.4.1.4.1, where fuel supply systems supply LPG in the liquid state, bleed lines are to be led to the fuel tank.

8.2.2 In applying the IGF Code, provision 9.4.1.4.1, a purging line is to be connected between two block valves to prevent heavy gas from remaining in bleed lines by automatically purging bleed line when a bleed valve is open.

8.2.3 In applying the IGF Code, provision 9.4.1.7, where fuel supply systems supply LPG in the liquid state, vent lines are to be led to the fuel tank.

8.2.4 In applying the IGF Code, provision 9.4.1.10, excess flow valve may be used, as appropriate, as means for rapid detection of a rupture in the gas line. Gas detection systems are not to be accepted as a means for rapid detection of a rupture in the gas line.

8.3 Design of ventilated duct, outer pipe against inner pipe gas leakage

In addition to item of the IGF Code, provision 9.8, at least the following requirement should be considered.

8.3.1 In applying the IGF Code, provision 9.8.2.2, the most conservative value is to be selected for k considering expected composition of fuels (propane: 1.13, butane: 1.096).

9 POWER GENERATION INCLUDING PROPULSION AND OTHER GAS CONSUMERS

9.1 Functional requirements

In addition to item of the IGF Code, provision 10.2, at least the following requirements should be considered.

9.1.1 Fuel consumers are to be suitably designed for operation with possible composition of intended LPG fuels.

9.1.2 The temperature of exhaust gas is to be subject to special consideration to prevent self-ignition of unburned gas in exhaust systems. However, where reducing the temperature of exhaust gas is impractical, documents are to be submitted demonstrating safety to be based on the risk assessment.

9.2 Gas turbines

In applying the IGF Code, provision 10.5.1.1, gas leakage in the enclosed space and the consequence are to be evaluated based on the risk assessment.

10 Ventilation

10.1 General requirements

In addition to item of the IGF Code, provision 13.3, at least the following requirements should be considered.

10.1.1 Ventilation ducts serving hazardous areas are not to be led through accommodation space, service space, machinery space, control stations and ro-ro space, except as allowed in the IGF Code 13.3.8.

10.1.2 In applying the IGF Code, provision 13.3, the ventilation outlets of hazardous spaces are to be located at the lowest part of the space and close to the bottom as far as ventilation is not interfered considering that LPG gas is heavier than air. Additionally, the ducts, and this emergency intake is to have a damper which is capable of being opened or closed from the weather deck and in the spaces.

10.1.3 In applying the IGF Code, provision 13.3, the number and location of the ventilation outlets in each space are to be considered taking into account the size and layout of the space. Where bottom arrangements are complicated, it is to be demonstrated based on ventilation analysis that capacity and duct arrangements of ventilation are adequate for the space.

10.1.4 In applying the IGF Code, provision 13.3.5, air outlets and air inlets for hazardous enclosed spaces are to be arranged to prevent exhausted gas from re-entering the space through air inlets. Satisfaction of this arrangement is to be demonstrated based on the risk assessment if necessary.

10.1.5 In applying the IGF Code, provision 13.3.5, ventilation exhaust ducts from gas-dangerous spaces are to discharge upwards.

10.1.6 In applying the IGF Code, provision 13.3.8, effectiveness of ventilation is to be verified in accordance with IEC 60092-10-1. Ventilation capacity is to be defined in such way that the degree of dilution for LPG gas leakage is to provide equivalent levels of the degree of dilution for LNG gas leakage with special consideration of density and lower explosion limit (LEL) of LPG gas.

10.2 Fuel preparation room

In addition to item of the IGF Code, provision 13.6, at least the following requirement should be considered.

10.2.1 In applying the IGF Code, provision 13.6.1, approved automatic fail-safe fire dampers are to be fitted in the ventilation trunk in the fuel preparation room.

10.3 Ducts and double pipes

In addition to item of the IGF Code, provision 13.8, at least the following requirements should be considered.

10.3.1 In applying the IGF Code, provision 13.8.1, ventilation inlets and outlets of double wall piping and ducts are to be located so that negative pressures are maintained in the whole space between inner pipes and outer ducts/pipes.

10.3.2 In applying the IGF Code 13.8.3, the ventilation inlets for the double wall piping and ducts are to be located in a non-hazardous open area away from ignition sources.

11 Electrical Installations

11.1 General requirement

In addition to item of the IGF Code, provision 14.3, at least the following requirement should be considered.

11.1.1 Equipment for hazardous areas is to 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

12 Control, Monitoring and Safety Systems

12.1 Gas detection

In addition to item of the IGF Code, provision 15.8.1, at least the following requirements should be considered.

12.1.1 In addition to the location required in the IGF Code, provision 15.8.1, gas detectors are to be permanently fitted in:

.1 ventilation inlet of ro-ro space if required based on the risk assessment; and

.2 bunkering station.

12.1.2 In applying the IGF Code, provision 15.8.6, in the detection of leakage of gas in the bunkering station, an alarm is to be given when the gas concentration reaches 30% of LEL and an ESD system of bunkering is to be activated when the gas concentration reaches 60% of LEL.

13 Special Consideration for Passenger Ships

13.1 General requirements

The following requirements should be specially considered for passenger ships, but not limited to:

13.1.1 Gas detection systems are to be fitted at openings of passenger spaces facing gas dangerous areas.

13.1.2 Risks of gas facilities and gas leakage on board that may affect the safety of passengers are to be identified based on the risk assessment.