**Amendments to the "Rules for the Classification of Ships": new requirements for LPG and Ammonia fuelled ships and relevant new additional class notations "LPG FUELLED", "NH3 FUELLED" and "NH3 FUELLED READY (X1, X2, X3…)":**

- **Part A, Chapter 1, Section 2: [6.14.52] (NEW), [6.14.53] (NEW), [6.14.54] (NEW);**
- **Part C, Chapter 1, Section 1: [2.9.1];**
- **Part C, Chapter 1, Appendix 13 (NEW APPENDIX);**
- **Part F, Chapter 13, Section 35 (NEW SECTION);**

RFC/002/AMN/009

*Effective from 1/5/2021*



+971 2 6922333 +971 2 4454333 info@tasneef.ae 111155, Abu Dhabi, UAE

# SECTION 2 CLASSIFICATION NOTATIONS

## 1 General

### 1.1 Purpose of the classification notations

**1.1.1** The classification notations give the scope according to which the class of the ship has been based and refer to the specific rule requirements which are to be complied with for their assignment. In particular, the classification notations are assigned according to the type, service and navigation of the ship and other criteria which have been provided by the Interested Party, when applying for classification.

The Society may change the classification notations at any time, when the information available shows that the requested or already assigned notations are not suitable for the intended service, navigation and any other criteria taken into account for classification.

Note 1: Reference should be made to Sec 1, [1.3] on the limits of classification and its meaning.

**1.1.2** The classification notations assigned to a ship are indicated on the Certificate of Classification, as well as in the Register of Ships published by the Society.

**1.1.3**

Ships and units, other than those covered in Parts B, C, D, E and F, are to comply with specific Rules published by the Society, which also stipulate the relevant classification notations.

**1.1.4** The classification notations applicable to existing ships conform to the Rules of the Society in force at the date of assignment of class, as indicated in Ch 2, Sec 1. However, the classification notations of existing ships may be updated according to the currrent Rules, as far as applicable.

### 1.2 Types of notations assigned

**1.2.1** The types of classification notations assigned to a ship are the following:

a) main class symbol
b) construction marks
c) service notations with additional service features, as applicable
d) navigation notations
e) operating area notations (optional)
f) additional class notations (optional)

The different classification notations and their conditions of assignment are listed in [2] to [6] below, according to their types.

**1.2.2** As an example, the classification notations assigned to a ship may be as follows (the kind of notation shown in brackets does not form part of the classification notation indicated in the Register of Ships and on the Certificate of Classification):

**C ✠ HULL ✠ MACH**

(main class symbol, construction marks)

**oil tanker-chemical tanker-ESP-Flash point > 60°C**

(service notation and additional service features)

**Unrestricted navigation**

(navigation notation)

**✠ SYS - NEQ**

(additional class notation).

## 2 Main class symbol

### 2.1 Main class symbol

**2.1.1** The main class symbol expresses the degree of compliance of the ship with the rule requirements as regards its construction and maintenance. There is one main class symbol, which is compulsory for every classed ship.

**2.1.2**

The main class symbol C is assigned to ships built in accordance with the requirements of the Rules or other rules recognised as equivalent, and maintained in a condition considered satisfactory by the Society. The period of class (or interval between class renewal surveys) assigned to a ship is maximum 5 years; see Ch 2, Sec 2, [4].

Except for special cases, class is assigned to a ship only when the hull, propulsion and auxiliary machinery installations, and equipment providing essential services have all been reviewed in relation to the requirements of the Rules.

Note 1: The symbol **C** with the 5 year class period is to be understood as being the highest class granted by the Society.

Note 2: The symbol **C** may be followed by the additional construction feature **light ship** in case of ships or other units having restricted navigation notations and generally having length not greater than 50 m as well as speed greater than 15 knots, whose hull scantlings and outfitting comply with the applicable requirements of Chapters 3 and 6 of the "Rules for the Classification of High Speed Craft", issued separately by the Society.

## 3 Construction marks

### 3.1 General

**3.1.1** The construction mark identifies the procedure under which the ship and its main equipment or arrangements have been surveyed for initial assignment of the class. The procedures under which the ship is assigned one of the construction marks are detailed in Ch 2, Sec 1.

is barrier free passage in public spaces on board and in escape routes to muster stations.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 32.

#### 6.14.50 BIOSAFE SHIP *(15/6/2020)*

The additional class notation **BIOSAFE SHIP** is assigned to:

- Cruise ships and ro-ro passenger ships with sleeping facilities for passengers
- Passenger ships, high-speed passenger craft and ro-ro passenger ships in short sea voyages
- Cargo ships

designed and provided with systems, components and operative procedures to control and prevent possible on board infection outbreak.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 33.

#### 6.14.51 REMOTE SURVEYABLE SHIP (REMOTE) *(5/6/2020)*

The additional class notation **REMOTE** is assigned to ships deemed by the Society eligible to remotely carry out the largest scope of class surveys, including periodical surveys, on the basis of:

- their age and service;
- their records of maintenance and operation; and,
- the specific arrangements and qualified personnel available on board to facilitate remote surveys (see Note 1).

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 34.

Note 1: Remote Survey: a survey carried out by the Society without the physical attendance of the Surveyor on board,

#### 6.14.52 LPG Fuelled *(1/5/2021)*

The additional class notation **LPG FUELLED** is assigned to ships operating with LPG as fuel for their internal combustion engines or boilers, complying with the design and constructional requirements of Pt C, Ch 1, App 13

#### 6.14.53 NH3 Fuelled *(1/5/2021)*

The additional class notation **NH3 FUELLED** is assigned to ships operating with Ammonia as fuel for their internal combustion engines or boilers, complying with the design and constructional requirements of Pt C, Ch 1, App 13.

#### 6.14.54 NH3 FUELLED READY (X1, X2, X3) *(1/5/2021)*

The additional class notation **NH3 FUELLED READY (X1, X2, X3…)** is assigned to ships whose design is in compliance with Pt C, Ch 1, App 13, and the relevant systems and arrangement are partially installed on board, thus easing a future ship conversion into a NH3 Fuelled Ship.

The requirements for the assignment of this additional class notation are given in Pt F, Ch 13, Sec 35.

## 7 Other notations

### 7.1

**7.1.1** The Society may also define other notations by means of provisional requirements and guidelines, which may then be published in the form of tentative rules.

**Table 3 : List of additional class notations** *(1/5/2021)*

| Additional class notation | Reference for definition | Reference | Remarks |
|---|---|---|---|
| **AIR LUBRICATION SYSTEM (AIR LUB)** | [6.14.48] | Pt F, Ch 13, Sec 31 | |
| **AIR-MON** | [6.14.34] | Pt F, Ch 13, Sec 22 | |
| **AUT-CCS** | [6.4.3] | Pt F, Ch 3, Sec 2 | **(1)** |
| **AUT-PORT** | [6.4.4] | Pt F, Ch 3, Sec 3 | **(1)** |
| **AUT-UMS** | [6.4.2] | Pt F, Ch 3, Sec 1 | **(1)** |
| **AVM-APS or AVM-APS-NS** | [6.3.2] | Pt F, Ch 2, Sec 1 | **(1)** |
| **AVM-IAPS** | [6.3.3] | Pt F, Ch 2, Sec 2 | **(1)** |
| **AVM-DPS or AVM-DPS-NS** | [6.3.4] | Pt F, Ch 2, Sec 3 | **(1)** |
| **AVM-IPS** | [6.3.5] | Pt F, Ch 2, Sec 4 | **(1)** |
| **BATTERY POWERED SHIPS** | [6.14.43] | Pt C, Ch 2, App 2 | |
| **BIOSAFE SHIP** | [6.14.50] | Pt F, Ch 13, Sec 33 | |
| **BWM-E** | [6.14.15] | NA | **(5)** |
| **BWM-T** | [6.14.15] | NA | |
| **CARGOCONTROL** | [6.14.9] | Pt F, Ch 13, Sec 9 | |

**(1)** A construction mark is added to this notation.
**(2)** This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).
**(3)** This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).
**(4)** When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).
**(5)** This notation may be completed by the specific features: **sequential, flow-through, dilution**.
**(6)** This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

| Additional class notation | Reference for definition | Reference | Remarks |
|---|---|---|---|
| **GREEN STAR 3 (TOC)** | [6.8.4] e) | - | |
| **GC CARGO HANDLING** | [6.8.5] | Pt F, Ch 7, Sec 6 | |
| **HELIDECK** | [6.14.20] | Pt F, Ch 13, Sec 16 | |
| **HELIDECK-H** | [6.14.20] | Pt F, Ch 13, Sec 16 | |
| **HYBRID PROPULSION SHIP (HYB-...)** | [6.14.45] | Pt F, Ch 13, Sec 28 | **(1)** |
| **HVSC** | [6.14.18] | Pt F, Ch 13, Sec 15 | |
| **ICE** | [6.10.5] | - | |
| **ICE CLASS IA** | [6.10.2] | Part F, Chapter 9 | **(6)** |
| **ICE CLASS IA SUPER** | [6.10.2] | Part F, Chapter 9 | **(6)** |
| **ICE CLASS IB** | [6.10.2] | Part F, Chapter 9 | **(6)** |
| **ICE CLASS IC** | [6.10.2] | Part F, Chapter 9 | **(6)** |
| **ICE CLASS ID** | [6.10.3] | Part F, Chapter 9 | **(6)** |
| **IMSBC-A** | [6.14.25] | Pt F, Ch 13, Sec 18 | |
| **IMSBC-nitrate** | [6.14.25] | Pt F, Ch 13, Sec 18 | |
| **IMSBC-non cohesive** | [6.14.25] | Pt F, Ch 13, Sec 18 | |
| **INERTGAS-A** | [6.14.21] | Pt C, Ch 4, Sec 1 | |
| **INERTGAS-B** | [6.14.21] | Pt C, Ch 4, Sec 1 | |
| **INERTGAS-C** | [6.14.21] | Pt C, Ch 4, Sec 1 | |
| **INWATERSURVEY** | [6.14.3] | Pt F, Ch 13, Sec 3 | |
| **INF 1, INF 2, INF 3** | [6.14.36] | NA | **(1)** |
| **LASHING** | [6.14.5] | Pt F, Ch 13, Sec 5 | |
| **LPG FUELLED** | [6.14.52] | Pt C, Ch 1, App 13. | |
| **MAN OVERBOARD DETECTION SYSTEM (MOB)** | [6.14.44] | Pt F, Ch 13, Sec 27 | |
| **MANOVR** | [6.14.10] | Pt F, Ch 13, Sec 10 | |
| **MLCDESIGN** | [6.14.16] | Pt F, Ch 13, Sec 13 | |
| **MON-HULL** | [6.6.2] | Pt F, Ch 5, Sec 1 | |
| **MON-SHAFT** | [6.6.3] | Pt F, Ch 5, Sec 2 | |
| **MOORING** | [6.14.30] | Pt F, Ch 13, Sec 21 | |
| **NH3 FUELLED** | [6.14.53] | Pt C, Ch 1, App 13. | |
| **NH3 FUELLED READY (X1, X2, X3)** | [6.14.54] | Pt F, Ch 13, Sec 35 | |
| **PERSONS WITH REDUCED MOBILITY (PMR-ITA)** | [6.14.49] | Pt F, Ch 13, Sec 32 | |
| **PMA** | [6.14.14] | NA | |
| **PMS** | [6.13.2] | Pt F, Ch 12, Sec 1 | |
| **PMS-CM(PROP)** | [6.13.3] | Pt F, Ch 12, Sec 2 | |
| **PMS-CM(HVAC)** | [6.13.4] | Pt F, Ch 12, Sec 3 | |
| **PMS-CM(CARGO)** | [6.13.5] | Pt F, Ch 12, Sec 4 | |
| **PMS-CM(ELE)** | [6.13.6] | Pt F, Ch 12, Sec 5 | |
| **PMS-CM(FDS)** | [6.13.7] | Pt F, Ch 12, Sec 6 | |
| **PMS-CM** | [6.13.8] | Pt F, Ch 12, Sec 7 | |
| **POLAR CLASS** | [6.11.1] | Part F, Chapter 10 | |
| **REF-CARGO** | [6.9.2] | Pt F, Ch 8, Sec 2 | **(1) (2)** |
| **REF-CONT** | [6.9.3] | Pt F, Ch 8, Sec 3 | **(1) (2)** |
| **REF-STORE** | [6.9.4] | Pt F, Ch 8, Sec 4 | **(1) (2)** |

**(1)** A construction mark is added to this notation.

**(2)** This notation may be completed by the specific notations **-PRECOOLING**, **-QUICKFREEZE** and/or **-AIRCONT** (see [6.9.5]).

**(3)** This notation may be completed by the specific notations **-MIDSHIP** and **-TRANSFER** (see [6.14.7]).

**(4)** When ships are assigned the notations **CLEAN-SEA** and **CLEAN-AIR**, the two separate notations are superseded by the cumulative additional class notation **GREEN STAR 3 DESIGN** (see [6.8.4]).

**(5)** This notation may be completed by the specific features: **sequential, flow-through, dilution**.

**(6)** This notation may be completed by the specific notation **-HULL** (see [6.10.4]).

# SECTION 1 GENERAL REQUIREMENTS

## 1 General

### 1.1 Application

**1.1.1** Chapter 1 applies to the design, construction, installation, tests and trials of main propulsion and essential auxiliary machinery systems and associated equipment, boilers and pressure vessels, piping systems, and steering and manoeuvring systems installed on board classed ships, as indicated in each Section of this Chapter.

### 1.2 Additional requirements

**1.2.1** Additional requirements for machinery are given in:

- Part E, for the assignment of the service notations
- Part F, for the assignment of additional class notations.

### 1.3 Documentation to be submitted

**1.3.1** Before the actual construction is commenced, the Manufacturer, Designer or Shipbuilder is to submit to the Society the documents (plans, diagrams, specifications and calculations) requested in the relevant Sections of this Chapter.

The list of documents requested in each Section is to be intended as guidance for the complete set of information to be submitted, rather than an actual list of titles.

The Society reserves the right to request the submission of additional documents to those detailed in the Sections, in the case of non-conventional design or if it is deemed necessary for the evaluation of the system, equipment or component.

Plans are to include all the data necessary for their interpretation, verification and approval.

Unless otherwise stated in the other Sections of this Chapter or agreed with the Society, documents for approval are to be sent in triplicate if submitted by the Shipyard and in four copies if submitted by the equipment supplier. Documents requested for information are to be sent in duplicate.

In any case, the Society reserves the rights to require additional copies when deemed necessary.

### 1.4 Definitions

#### 1.4.1 Machinery spaces of Category A

*Machinery spaces of Category A are those spaces and trunks to such spaces which contain:*

- *internal combustion machinery used for main propulsion, or*
- *internal combustion machinery used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW, or*
- *any oil fired boiler or fuel oil unit,* or
- gas generators, incinerators, waste disposal units, etc., which use oil fired equipment.

#### 1.4.2 Machinery spaces

*Machinery spaces are all machinery spaces of Category A and all other spaces containing propulsion machinery, boilers, fuel oil units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilising, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.*

#### 1.4.3 Fuel oil unit

*Fuel oil unit is the equipment used for the preparation of fuel oil for delivery to an oil fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0,18 N/mm$^2$.*

For the purpose of this definition, inert gas generators are to be considered as oil fired boilers and gas turbines are to be considered as internal combustion engines.

#### 1.4.4 Dead ship condition

Dead ship condition is the condition under which the whole propulsion system, including the main power supply, is not in operation and auxiliary means for bringing the main propulsion machinery into operation and for the restoration of the main power supply, such as compressed air and starting current from batteries, are not available, but assuming that means are available to start the emergency generator at all times.

## 2 Design and construction

### 2.1 General

**2.1.1** *The machinery, boilers and other pressure vessels, associated piping systems and fittings are to be of a design and construction adequate for the service for which they are intended and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards.*

*The design is to have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.*



...OMISSIS...

b) subject to the following:

- fuel oil tanks except those arranged in double bottom compartments are located outside of category A machinery spaces;
- *provisions for the measurement of oil temperature are provided on the suction pipe of the fuel oil pump;*
- stop valves and/or cocks are provided on the inlet side and outlet side of the fuel oil strainers; and
- pipe joints of welded construction or of circular cone type or spherical type union joint are applied as far as possible.

Fuel oil having flash points of less than 43°C may be employed on board cargo ships provided that it is stored outside machinery spaces and the arrangements adopted are specially approved by the Society.

The use of boil-off gas as fuel for boilers or propulsion engines is allowed on gas carriers subject to the requirements of Pt E, Ch 9, Sec 16.

The use of liquefied or compressed natural gas as fuel is allowed on other ship types subject to the specific requirements given in Appendix 7 or on ships in compliance with the latest edition of the International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), as amended, or equivalent arrangements. The use of LPG or NH3 as fuel is allowed subject to the specific requirements given in Appendix 13. The arrangement on ships of less than 500 gross tonnage is considered by the Society on a case by case basis. The use of other gases as fuel is considered by the Society on a case-by-case basis.

Note 1: The use of gas as fuel in ships requires additional acceptance by the Administration of the State whose flag the ship is entitled to fly.

### 2.10 Use of asbestos

**2.10.1**

*New installation of materials which contain asbestos is prohibited.*

## 3 Arrangement and installation on board

### 3.1 General

**3.1.1** *Provision shall be made to facilitate cleaning, inspection and maintenance of main propulsion and auxiliary machinery, including boilers and pressure vessels.*

Easy access to the various parts of the propulsion machinery is to be provided by means of metallic ladders and gratings fitted with strong and safe handrails.

Spaces containing main and auxiliary machinery are to be provided with adequate lighting and ventilation.

### 3.2 Floors

**3.2.1** Floors in engine rooms are to be metallic, divided into easily removable panels.

### 3.3 Bolting down

**3.3.1** Bedplates of machinery are to be securely fixed to the supporting structures by means of foundation bolts which are to be distributed as evenly as practicable and of a sufficient number and size so as to ensure a perfect fit.

Where the bedplates bear directly on the inner bottom plating, the bolts are to be fitted with suitable gaskets so as to ensure a tight fit and are to be arranged with their heads within the double bottom.

Continuous contact between bedplates and foundations along the bolting line is to be achieved by means of chocks of suitable thickness, carefully arranged to ensure a complete contact.

The same requirements apply to thrust block and shaft line bearing foundations.

Particular care is to be taken to obtain a perfect levelling and general alignment between the propulsion engines and their shafting (see Sec 7).

**3.3.2** Chocking resins are to be type approved.

### 3.4 Safety devices on moving parts

**3.4.1** Suitable protective devices are to be provided in way of moving parts (flywheels, couplings, etc.) in order to avoid injuries to personnel.

### 3.5 Gauges

**3.5.1** All gauges are to be grouped, as far as possible, near each manoeuvring position; in any event, they are to be clearly visible.

### 3.6 Ventilation in machinery spaces

**3.6.1**

Machinery spaces of category A are to be sufficiently ventilated so as to ensure that when machinery or boilers therein are operating at full power in all weather conditions, including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery.

Any other machinery space shall be adequately ventilated in relation to the purpose of that machinery space.

This sufficient amount of air is to be supplied through suitably protected openings arranged in such a way that they can be used in all weather conditions, taking into account Regulation 17(3) and Regulation 19 of the 1966 Load Line Convention as amended by the Protocol of 1988.

Special attention is to be paid both to air delivery and extraction and to air distribution in the various spaces. The quantity and distribution of air are to be such as to satisfy machinery requirements for developing maximum continuous power.

The ventilation is to be so arranged as to prevent any accumulation of flammable gases or vapours.



...OMISSIS...

# APPENDIX 13 LPG OR NH3 FUELLED SHIPS

## 1 General

### 1.1 Scope

#### 1.1.1 Application *(1/5/2021)*

The provisions of this Appendix apply to the arrangement, installation, control and monitoring of machinery, equipment and systems of ships using LPG or NH3 as fuel, other than ships covered by the IGC Code (hereinafter named "LPG or NH3 fuelled ships"). These ships are to comply with the requirements of the latest version of the International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code), as amended. In these Rules, reference to this Code and its amendments is made by the wording "IGF Code".

#### 1.1.2 Acceptance by the flag Administration *(1/5/2021)*

The use of LPG or NH3 as fuel in ships requires additional acceptance by the Administration of the State whose flag the ship is entitled to fly on the basis of the alternative design approach as required in IGF Code 2.3.

#### 1.1.3 IGF Code requirements and the Society's rules *(1/5/2021)*

a) For LPG or NH3 fuelled ships, the IGF Code requirements are to be considered as rule requirements, with the departures given in this Appendix;

b) for the scope of classification, the references to "LNG" and "gas" that are given in the IGF Code, are to be regarded as referring to LPG or NH3;

c) for the scope of classification, the references to "the Administration" that are given in the IGF Code, are to be regarded as referring to "the Society";

d) unless otherwise specified, the machinery, equipment and systems of ships using LPG or NH3 as fuel are also to comply with the requirements given in Part C;

e) the requirements of this Appendix include additional mandatory class requirements, as well as the Society's interpretations of the IGF Code, which are also to be considered mandatory for Class;

f) in general, this Appendix applies to machinery, equipment and systems of ships using LPG or NH3 as fuel and to the inter-faces between these systems and the other parts of the ship.

#### 1.1.4 IGF Code requirements not within the scope of classification *(1/5/2021)*

The following requirements of the IGF Code are not within the scope of classification:

- Chapter 11 - Fire Safety
- Chapter 17 - Drills and emergency exercises
- Chapter 18 - Operation
- Chapter 19 - Training

These requirements are applied by the Society when acting on behalf of the flag Administration, within the scope of delegation (see [1.1.6]).

#### 1.1.5 Correspondence of the IGF Code with the Rules *(1/5/2021)*

All the requirements of this Appendix are cross referenced to the applicable Chapters, Sections or paragraphs of the IGF Code, as appropriate.

#### 1.1.6 Certificate of Fitness *(1/5/2021)*

The responsibility for interpretation of the IGF Code requirements for the purpose of issuing an International Certificate of Fitness for the Gas-fuelled Ships lies with the Administration of the State whose flag the ship is entitled to fly.

Whenever the Society is authorised by an Administration to issue on its behalf the "Certificate of Fitness for the Gas-Fuelled ships", or where the Society is authorised to carry out investigations and surveys on behalf of an Administration on the basis of which the "Certificate of Fitness for the Gas-Fuelled ships" will be issued by the Administration, or where the Society is requested to certify compliance with the IGF Code, the full compliance with the requirements of the IGF Code, including the operative requirements mentioned in [1.1.4], will be granted by the Society, subject to [1.1.2].

### 1.2 Documentation to be submitted

#### 1.2.1 *(1/5/2021)*

Tab 1 lists the plans, information, analysis, etc. which are to be submitted in addition to the information required in the other Parts of the Rules, for the portion of the ship not involved in the LNG or NH3 handling.

**Table 1 : Documents to be submitted** *(1/5/2021)*

| No. | A/I **(1)** | Document |
|---|---|---|
| 1 | I | Propulsion system general arrangement - Design philosophy including information on the machinery configuration, engine room arrangements, fuel arrangements, shutdown philosophy (if applicable), redundancy considerations etc. are to be submitted before other documentation |
| 2 | I | Fuel system Risk assessment |
| 3 | A | Fuel system arrangement plan - including:<br>• gas tanks and gas containment systems with indication of distances required in 5.4 and calculations per 5.4.4, if applicable<br>• tank connection spaces<br>• fuel storage hold spaces<br>• fuel preparation rooms<br>• bunkering stations and other shore connections<br>• machinery and boiler spaces, service and control station spaces<br>• doors and openings to fuel preparation rooms and other hazardous areas |
| 4 | I | Fuel gas system operational manual including procedures for:<br>• bunkering, including filling limits curve<br>• gas freeing and inerting<br>• normal operation<br>• emergency operation |
| 5 | A | Fuel gas tanks including drawings of:<br>• tanks<br>• supports and stays<br>• secondary barriers<br>• insulation<br>• marking plates<br>• tank hatches, pipes and any other openings to gas tanks<br>Fuel gas tank design analysis:<br>• specification of design loads and structural analysis of gas tanks<br>• complete stress analysis for independent tanks type B and type C.<br>Fuel gas tanks production process including:<br>• fuel gas tank non-destructive testing (NDT) plan including:<br>• information about strength and tightness testing<br>• specification of stress relieving procedures for independent tanks type C (thermal or mechanical).<br>• fuel gas tank welding procedures<br>• fuel gas tank material specifications including connected pipes |
| 6 | A | Fuel gas tank safety relief valves and associated vent piping specification, piping capacity analysis including back pressure |
| 7 | A | Fuel gas tank gas freeing and purging system piping diagram |
| 8 | A | Fuel gas tank control and monitoring system |
| 9 | A | Fuel gas piping system:<br>Pipe routing sketch<br>Piping diagram (including bunkering lines and vent lines for safety relief valves or similar piping, vent mast, and secondary enclosure for gas pipes) |
| 10 | I | Fuel gas piping system - Specification of valves, flanges and fittings including offsets, loops, bends, expansion elements such as bellows and slip joints. For valves intended for service with a design temperature be-low -55°C, documentation of leak test and functional test at design temperature (type test) is to be included |
| 11 | A | Fuel gas system drip trays - System arrangement plan - Hull protection beneath liquid piping where leakages may be anticipated, such as at shore connections and at pump seals. Including specification |
| 12 | I | Electrical bonding of piping - Specification |

**(1)** A = to be submitted for approval, in four copies
I = to be submitted for information, in duplicate.

| No. | A/I (1) | Document |
|---|---|---|
| 13 | A | Cooling system - Piping diagram in connection with fuel gas system |
| 14 | A | Heating system - Piping diagram in connection with fuel gas system |
| 15 | A | Fuel gas system control, monitoring and safety systems, including a test program for safety functions |
| 16 | A | Fuel gas driven engines - Failure mode and effect analysis |
| 17 | A | Exhaust gas system - Piping diagram |
| 18 | A | Hazardous area classification drawing, including air-lock location, construction details and alarm equipment |
| 19 | A | Gastight bulkhead penetrations - Detailed drawing |
| 20 | A | Ventilation of gas fuel system spaces - Ducting diagram for spaces containing gas installations, such as gas pipe ducts led through enclosed spaces, storage tanks below deck. Including capacity and location of fans and their motors |
| 21 | I | Explosion protection<br>• System arrangement plan of electrical equipment in hazardous areas<br>• Single line diagrams for all intrinsically safe circuits, for each circuit, including data for verification of the compatibility between the barrier and the field components<br>• List of non-certified safe electrical equipment to be disconnected for ESD protected machinery spaces<br>• Documentation to demonstrate the fulfilment of [4.3]<br>• List of certified safe type equipment/instruments (Ex)<br>• Certificates of the safe type (Ex) equipment/instrumentation as per [1.3.2] |
| 22 | A | Fixed gas detection system arrangement plan<br>Detectors, call points and alarm devices specification |
| 23 | I | FMEA of the whole gas-fuelled system |
| 24 | A | Test procedures of safety-critical items, in particular those related to the gas system as ascertained by the FMEA |
| 25 | I | Documentation of alternative design as per [2], as applicable |

**(1)** A = to be submitted for approval, in four copies
I = to be submitted for information, in duplicate.

## 1.3 Definitions

**1.3.1** *(1/5/2021)*

IGF CODE REFERENCE: Ch. 2, 2.1

Unless otherwise stated below, definitions are as defined in SOLAS chapter II-2 and IGF Code 2.2.

**1.3.2** *(1/5/2021)*

IGF CODE REFERENCE: Ch. 2, 2.2

Certified safe type means electrical equipment that is certified safe by the relevant recognized authorities for operation in a flammable atmosphere based on a recognized standard.

*Note 1: Refer to IEC 60079 series, Explosive atmospheres and IEC 60092-502:1999 Electrical Installations in Ships - Tankers - Special Features.*

**1.3.3** *(1/5/2021)*

LPG means liquefied petroleum gas, but it also means LPG vapours.

**1.3.4** *(1/5/2021)*

Immediately Dangerous to Life and Health (IDLH) for NH3 means a volumetric concentration of 300 ppm, according to the USA National Institute for Occupational Safety and Health (NIOSH).

**1.3.5** *(1/5/2021)*

Gas and Gas Fuel in the context of this appendix in general mean either LPG or NH3 in liquefied or vapour form (except specified otherwise, like "inert gas" or "liquid gas").

**1.3.6** *(1/5/2021)*

High pressure means a maximum working pressure greater than 2.0 MPa.

**1.3.7** *(1/5/2021)*

NH3 means liquefied anhydrous ammonia, but it also includes ammonia vapours.

**1.3.8** *(1/5/2021)*

Permissible exposure limit (PEL) for NH3 means a volumetric concentration of 50 ppm, according to UE Directive 2019/1831 “Indicative occupational exposure limit value”.

# 2 Alternative design

IGF CODE REFERENCE: Ch. 2, 2.3

## 2.1

**2.1.1** *(1/5/2021)*

Appliances and arrangements may deviate from those set out in this Appendix provided that these meet the intent of the goal and functional requirements concerned and provide an equivalent level of safety of the relevant paragraphs.

**2.1.2** *(1/7/2021)*

The equivalence of the alternative design is to be demonstrated as specified in SOLAS regulation II-1/55, and approved by the Society. Operational methods or procedures will not be allowed as an alternative to a particular fitting, material, appliance, apparatus, item of equipment, or type thereof which is prescribed by this Appendix.

# 3 Goal and functional requirements

IGF CODE REFERENCE: Ch. 3

## 3.1 Goal

**3.1.1** *(1/5/2021)*

The goal of this Appendix 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 gas as fuel.

## 3.2 Functional requirements

**3.2.1** *(1/5/2021)*

*The safety, reliability and dependability of the systems is to be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery.* A FMEA consistent with the "Tasneef Guide for FMEA" is to be carried out for the whole gas-fuelled system, including pro-cess system, electrical power supplies and control system, to check the potential existence of failure modes that can jeopardize the ship's safety. The results of the FMEA are then to be used to establish a trial program.

**3.2.2** *(1/5/2021)*

*The probability and consequences of fuel-related hazards are to 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 are to be initiated.*

**3.2.3** *(1/5/2021)*

*The design philosophy is to 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** *(1/5/2021)*

*Hazardous areas are to 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** *(1/5/2021)*

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

**3.2.6** *(1/5/2021)*

*Unintended accumulation of explosive, flammable or toxic gas concentrations are to be prevented.*

**3.2.7** *(1/5/2021)*

*System components are to be protected against external damages.*

**3.2.8** *(1/5/2021)*

*Sources of ignition in hazardous areas are to be minimized to reduce the probability of explosions.*

**3.2.9** *(1/5/2021)*

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

**3.2.10** *(1/5/2021)*

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

**3.2.11** *(1/5/2021)*

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

**3.2.12** *(1/5/2021)*

*Fuel containment system and machinery spaces containing source that might release gas into the space are to 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** *(1/5/2021)*

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

**3.2.14** *(1/5/2021)*

*Fixed gas detection suitable for all spaces and areas concerned are to be arranged.*

**3.2.15** *(1/5/2021)*

*Fire detection, protection and extinction measures appropriate to the hazards concerned are to be provided.*

**3.2.16** *(1/5/2021)*

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

**3.2.17** *(1/5/2021)*

*The technical documentation is to 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** *(1/5/2021)*

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

# 4 General requirements

IGF CODE REFERENCE: Ch. 4, 4.1

## 4.1 Goal

**4.1.1** *(1/5/2021)*

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

## 4.2 Risk assessment

IGF CODE REFERENCE: Ch. 4, 4.2.

**4.2.1** *(1/5/2021)*

A risk assessment is to be conducted to ensure that risks arising from the use of LPG or NH3 as fuel and potentially affecting persons on board, the environment, the structural strength or the integrity of the ship are addressed. Consideration are to be given to the hazards associated with physical layout, operation and maintenance, following any reasonably foreseeable failure.

**4.2.2** *(1/5/2021)*

For ships to which this Appendix applies, the risk assessment required by [4.2.1] need to be conducted:

a) where explicitly required by:

- IGF Code paragraphs 5.10.5, 5.12.3, 6.4.1.1, 6.4.15.4.7.2, 8.3.1.1, 13.4.1, 13.7 and 15.8.1.10, and
- paragraphs 4.4 and 6.8 of Annex to IGF Code, and
- paragraphs 5.2.1, 5.4.2, 5.10.5, 5.10.6, 5.12.2, 6.3.3, 6.4.2, 6.7.2, 8.3.1, 9.7.2, 13.7.1 and 15.8.2 of this Appendix, and

b) when other potential hazards connected with the use of LPG or NH3 as fuel are to be addressed.

**4.2.3** *(1/5/2021)*

*The risks are to be analysed using acceptable and recognized risk analysis techniques, and loss of function, component damage, fire, explosion and electric shock are as a minimum to be considered. The analysis is to ensure that risks are eliminated wherever possible. Risks which cannot be eliminated are to be mitigated as necessary. Details of risks, and the means by which they are mitigated, are to be documented to the satisfaction of the Society*. Guidance on risk analysis techniques can be found in the "Tasneef Guide on Risk Analysis".

**4.2.4** *(1/5/2021)*

The assumptions for the risk assessment are to be agreed by a team of experts acceptable to the Society. It may include a representative of Class, owner, builder or designer, and consultants having the necessary knowledge and experience in safety, design and/or operation as necessary for the specific evaluation at hand. Other members may include marine surveyors, ship operators, safety engineers, equipment manufacturers, human factors experts, naval architects and marine engineers, according to the problem under scope.

## 4.3 Limitation of explosion consequences

IGF CODE REFERENCE: Ch. 4, 4.3

**4.3.1** *(1/5/2021)*

The preferred safety policy is to be the elimination of either any source of release or any source of ignition, or both. Only in case this is demonstrated not to be feasible, the following applies.

*An explosion in any space containing any potential sources of release (note 1) and potential ignition sources is not to:*

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

*b) damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;*

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

*d) disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution;*

*e) damage life-saving equipment or associated launching arrangements;*

*f) disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space;*

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

*h) prevent persons access to life-saving appliances or impede escape routes.*

Note 1: Double wall fuel pipes are not considered as potential sources of release.

The aforesaid points are to be demonstrated in a way acceptable to the Society.

# 5 Ship design and arrangement

IGF CODE REFERENCE: Ch. 5

## 5.1 Goal

IGF CODE REFERENCE: Ch. 5, 5.1

**5.1.1** *(1/5/2021)*

*The goal of this paragraph [5] is to provide for safe location, space arrangements and mechanical protection of power generation equipment, fuel storage systems, fuel supply equipment and refuelling systems.*

## 5.2 Functional requirements

IGF CODE REFERENCE: Ch. 5, 5.2

**5.2.1** *(1/5/2021)*

*This paragraph [5] is related to functional requirements in IGF Code paragraphs 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 apply:*

a) the fuel tank(s) is (are) to be located on open deck; consideration may be given to accepting the tanks under deck upon satisfactory consideration in the context Risk Analysis.

Anyway, the tank(s) is (are) to *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;*

*b) fuel containment systems, fuel piping and other fuel sources of release are to be so located and arranged that released gas is lead to a safe location in the open air;*

*c) the access or other openings to spaces containing fuel sources of release are to be so arranged that flammable,*

*asphyxiating or toxic gas cannot escape to spaces that are not designed for the presence of such gases;*

*d) fuel piping is to be protected against mechanical damage;*

*e) the propulsion and fuel supply system are to be so designed that safety actions after any gas leakage do not lead to an unacceptable loss of power; and*

*f) the probability of a gas explosion in a machinery space with gas or low-flashpoint fuelled machinery is to be minimized.*

## 5.3 Regulations - General

IGF CODE REFERENCE: Ch. 5, 5.3

**5.3.1** *(1/5/2021)*

The requirements in IGF Code 5.3 apply.

## 5.4 Machinery space concepts

IGF CODE REFERENCE: Ch. 5, 5.4

**5.4.1** *(1/5/2021)*

In a machinery space with LPG fuelled machinery, one of these two alternative concepts may be applied:

a) *Gas safe machinery spaces: arrangements in machinery spaces are such that the spaces are considered gas safe under all conditions, normal as well as abnormal conditions, i.e. inherently gas safe.*

*In a gas safe machinery space a single failure cannot lead to release of fuel gas into the machinery space.*

b) *ESD-protected machinery spaces: arrangements in machinery spaces are such that the spaces are considered non-hazardous under normal conditions, but under certain abnormal conditions may have the potential to become hazardous. In the event of abnormal conditions involving gas hazards, emergency shutdown (ESD) of non-safe equipment (ignition sources) and machinery is to be automatically executed while equipment or machinery in use or active during these conditions is to be of a certified safe type.*

*In an ESD protected machinery space a single failure may result in a gas release into the space. Venting is designed to accommodate a probable maximum leakage scenario due to technical failures.*

*Failures leading to dangerous gas concentrations, e.g. gas pipe ruptures or blow out of gaskets are covered by explosion pressure relief devices and ESD arrangements.*

**5.4.2** *(1/5/2021)*

In a machinery space with NH3 fuelled machinery only gas safe machinery is allowed, such that the spaces are considered gas safe under all conditions, normal as well as abnormal conditions, i.e. inherently gas safe.

In a gas safe machinery space a single failure cannot lead to release of fuel gas into the machinery space.

Consideration may be given to accepting an ESD protected machinery space on small ships, upon satisfactory consideration in the context of the Risk analysis.

## 5.5 Regulations for gas safe machinery space

IGF CODE REFERENCE: Ch. 5, 5.5

**5.5.1** *(1/5/2021)*

The requirements in IGF Code 5.5 apply.

## 5.6 Regulations for ESD-protected machinery spaces

IGF CODE REFERENCE: Ch. 5, 5.6

**5.6.1** *(1/5/2021)*

The requirements in IGF Code 5.6 apply.

## 5.7 Regulations for location and protection of fuel piping

IGF CODE REFERENCE: Ch. 5, 5.7

**5.7.1** *(1/5/2021)*

The requirements in IGF Code 5.7 apply.

## 5.8 Regulations for fuel preparation room design

IGF CODE REFERENCE: Ch. 5, 5.8

**5.8.1** *(1/5/2021)*

The requirements in IGF Code 5.8 apply.

## 5.9 Regulations for bilge systems

IGF CODE REFERENCE: Ch. 5, 5.9

**5.9.1** *(1/5/2021)*

The requirements in IGF Code 5.9 apply.

## 5.10 Regulations for drip trays

IGF CODE REFERENCE: Ch. 5, 5.10

**5.10.1** *(1/5/2021)*

The requirements in IGF Code 5.10 apply.

**5.10.2** *(1/5/2021)*

The risk assessment is to follow the steps outlined below.

a) The experts team is to conduct a Hazard Identification (HAZID) to agree on the scenarios to be subjected to the risk analysis, and on the assumptions regarding the most critical events (typically, connection failures causing an LPG or NH3 spill).

b) Reasonable assumptions on the extent of connection failures or other selected events and the process parameters of the LPG or NH3 are to be made by the team of experts, preferably on the basis of statistics available in the public domain or provided and documented by stakeholders.

c) Reasonable assumptions on the operation of ventilation system are to be made according to layout and procedures of the affected space.

d) In order to verify the drip tray capacity, a specific simulation is to be set up, aimed at evaluating the maximum amount of LPG or NH3 spilled into the drip tray, the evaporation rate, and the possibility to fully accommodate the LPG or NH3 in the drip tray. The dispersion of vapours resulting from LPG or NH3 evaporation in the affected space is also to be ascertained in respect of

explosive and toxic atmosphere. For NH3 release the toxicity level (e.g. concentration in ppm) shall be evaluated together with possible risks connected to the presence of persons in the same space or area, taking into account that according to UE Directive 2019/1831 "Indicative occupational exposure limit value" the Short Term Exposure Limit (STEL -15 minutes) is 50 ppm and according to the USA National Institute for Occupational Safety and Health (NIOSH) the Immediately Dangerous to Life and Health (IDLH) is of 300 ppm.

e) The simulation is to be conducted by commercially available and validated tools (typically, by CFD tools). It is to focus on the calculation of the amount of LPG or NH3spilled before the stop of LPG or NH3 flow. Other calculation methods (e.g. empirical formulas based on literature) are subject to special consideration.

f) As a precaution, in order to maximize the accumulation of LPG or NH3 into the drip tray, LPG or NH3 release is to be directed downward, impinging on the drip tray, and ambient temperature is to be set to the minimum credible winter temperature. Equipment and space surfaces and drip tray are to be considered adiabatic, to conservatively minimize the heat exchange with the LPG or NH3 droplets, and to increase the amount of liquid accumulated in the drip tray.

g) Reasonable assumptions are to be made by the experts team regarding detection time, LPG or NH3 flow stop time and human reaction time, in case operators are credited in the emergency.

h) If the simulation demonstrates that the drip tray cannot accommodate the LPG or NH3 spill, mitigating measures are to be provided and subjected to the same simulation process, to appreciate the risk reduction.

## 5.11 Regulations for arrangement of entrances and other openings in enclosed spaces

IGF CODE REFERENCE: Ch. 5, 5.11

**5.11.1** *(1/5/2021)*

The requirements in IGF Code 5.11 apply.

## 5.12 Regulations for airlocks

IGF CODE REFERENCE: Ch. 5, 5.12

**5.12.1** *(1/5/2021)*

The requirements in IGF Code 5.12 apply.

**5.12.2** *(1/5/2021)*

In the context of the risk analysis required in IGF Code 5.12.3, the team of experts is to conduct a Hazard Identification (HAZID) to agree on the airlocks to be subjected to the risk analysis, and on the assumptions regarding the most critical events.

In order to assess the structural integrity of the room and the suitability of the designed airlock, the maximum pressure within the spaces identified by the HAZID has to be evaluated, considering the effectiveness of the ventilation system. This calls for a simulation by means of the tools mentioned in [5.10.2]. The following steps, as a minimum, are to be performed.

a) Representative accidental scenarios of loss of LPG or NH3 from failures in process or containment systems are to be selected by the team of experts in the identified spaces. The simulation is to focus on the calculation of the amount of LPG or NH3 spilled before the stop of the LPG or NH3 flow

b) Reasonable assumptions on the extent of containment failure and the process parameters of the LPG or NH3 are to be made by the team of experts, preferably on the basis of statistics available in the public domain or provided and documented by stakeholders.

c) Reasonable assumptions on the operation of ventilation system are to be made according to layout and procedures of the selected spaces.

d) As a precaution, in order to maximize the accumulation of LPG or NH3 onto the space floor, LPG or NH3 release is to be directed downward, impinging on the floor, and ambient temperature is to be set to the maximum credible summer temperature in the space. The surfaces are to be considered isothermal at ambient temperature, to conservatively increase the evaporation rate and, consequently, the pressure buildup.

e) Reasonable assumptions are to be made by the team of experts regarding detection time, LPG or NH3 flow stop time and human reaction time, in case operators are credited in the emergency.

If the simulation demonstrates that the analysed airlocks cannot prevent gas release in safe space, mitigating measures are to be provided and subjected to the same simulation process, to appreciate the risk reduction.

# 6 Fuel containment system

IGF CODE REFERENCE: Ch. 6

## 6.1 Goal

**6.1.1** *(15/2021)*

*The goal of this paragraph [6] is to provide that gas 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

**6.2.1** *(1/5/2021)*

*This paragraph [6] relates to functional requirements in IGF Code 3.2.1, 3.2.2, 3.2.5 and 3.2.8 to 3.2.17. In particular the following apply:*

a) *the fuel containment system is to 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 assembly stations, escape routes and life-saving appliances (LSA); and*

5) *reduction in availability of LSA.*

b) *the pressure and temperature in the fuel tank are to be kept within the design limits of the containment system and possible carriage requirements of the fuel;*

c) *the fuel containment arrangement is to be so designed that safety actions after any gas leakage do not lead to an unacceptable loss of power; and*

d) *if portable tanks are used for fuel storage, the design of the fuel containment system is to be equivalent to permanent installed tanks as described in this paragraph.*

## 6.3 Regulations - General

**6.3.1** *(1/5/2021)*

The requirements in IGF Code 6.3 apply, with the following departures from IGF Code 6.3.1 and 6.3.4.

**6.3.2** *(1/5/2021)*

LPG and NH3 in a liquid state may be stored with a maximum allowable relief valve setting (MARVS) of up to 2.0 MPa.

**6.3.3** *(1/5/2021)*

All tank connections, fittings, flanges and tank valves are to be enclosed in a tank connection spaces which is gastight toward other enclosed spaces, including tank connections on open deck, unless, for LPG only, the risk assessment exclude the risk of gas accumulating on the deck or flowing into non-hazardous areas. The tank connection space is to be able to safely contain leakage from the tank connections.

## 6.4 Regulations for liquefied gas fuel containment

**6.4.1** *(1/5/2021)*

The requirements in IGF Code 6.4 apply.

**6.4.2 Tank types** *(1/5/2021)*

Normally LPG and NH3 should be stored in Type C tanks designed to withstand the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature, so that no system is required to be operated to maintain the fuel tanks' pressure and temperature within their design range.

Consideration may be given to accepting Type C tanks designed to withstand a pressure lower than the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature; for NH3 this will be limited to cases where the storage conditions and tank properties ensure compliance with IGF Code 6.9.1.1 by pressure accumulation.

Other types of tanks will be considered on a case by case basis, for justified reasons and upon satisfactory consideration in the context of the Risk analysis.

**6.4.3 Materials and construction** *(1/5/2021)*

When applying IGF Code 6.4.13.1.1.1.5, loss of vacuum for vacuum insulated tanks shall also be considered.

## 6.5 Regulations for portable liquefied gas fuel tanks

**6.5.1** *(1/5/2021)*

The requirements in IGF Code 6.5 apply, with the following departure.

**6.5.2** *(1/5/2021)*

Portable fuel tanks for NH3 are to be located in dedicated areas on open deck.

## 6.6 Regulations for CNG fuel containment

**6.6.1** *(1/5/2021)*

The requirements in IGF Code 6.6 apply to containment system for LPG and NH3 when the design pressure is 0.07 MPa or above.

## 6.7 Regulations for pressure relief system

**6.7.1 General** *(1/5/2021)*

The requirements in IGF Code 6.7.1 and 6.7.3 apply. IGF Code 6.7.2 is replaced by the following.

**6.7.2 Pressure relief systems for liquefied gas fuel tanks** *(1/5/2021)*

a) If fuel release into the vacuum space of a vacuum insulated tank cannot be excluded, the vacuum space is to be protected by a pressure relief device which is to be connected to a vent system.

*b) Liquefied gas fuel tanks are to be fitted with a minimum of 2 pressure relief valves (PRVs) allowing for disconnection of one PRV in case of malfunction or leakage.*

*c) Interbarrier spaces are to be provided with pressure relief devices. For membrane systems, the designer is to demonstrate adequate sizing of interbarrier space PRVs.*

*d) The setting of the PRVs is not to be higher than the vapour pressure that has been used in the design of the tank. Valves comprising not more than 50% of the total relieving capacity may be set at a pressure up to 5% above MARVS to allow sequential lifting, minimizing unnecessary release of vapour.*

*e) The following temperature regulations apply to PRVs fitted to pressure relief systems:*

*1) PRVs on fuel tanks with a design temperature below 0oC are to be designed and arranged to prevent their becoming inoperative due to ice formation;*

*2) the effects of ice formation due to ambient temperatures are to be considered in the construction and arrangement of PRVs;*

*3) PRVs are to be constructed of materials with a melting point above 925°C. Lower melting point materials for internal parts and seals may be accepted provided that fail-safe operation of the PRV is not compromised; and*

*4) sensing and exhaust lines on pilot operated relief valves are to be of suitably robust construction to prevent damage.*

f) *In the event of a failure of a fuel tank PRV a safe means of emergency isolation is to be available.*

*1) procedures are to be provided and included in the operation manual;*

*2) the procedures are to allow only one of the installed PRVs for the liquefied gas fuel tanks to be isolated, physical interlocks are to be included to this effect; and*

3) *isolation of the PRV is to be carried out under the supervision of the master. This action is to be recorded in the ship's log, and at the PRV.*

g) Each pressure relief valve installed on a liquefied NH3 or LPG gas fuel tank is to be connected to a collecting system venting system whose discharge position will be considered on a case-by-case, subject to:

- the submission of an appropriate risk assessment. Such a risk assessment is to be based on a ship specific gas dispersion analysis;
- the discharge will be unimpeded and directed toward areas where the discharge does not cause risks to be determined according to d), also taking into account the density of discharged gases;
- minimizing the possibility of water or snow entering the vent system;

*h)* The outlet from the pressure relief valves is normally to be located at a suitable distance from the nearest:

- air intake, air outlet or opening to accommodation, service and control spaces, or other non-hazardous area; and
- exhaust outlet from machinery installations.

*i) All other fuel gas vent outlets are also to be arranged in accordance with g) and h). Means are to be provided to prevent liquid overflow from gas vent outlets, due to hydrostatic pressure from spaces to which they are connected.*

*j)* The distances needed to fulfil the requirements in g) and h) are to be determined by the Risk assessment required in [4.2], considering the physical properties of the released gas and relevant dispersion.

k) *In the vent piping system, means for draining liquid,* including condensed LPG or NH3, *from places where it may accumulate are to be provided. The PRVs and piping are to be arranged so that liquid can, under no circumstances, accumulate in or near the PRVs;* to this purpose the discharge line from the PRV is to be equipped with a drainage system leading to a suitable tank.

*l) Suitable protection screens of not more than 13 mm square mesh are to be fitted on vent outlets to prevent the ingress of foreign objects without adversely affecting the flow.*

*m) All vent piping is to be designed and arranged not to be damaged by the temperature variations to which it may be exposed, forces due to flow or the ship's motions.*

n) *PRVs are to be connected to the highest part of the fuel tank. PRVs are to be positioned on the fuel tank so that they will remain in the vapour phase at the filling limit (FL) as given in [6.8], under conditions of 15° list and 0.015L trim, where L is defined in IGF Code 2.2.25.*

## 6.8 Regulations on loading limit for liquefied gas fuel tanks

**6.8.1** *(1/5/2021)*

The requirements in IGF Code 6.8 apply.

## 6.9 Regulations for the maintaining of fuel storage condition

**6.9.1** *(1/5/2021)*

The requirements in IGF Code 6.9 apply, with the following departures to IGF Code 6.9.1.

**6.9.2 Control of tank pressure and temperature** *(1/5/2021)*

a) *With the exception of liquefied gas fuel tanks designed to withstand the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature, liquefied gas fuel tanks' pressure and temperature are to be maintained at all times within their design range by means acceptable to the Society, e.g. by one of the following methods:*

*1) reliquefaction of vapours;*

*2) thermal oxidation of vapours;*

*3)* pressure accumulation in a separate tank; or

*4) liquefied gas fuel cooling.*

*The method chosen is to be capable of maintaining tank pressure below the set pressure of the tank pressure relief valves for a period of 15 days assuming full tank at normal service pressure,* a tank valve closed by the safety system *and the ship in idle condition, i.e. only power for domestic load is generated.*

b) *Venting of fuel vapour for control of the tank pressure is not acceptable except in emergency situations.*

The activation of the safety system alone is not deemed as an emergency situation.

## 6.10 Regulations on atmospheric control within the fuel containment system

**6.10.1** *(1/5/2021)*

The requirements in IGF Code 6.10 apply.

## 6.11 Regulations on atmosphere control within fuel storage hold spaces (Fuel containment systems other than type C independent tanks)

**6.11.1** *(1/5/2021)*

The requirements in IGF Code 6.11 apply.

## 6.12 Regulations on environmental control of spaces surrounding type C independent tanks

**6.12.1** *(1/5/2021)*

The requirements in IGF Code 6.12 apply.

### 6.13 Regulations on inerting

**6.13.1** *(1/5/2021)*

The requirements in IGF Code 6.13 apply.

**6.13.2** *(1/5/2021)*

The spaces where the inert gas double block and bleed valves and closable non-return valve are fitted are to be classified as a Zone 1 hazardous spaces.

### 6.14 Regulations on inert gas production and storage on board

**6.14.1** *(1/5/2021)*

The requirements in IGF Code 6.14 apply.

## 7 Material and general pipe design

IGF CODE REFERENCE: Ch. 7

### 7.1 Goal

**7.1.1** *(1/5/2021)*

*The goal of this paragraph [7] is to ensure the safe handling of fuel, under all operating conditions, to minimize the risk to the ship, personnel and to the environment, having regard to the nature of the products involved.*

### 7.2 Functional requirements

**7.2.1** *(1/5/2021)*

*This paragraph [7] relates to functional requirements in IGF Code 3.2.1, 3.2.5, 3.2.6, 3.2.8, 3.2.9 and 3.2.10. In particular the following apply:*

*a) Fuel piping is to be capable of absorbing thermal expansion or contraction caused by extreme temperatures of the fuel without developing substantial stresses.*

*b) Provision is to be made to protect the piping, piping system and components and fuel tanks from excessive stresses due to thermal movement and from movements of the fuel tank and hull structure.*

*c) If the fuel gas contains heavier constituents that may condense in the system, means for safely removing the liquid are to be fitted.*

d) *Low temperature piping is to be thermally isolated from the adjacent hull structure, where necessary, to prevent the temperature of the hull from falling below the design temperature of the hull material.*

### 7.3 Regulations for general pipe design

**7.3.1 General** *(1/5/2021)*

The requirements in IGF Code 7.3 apply.

### 7.4 Regulations for materials

**7.4.1 Metallic materials** *(1/5/2021)*

The requirements in IGF Code 7.4 apply.

## 8 Bunkering

IGF CODE REFERENCE: Ch. 8

### 8.1 Goal

**8.1.1** *(1/5/2021)*

*The goal of this paragraph [8] 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** *(1/5/2021)*

*This paragraph [8] relates to functional requirements in IGF Code 3.2.1 to 3.2.11 and 3.2.13 to 3.2.17. In particular the following apply.*

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

### 8.3 Regulations for bunkering station

**8.3.1 General** *(1/5/2021)*

The requirements in IGF Code 8.3 apply, with the following additions:

a) The bunkering station is to be under direct view from a bunkering control station, if any, or from the bridge; as an alternative a CCTV system may be considered.

For bunkering of LPG or NH3, a risk assessment is to be carried out, following the steps outlined below.

1) The team of experts is to conduct a Hazard Identification (HAZID) to agree on the scenarios to be subjected to the risk analysis, and on the assumptions regarding the most critical events (typically, connection failures causing an LPG or NH3 spill). The effects in the bunker station and above and below it are to be simulated by means of the tools mentioned in [5.10.2].

2) As a minimum, a scenario to be assumed is the failure of the presentation flange on the liquid bunkering line. The simulation is to focus on the calculation of the amount of LPG or NH3 spilled before the intervention of ESD and the stop of the bunkering pumps. After the stop of the pumps, the amount of the discharge of the residual inventory of the hose or loading arm is to be calculated according to the bunkering configuration, to estimate whether it is significant; in this case, it is to be taken into account in the simulation.

3) Reasonable assumptions on the extent of connection failures or other selected events and the parameters of the LPG or NH3 process are to be made by the team of experts, preferably on the basis of statistics available in the public domain or provided and doc-

umented by stakeholders or using industry safety standards.

4) Reasonable assumptions on the operation of ventilation system are to be made according to layout and procedures of the bunker station.

5) In order to verify the drip tray capacity, a specific simulation is to be set up, aimed at evaluating the maximum amount of LPG or NH3 spilled onto the drip tray, the evaporation rate, and the possibility to fully accommodate the LPG or NH3 in the drip tray avoiding any overboard disposal.

6) In particular, the dispersion of methane resulting from LPG or NH3 evaporation in the bunker station and from the bunker station to the upper decks, if realistically possible, is to be simulated.

7) As a precaution, in order to maximize the accumulation of LPG or NH3 onto the drip tray, LPG or NH3 release is to be directed downward, impinging on the drip tray, and ambient temperature is to be set to the minimum credible winter temperature. Equipment, bunker station floor and surfaces and drip tray are to be considered adiabatic, to conservatively increase the amount of liquid accumulated in the drip tray.

8) Reasonable assumptions are to be made by the team of experts regarding detection time, LPG or NH3 flow stop time and human reaction time, in case operators are credited in the emergency. If the simulation demonstrates that the drip tray cannot accommodate the LPG or NH3 spill, or the dispersion of evaporated gas reaches areas not suitable to an explosive gas or toxic gas atmosphere, mitigating measures are to be provided and subjected to the same simulation process, to appreciate the risk reduction.

b) Low temperature steel shielding is to be considered if the escape of cold jets impinging on surrounding hull structure is possible.

## 8.4 Regulations for manifold

**8.4.1** *(1/5/2021)*

The requirements in IGF Code 8.4 apply.

## 8.5 Regulations for bunkering system

**8.5.1** *(1/5/2021)*

*An arrangement for purging fuel bunkering lines with inert gas is to be provided.*

**8.5.2** *(1/5/2021)*

The bunkering system is to be so arranged that the gas discharged to the atmosphere during filling of storage tanks is minimized.

**8.5.3** *(1/5/2021)*

*A manually operated stop valve and a remote operated shutdown valve in series, or a combined manually operated and remote valve is to be fitted in every bunkering line close to the connecting point. It is to be possible to operate the remote valve in the control location for bunkering operations and/or from another safe location.*

***8.5.4*** *(1/5/2021)*

*Means are to be provided for draining any fuel from the bunkering pipes upon completion of operation,* unless these are arranged for a permanent containment of LPG or NH3.

***8.5.5*** *(1/5/2021)*

*Bunkering lines are to be arranged for inerting and gas freeing. When not engaged in bunkering, the bunkering pipes are to be free of gas,* unless these are arranged for a permanent containment of LPG or NH3 and the consequences of not gas freeing are evaluated and approved.

***8.5.6*** *(1/5/2021)*

*In case bunkering lines are arranged with a cross-over it is to be ensured by suitable isolation arrangements that no fuel is transferred inadvertently to the ship side not in use for bunkering,* unless the lines are arranged for a permanent containment of LPG or NH3.

***8.5.7*** *(1/5/2021)*

*A ship-shore link (SSL) or an equivalent means for automatic and manual ESD communication to the bunkering source is to be fitted.*

***8.5.8*** *(1/7/2021)*

*If not demonstrated to be required at a higher value due to pressure surge considerations a default time as calculated in accordance with IGF Code 16.7.3.7 from the trigger of the alarm to full closure of the remote operated valve required by [8.5.3] is to be adjusted.*

***8.5.9*** *(1/5/2021)*

Means are to be provided to manage the vapours generated during the bunkering, either by vapour return to the bunkering manifold or by one of the systems required in [6.9.2].

# 9 Fuel supply to consumers

IGF CODE REFERENCE: Ch. 9

## 9.1 Goal

**9.1.1** *(1/7/2021)*

*The goal of this paragraph [9] is to ensure safe and reliable distribution of fuel to the consumers.*

## 9.2 Functional requirements

**9.2.1** *(1/7/2021)*

*This paragraph [9] is related to functional requirements in IGF Code 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 apply:*

*a) the fuel supply system is to be so arranged that the consequences of any release of fuel will be minimized, while providing safe access for operation and inspection;*

*b) the piping system for fuel transfer to the consumers is to 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; and*

*c) fuel lines outside the machinery spaces are to be installed and protected so as to minimize the risk of*

*injury to personnel and damage to the ship in case of leakage.*

d) the fuel supply system is to be so arranged that when the fuel is intended to be supplied in a specific status (liquid/gaseous), arrangement are in place to prevent its change of status, e.g. by providing heat tracing to gaseous fuel lines.

## 9.3 Regulations on redundancy of fuel supply

**9.3.1** *(1/7/2021)*

The requirements in IGF Code 9.3 apply.

## 9.4 Regulations on safety functions of gas supply system

***9.4.1*** *(1/7/2021)*

The requirements in IGF Code 9.4 apply with the following departures from IGF Code 9.4.7.

***9.4.2*** *(1/7/2021)*

In cases where the master gas fuel valve is automatically shut down, the complete gas supply branch downstream of the double block and bleed valve is to be automatically vented; the requirements in [6.7.2] i) apply.

## 9.5 Regulations for fuel distribution outside of machinery space

**9.5.1** *(1/5/2021)*

Fuel pipes are to be protected by a secondary enclosure. *This enclosure can be a ventilated duct or a double wall piping system. The duct or double wall piping system is to be mechanically under pressure ventilated with 30 air changes per hour, and gas detection as required in IGF Code 15.8 is to be provided. Other solutions providing an equivalent safety level may also be accepted by the Society.*

**9.5.2** *(1/5/2021)*

*The requirement in [9.5.1] need not be applied for fully welded* open ended *fuel gas vent pipes led through mechanically ventilated spaces* nor for fully welded fuel gas pipes on the open deck.

## 9.6 Regulations for fuel supply to consumers in gas-safe machinery spaces

**9.6.1** *(1/5/2021)*

The requirements in IGF Code 9.6 apply.

## 9.7 Regulations for gas fuel supply to consumers in ESD-protected machinery spaces

**9.7.1** (1/5/2021)

The requirements in IGF Code 9.7 apply.

**9.7.2** *(1/5/2021)*

Pressures higher than 1.0 MPa will be considered on a case by case basis, for justified reasons and upon satisfactory consideration in the context of the Risk analysis.

## 9.8 Regulations for the design of ventilated duct, outer pipe against inner pipe gas leakage

**9.8.1** *(1/5/2021)*

*The design pressure of the outer pipe or duct of fuel systems is not to be less than the maximum working pressure of the inner pipe.*

Alternatively for fuel piping systems with a working pressure greater than 1.0 MPa, the design pressure of the outer pipe or duct is not to be less than the maximum built-up pressure arising in the annular space considering the higher between:

- maximum built-up pressure as the static pressure in way of the rupture resulting from the gas flowing in the annular space.
- the local instantaneous peak pressure in way of any rupture considering the ventilation arrangements.

*The tangential membrane stress of a straight pipe is not to exceed the tensile strength divided by 1.5 (Rm/1.5) when subjected to the above pressures. The pressure ratings of all other piping components are to reflect the same level of strength as straight pipes.*

***9.8.2*** *(1/5/2021)*

*Verification of the strength is to be based on calculations demonstrating the duct or pipe integrity. As an alternative to calculations, the strength can be verified by representative tests.*

***9.8.3*** *(1/5/2021)*

*The duct is to be pressure tested to show that it can withstand the expected maximum pressure at fuel pipe rupture.*

## 9.9 Regulations for compressors and pumps

**9.9.1** *(1/5/2021)*

The requirements in IGF Code 9.9 apply.

# 10 Power generation including propulsion and other gas consumers

IGF CODE REFERENCE: Ch. 10

## 10.1 Goal

**10.1.1** *(1/5/2021)*

*The goal of this paragraph [10] is to provide safe and reliable delivery of mechanical, electrical or thermal energy.*

## 10.2 Functional requirements

**10.2.1** *(1/5/2021)*

*This paragraph [10] is related to functional requirements in IGF Code 3.2.1, 3.2.11, 3.2.13, 3.2.16 and 3.2.17. In particular the following apply:*

*a) the exhaust systems are to be configured to prevent any accumulation of unburnt gaseous fuel;*

*b) 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 are to be fitted with suita-*

*ble pressure relief systems. Dependent on the particular engine design this may include the air inlet manifolds and scavenge spaces;*

*c) the explosion venting is to be led away from where personnel may normally be present; and*

d) *all gas consumers are to have a separate exhaust system.*

### 10.3 Regulations for internal combustion engines of piston type

#### 10.3.1 General *(1/5/2021)*

The requirements in IGF Code 10.3 apply with the following additions to IGF Code 10.3.1.2 and 10.3.1.4:

a) for NH3 fuelled engines where the space below the piston is in direct communication with the crankcase, a crankcase ventilation is required that goes to the vent system. In the vent line a NH3 gas detection should be installed for monitoring/alarm function;

*b) the gas extracted from auxiliary systems media is to be vented to a safe location in the atmosphere.* In the vent line a gas detection should be installed for monitoring/alarm function.

### 10.4 Regulations for main and auxiliary boilers

#### 10.4.1 *(1/5/2021)*

The requirements in IGF Code 10.4 apply.

### 10.5 Regulations for gas turbines

#### 10.5.1 *(1/5/2021)*

The requirements in IGF Code 10.5 apply.

## 11 Fire safety

### 11.1

#### 11.1.1 *(1/5/2021)*

This paragraph is void, as the provisions of IGF Code Ch 11 are not within the scope of classification.

## 12 Explosion prevention

IGF CODE REFERENCE: Ch. 12

### 12.1 Goal

#### 12.1.1 *(1/5/2021)*

*The goal of this paragraph [12] is to provide for the prevention of explosions and for the limitation of effects from explosion.*

### 12.2 Functional requirements

#### 12.2.1 *(1/5/2021)*

*This paragraph [12] is related to functional requirements in IGF Code 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 apply.*

*The probability of explosions is to be reduced to a minimum by:*

*a) reducing number of sources of ignition; and*

*b) reducing the probability of formation of ignitable mixtures.*

### 12.3 Regulations - General

#### 12.3.1 *(1/5/2021)*

The requirements in IGF Code 12.3 apply.

### 12.4 Regulations on area classification

#### 12.4.1 *(1/5/2021)*

The requirements in IGF Code 12.4 apply.

### 12.5 Hazardous area zones

#### 12.5.1 *(1/5/2021)*

The requirements in IGF Code 12.5 apply.

#### 12.5.2 Hazardous area zone 1 *(1/5/2021)*

*a)* Fuel storage hold spaces containing Type C tanks with all potential leakage sources in a tank connection space and having no access to any hazardous area, are to be considered as non-hazardous.

b) Where the fuel storage hold spaces include potential leak sources, e.g. tank connections, they are to be considered hazardous area zone 1.

*c)* Where the fuel storage hold spaces included bolted access to the tank connection space, they are to be considered hazardous are zone 2.

## 13 Ventilation

IGF CODE REFERENCE: Ch. 13

### 13.1 Goal

#### 13.1.1 *(1/5/2021)*

*The goal of this paragraph [13] is to provide for the ventilation required for safe operation of gas-fuelled machinery and equipment.*

### 13.2 Functional requirements

#### 13.2.1 *(1/5/2021)*

*This paragraph [13] is related to functional requirements in IGF Code 3.2.2, 3.2.5, 3.2.8, 3.2.10, 3.2.12 to 3.2.14 and 3.2.17.*

### 13.3 Regulations - General

#### 13.3.1 *(1/5/2021)*

The requirements in IGF Code 13.3 apply.

#### 13.3.2 *(1/5/2021)*

Areas where fuel covered by this Appendix can be present are to be provided with suction points of the mechanical exhaust system fitted in the lower part of the space, where LPG or NH3 is likely to accumulate.

### 13.4 Regulations for tank connection space

**13.4.1** *(1/5/2021)*

The requirements in IGF Code 13.4 apply.

### 13.5 Regulations for machinery spaces

**13.5.1** *(1/5/2021)*

The requirements in IGF Code 13.5 apply.

### 13.6 Regulations for fuel preparation room

**13.6.1** *(1/5/2021)*

The requirements in IGF Code 13.6 apply.

### 13.7 Regulations for bunkering station

**13.7.1** *(1/5/2021)*

Bunkering station are to be suitably ventilated to ensure that any vapour being released during bunkering operations will be removed. *If the natural ventilation is not sufficient, mechanical ventilation is to be provided in accordance with the risk assessment required by IGF Code 8.3.1.1.*

### 13.8 Regulations for ducts and double pipes

**13.8.1** *(1/5/2021)*

The requirements in IGF Code 13.8 apply with the following departures from IGF Code 13.8.2 and 13.8.3.

**13.8.2** *(1/5/2021)*

*The ventilation system for double piping and for gas valve unit spaces in gas safe engine-rooms is to be independent of all other ventilation systems* except other fuel supply ventilation systems.

**13.8.3** *(1/5/2021)*

*The ventilation inlet for the double wall piping or duct is always to be located in a non-hazardous area* in open air *away from ignition sources. The inlet opening is to be fitted with a suitable wire mesh guard and protected from ingress of water.*

## 14 Electrical installations

IGF CODE REFERENCE: Ch. 14

### 14.1 Goal

**14.1.1** *(1/5/2021)*

*The goal of this paragraph [14] is to provide for electrical installations that minimize the risk of ignition in the presence of a flammable atmosphere.*

### 14.2 Functional requirements

**14.2.1** *(1/5/2021)*

*This paragraph [14] is related to functional requirements in IGF Code 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 apply.*

*Electrical generation and distribution systems, and associated control systems, are to 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 Regulations - General

**14.3.1** *(1/5/2021)*

The requirements in IGF Code 14.3 apply.

## 15 Control monitoring and safety systems

IGF CODE REFERENCE: Ch. 15

### 15.1 Goal

**15.1.1** *(1/5/2021)*

*The goal of this paragraph [15] is to provide for the arrangement of control, monitoring and safety systems that support an efficient and safe operation of the gas-fuelled installation as covered in the other paragraphs of this Appendix.*

### 15.2 Functional requirements

**15.2.1** *(1/5/2021)*

*This paragraph [15] is related to functional requirements in IGF Code 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 apply:*

a) *the control, monitoring and safety systems of the gas-fuelled installation are to be so arranged that the remaining power for propulsion and power generation is in accordance with IGF Code 9.3.1 in the event of single failure;*

b) *a gas safety system is to be arranged to close down the gas supply system automatically, upon failure in systems as described in IGF Code Table* 1 complemented by Table 2 for NH3 fuelled ships *and upon other fault conditions which may develop too fast for manual intervention;*

c) *for ESD protected machinery configurations the safety system is to shut down gas supply upon gas leakage and in addition disconnect all non-certified safe type electrical equipment in the machinery space;*

d) *the safety functions are to be arranged in a dedicated gas safety system that is independent of the gas control system in order to avoid possible common cause failures. This includes power supplies and input and output signal;*

e) *the safety systems including the field instrumentation are to 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*

f) *where two or more gas supply systems are required to meet the regulations, each system is to be fitted with its own set of independent gas control and gas safety systems.*

### 15.3 Regulations - General

**15.3.1** *(1/5/2021)*

The requirements in IGF Code 15.3 apply.

## 15.4 Regulations for bunkering and liquefied gas fuel tank monitoring

**15.4.1** *(1/5/2021)*

The requirements in IGF Code 15.4 apply.

## 15.5 Regulations for bunkering control

**15.5.1** *(1/5/2021)*

The requirements in IGF Code 15.5 apply.

## 15.6 Regulations for gas compressor monitoring

**15.6.1** *(1/5/2021)*

The requirements in IGF Code 15.6 apply.

## 15.7 Regulations for gas engine monitoring

**15.7.1** *(1/5/2021)*

The requirements in IGF Code 15.7 apply.

## 15.8 Regulations for gas detection

**15.8.1** *(1/5/2021)*

The requirements in IGF Code 15.8 apply, with the following departures.

**15.8.2** *(1/5/2021)*

Permanently installed gas detectors are also to be fitted:

a) at ventilation inlets to service spaces, ro-ro spaces, special category spaces and other machinery spaces if required based on the risk assessment required in [4.2];

b) in bunker stations.

**15.8.3** *(1/5/2021)*

Gas detection equipment is to be designed, installed and tested in accordance with IEC 60079-29-1 or an equivalent recognized standard acceptable to the Society.

**15.8.4** *(1/5/2021)*

On NH3 fuelled ships, audible and visible alarm is to be activated at a gas vapour concentration of 20% of the permissible exposure limit (PEL). The safety system is to be activated at 40% of the immediately dangerous to life of health limit (IDLH).

**15.8.5** (1/5/2021)

*Audible and visible alarms from the gas detection equipment are to be located on the navigation bridge or in the continuously manned central control station* or safety centre.

## 15.9 Regulations for fire detection

**15.9.1** *(1/5/2021)*

The requirements in IGF Code 15.9 apply.

## 15.10 Regulations for ventilation

**15.10.1** *(1/5/2021)*

The requirements in IGF Code 15.10 apply.

## 15.11 Regulations on safety functions of fuel supply systems

**15.11.1** *(1/5/2021)*

The requirements in IGF Code 15.11 apply.

**Table 2 : Monitoring of NH3 supply system to engines** *(1/5/2021)*

| No | Parameter | Alarm | Automatic shutdown of tank valve **(4)** | Automatic shut-down of gas supply to machinery space containing NH3-fuelled engines | Comments |
|---|---|---|---|---|---|
| 1 | Gas detection in tank connection space at 20% PEL | x | | | |
| 2 | Gas detection on two detectors **(1)** in tank connection space at 40% IDLH | x | x | | |
| 3 | Gas detection in duct between tank and machinery space containing NH3-fuelled engines at 20% PEL | x | | | |

**(1)** Two independent gas detectors located close to each other are required for redundancy reasons. If the gas detector is of self-monitoring type the installation of a single gas detector can be permitted

**(2)** If the tank is supplying gas to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.

**(3)** If the gas is supplied to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct and outside of the machinery space containing gas-fuelled engines, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.

**(4)** Valves referred to in IGF Code 9.4.1.

| No | Parameter | Alarm | Automatic shutdown of tank valve **(4)** | Automatic shut-down of gas supply to machinery space containing NH3-fuelled engines | Comments |
|---|---|---|---|---|---|
| 4 | Gas detection on two detectors **(1)** in duct between tank and machinery space containing NH3-fuelled engines at 40% IDLH | x | x **(2)** | | |
| 5 | Gas detection in fuel preparation room at 20% PEL | x | | | |
| 6 | Gas detection on two detectors **(1)** in fuel preparation room at 40% IDLH | x | x **(2)** | | |
| 7 | Gas detection in duct inside machinery space containing NH3-fuelled engines at 20% PEL | x | | | If double pipe fitted in machinery space containing NH3-fuelled engines |
| 8 | Gas detection on two detectors **(1)** in duct inside machinery space containing NH3-fuelled engines at 40% IDLH | x | | x **(3)** | If double pipe fitted in machinery space containing NH3-fuelled engines |
| 9 | Gas detection in ESD protected machinery space containing NH3-fuelled engines at 20% PEL | x | | | |
| 10 | Gas detection on two detectors **(1)** in ESD protected machinery space containing NH3-fuelled engines at 40% IDLH | x | | x | |
| 11 | Gas detection in the vent line from crankcase of NH3-fuelled engines per [10.3.1]a) at 40% IDLH | x | | | |
| 12 | Gas detection in auxiliary system media vent line of NH3-fuelled engines at 40% IDLH | x | | | |

**(1)** Two independent gas detectors located close to each other are required for redundancy reasons. If the gas detector is of self-monitoring type the installation of a single gas detector can be permitted

**(2)** If the tank is supplying gas to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.

**(3)** If the gas is supplied to more than one engine and the different supply pipes are completely separated and fitted in separate ducts and with the master valves fitted outside of the duct and outside of the machinery space containing gas-fuelled engines, only the master valve on the supply pipe leading into the duct where gas or loss of ventilation is detected is to close.

**(4)** Valves referred to in IGF Code 9.4.1.

# 16 Manufacture workmanship and testing

IGF CODE REFERENCE: Ch. 16

## 16.1 General

**16.1.1** *(1/5/2021)*

*The manufacture, testing, inspection and documentation are to be in accordance with recognized standards and the regulations given in this Appendix.*

**16.1.2** *(1/5/2021)*

*Where post-weld heat treatment is specified or required, the properties of the base material are to be determined in the heat treated condition, in accordance with the applicable Tables of IGF Code Ch 7 and the weld properties are to be determined in the heat treated condition in accordance with IGF Code 16.3. In cases where a post-weld heat treatment is applied, the test regulations may be modified at the discretion of the* Society.

## 16.2 General test regulations and specifications

### 16.2.1 Tensile test *(1/5/2021)*

The requirements in IGF Code 16.2 apply.

## 16.3 Welding of metallic materials and non-destructive testing for the fuel containment system

### 16.3.1 General *(1/5/2021)*

The requirements in IGF Code 16.3 apply.

## 16.4 Other regulations for construction in metallic materials

### 16.4.1 General *(1/5/2021)*

The requirements in IGF Code 16.4 apply.

## 16.5 Testing

### 16.5.1 General *(1/5/2021)*

The requirements in IGF Code 16.5 apply.

### 16.5.2 Testing and inspections during construction *(1/5/2021)*

a) Process pressure vessels containing NH3 and LPG are categorized as class 1 for the application of the requirements in Sec 3, irrespective of their design pressure and design temperature.

b) The fuel containment system for low temperature LPG or NH3 is to be inspected for cold spots during or immediately following the first LPG or NH3 bunkering, when steady thermal conditions are reached. Inspection of the integrity of thermal insulation surfaces that cannot be visually checked is to be carried out in accordance with the requirements of the Society.

## 16.6 Welding, post-weld heat treatment and non-destructive testing

### 16.6.1 General *(1/5/2021)*

The requirements in IGF Code 16.6 apply.

## 16.7 Testing regulations

### 16.7.1 *(1/5/2021)*

The requirements in IGF Code 16.7 apply.

# SECTION 35 NH3 FUELLED READY (X1, X2, X3…)

## 1 General

### 1.1 Application

**1.1.1** *(1/5/2021)*

The additional class notation **NH3 FUELLED READY (X1, X2, X3…)** is assigned, in accordance with Pt A, Ch 1, Sec 2, [6.14.54], to ships fulfilling the requirements of this section.

A Statement of Compliance may be issued to ships not classed with the Society, fulfilling the requirements of this section.

## 2 Assignment criteria

### 2.1

**2.1.1** *(1/5/2021)*

The additional class notation **NH3 FUELLED READY (X1, X2, X3…)** is assigned:

a) to new buildings that are in accordance with the Tasneef Rules in force at the date when the contract for construction between the Owner and the shipbuilder is signed;

b) to existing ships that are in accordance with the Tasneef Rules in force at the date of request of notation assignment.

having the following characteristics:

- Design (X1); and
- One of the following:
  - Structure (X2);
  - Tank (X3);
  - Piping (X4);
  - Users (X5).

The notation characteristics **(X1, X2, X3…)** are defined in Tab 1.

Irrespective of previous assignment of the **NH3 FUELLED READY** notation, when the ship will be converted to use NH3 as fuel, approval for compliance with Tasneef requirements in force at the time of conversion, followed by testing and commissioning under survey, will be required.

**Table 1 : Description of the notation characteristics** *(1/5/2021)*

| $X_i$ | Characteristic | Description |
|---|---|---|
| 1 | Design | The complete design of the ship with NH3 fuelled system is found to be in compliance with the rules applicable to new buildings, including those in Pt C, Ch 1, App 13 |
| 2 | Structure | Structural reinforcements to support the fuel containment system (NH3 fuel tank(s)) are installed and materials to support the relevant temperatures are used. |
| 3 | Tank | NH3 storage tank, tank master isolation valve, fuel venting arrangements and, where applicable, the fuel storage hold space, structural fire protection and ventilation arrangements for under deck tank locations are built under survey and installed in accordance with approved drawings and certified fit for NH3 fuel operations. |
| 4 | Piping | All piping equipment associated with the NH3 fuelled system, e.g. pipes, pumps, valves, etc. including all bunkering arrangements and associated access arrangements including structural fire protection as applicable, are built and installed in accordance with approved drawings and certified fit for NH3 fuel operations |

| $X_i$ | Characteristic | Description |
|---|---|---|
| 5 | Users | Engineering systems are installed in accordance with approved drawings and certified fit for using NH3 as fuel or ready to be retrofitted:<br>• $ME_{NH3r}$: Main engine(s) installed can be converted to using NH3 as fuel;<br>• $ME_{NH3}$: Main engine(s) installed are suitable to use NH3 as fuel;<br>• $AE_{NH3r}$: Auxiliary engines installed can be converted to using NH3 as fuel (see Note 1);<br>• $AE_{NH3}$: Auxiliary engines installed are suitable to use NH3 as fuel (see Note 1);<br>• $B_{NH3r}$: Boilers installed can be converted to using NH3 as fuel;<br>• $B_{NH3}$: Boilers installed can be operated on NH3 as fuel. |
| Note 1: The capacity of the converted auxiliary engines is to be sufficient for the ship power balance.<br>Examples:<br>• NH3 FUELLED READY (Design, Users($ME_{NH3r}$)) means that the future NH3 fuelled design has been examined and found in compliance with the applicable rules and the ship main engine is of a type that can be converted to use NH3 as fuel;<br>• NH3 FUELLED READY (Design, Structure, Users($ME_{NH3r}$, $AE_{NH3r}$)) means that the future NH3 fuelled design has been examined and found in compliance with the applicable rules, the ship is constructed with the necessary structural reinforcement and suitable materials around the NH3 fuel tank(s), and the main and auxiliary engines are of types that can be converted to dual fuel engines. | | |

# 3 Documents to be submitted

## 3.1 Documentation requirements for characteristic "Design"

### 3.1.1 *(1/5/2021)*

The list of plans and documents to be submitted is given in Tab 2.

The documentation is to be marked "NH3 FUELLED ready" in each drawing title.

The Society reserves the right to require additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the systems and components.

## 3.2 Documentation requirements for characteristics "Structure", "Tank", "Piping", "Users"

### 3.2.1 *(1/5/2021)*

The design, applicable to the assigned characteristic, is to be submitted and approved for compliance with the applicable requirements of Pt C, Ch 1, App 13.

**Table 2 : Documents to be submitted** *(1/5/2021)*

| Item n° | Documentation | Additional description |
|---|---|---|
| 1 | General arrangement | Including NH3 tank location with distances from ship side, adjacent spaces, bunkering station location, pipe routing, engine room arrangement and location of any other spaces containing NH3 equipment. Location of entrances (air locks as relevant) for spaces with NH3 equipment are also to be shown. |
| 2 | Engine room arrangement | Only if not included in the general arrangement. |
| 3 | Design philosophy/ description | Including information on the NH3 storage, machinery configuration, engine room arrangements, fuel arrangements, shut down philosophy, redundancy considerations etc. |
| 4 | Hazardous zones drawing | General arrangement plan with the indication of the hazardous area classification according to IEC 60092-502, but including the additional areas to be regarded as hazardous in respect of toxic or oxygen depleted atmosphere. |
| 5 | Ventilation system | For NH3 equipment spaces, including ventilation capacity, location of inlets and outlets, segregation from other ventilation systems. |
| 6 | Tank drawings and arrangement | Including arrangement of tank connection space and pump rooms/compressor rooms where relevant. The NH3 tank design drawings are preferably to contain sufficient detail to allow for structural strength and thermal exposure calculations for surrounding structure. |
| 7 | Structural strength calculation for the NH3 fuel tank location | |

| Item n° | Documentation | Additional description |
|---|---|---|
| 8 | Temperature calculations around the NH3 fuel tanks | In case the NH3 is not carried in a fully-pressurized status at ambient conditions |
| 9 | P&ID for NH3 bunkering and NH3 fuel systems | Including details for double piping/ducts and arrangement/ location of vent mast/vent outlet(s) for pressure relief valves and purging. |
| 10 | Inert gas system | |
| 11 | Bilge system | Where fitted in spaces containing NH3 equipment |
| 12 | Stability calculations with NH3 tank(s) included | |
| 13 | Bunkering station arrangement | |
| 14 | Risk assessment report | |