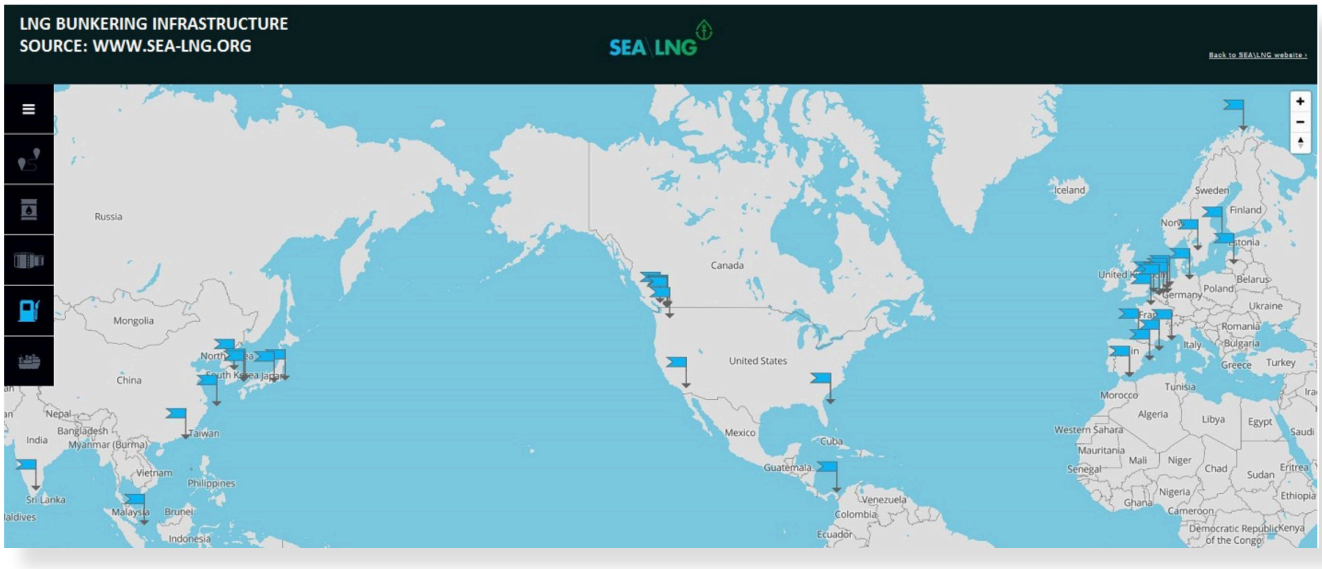
INTERNATIONAL CODE OF SAFETY FOR SHIPS USING GASES OR OTHER LOW-FLASHPOINT FUELS (IGF CODE)



Global LNG Bunkering Infrastructure

The International Maritime Organization has adopted a mandatory code of safety for ships using gas or other low-flashpoint fuels (IGF Code).

In this booklet you will find information on how the IGF Code applies to you and to the design and architecture of ships operating with low flash-point fuels. You will also find definitions used in the Code and information on safe operation and maintenance of low flash-point fuel related equipment.

What is the purpose of the IGF Code?

The International Code of Safety for Ships using gas or other low-flashpoint fuels (IGF Code) was developed to provide an international standard for ships, using low flash-point fuels other than those ships covered by the IGC Code. Much of the information in this code is similar to information found in the code developed for ships carrying low flash-point cargo (IGC Code).

The basic philosophy of the IGF Code is to provide for the arrangement, installation, control and monitoring of machinery, equipment and systems using low-flashpoint fuels to minimize risk to the ship, its crew and the environment. This Code addresses specific areas that need special consideration for the use of the low-flashpoint fuel.

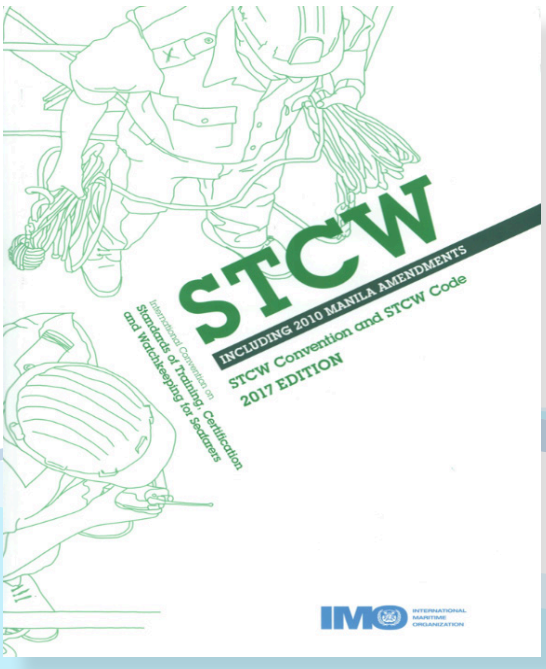
The basic philosophy of the IGF Code considers the IMO's goal-based approach to regulations (MSC.1/Circ.1394/Rev.2). Therefore, goals and functional requirements were specified for each section of the code forming the basis for the design, construction and operation. The current version of this Code includes regulations to meet the functional requirements for natural gas fuel. Regulations for other low-flashpoint fuels will be added to the Code as, and when, they are reviewed by the Organization.

When does the IGF Code come into force?

IGF Code became effective on 1 January 2017 along with related changes to SOLAS. The amendments to SOLAS chapter II-1 (Construction – Structure, subdivision and stability, machinery and electrical installations), include amendments to Part F Alternative design and arrangements, to provide a methodology for alternative design and arrangements for machinery, electrical installations and low-flashpoint fuel storage and distribution systems; and a new Part G Ships using low-flashpoint fuels, to add new regulations to require ships constructed after the expected date of entry into force to comply with the requirements of the IGF Code, together with related amendments to chapter II-2 and Appendix (Certificates).

Additional STCW Training requirements

The IMO Maritime Safety Committee also adopted related amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), and STCW Code, to include new mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on ships subject to the IGF Code. The STCW amendments also had an entry into force date of 1 January 2017, in line with the SOLAS amendments related to the IGF Code. The details of the new requirements can be found in the forthcoming update to the ITF STCW A Guide for Seafarers. General requirements are listed below.



Advanced training for personnel sailing on ships subject to the IGF Code

Masters, engineering officers and all personnel with immediate responsibility for the care and use of fuels and fuel systems on ships subject to the IGF Code shall hold a certificate in advanced training for service on ships subject to the IGF Code.

Every candidate for certification in advanced training for service on ships subject to the IGF Code shall:

1. have successfully completed the approved advanced training required by regulation V/3, paragraph 7 in accordance with their capacity, duties and responsibilities as set out in STCW Code table A-V/3-2; and

2. provide evidence that the required standard of competence has been achieved in accordance with the methods and the criteria for evaluating competence tabulated in columns 3 and 4 of STCW Code table A-V/3-2; or

have received appropriate training and certification according to the requirements for service on liquefied gas tankers as set out in STCW Code regulation V/3, paragraph 8.

Basic training for personnel sailing on ships subject to the IGF Code

Seafarers responsible for designated safety duties associated with the care, use or emergency response to the fuel onboard ships subject to the IGF Code shall hold a certificate in basic training for service on ships subject to the IGF Code.

Every candidate for certification in basic training for service on ships subject to the IGF Code shall:

1. have successfully completed the approved basic training required by regulation V/3, paragraph 5, in accordance with their capacity, duties and responsibilities as set out in STCW Code table A-V/3-1; and

2. be required to provide evidence that the required standard of competence has been achieved in accordance with the methods and the criteria for evaluating competence tabulated in columns 3 and 4 of STCW Code table A-V/3-1.

Training Requirement Exemptions

If an administration considers a ship's size (typically less than 500 gross tonnage, except for passenger ships) and the length or character of its voyage are such to render the application of the full training requirements unreasonable or impracticable, it may exempt the seafarers on such a ship or class of ships from some of the requirements, bearing in mind the safety of people on board, the ship and property along with the protection of the marine environment.

Drills and Emergency Exercises

Shall be conducted at regular intervals. Such gas-related exercises could include for example:

tabletop exercise; review of fueling procedures based in the ISM approved Company Operations Procedures Manual; responses to identified hazardous contingences; tests of equipment intended for contingency response; and reviews that assigned seafarers are trained to perform assigned duties during fueling and contingency response.

Low-flashpoint fuel related exercises must be incorporated into periodical drills required by SOLAS. The response and safety system for hazards and accident control shall be reviewed and tested (see picture below).

Some Key definitions in the IGF Code

Bunkering means the transfer of liquid or gaseous fuel from land based or floating facilities into a ship's permanent tanks or connection of portable tanks to the fuel supply system.

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

CNG means compressed natural gas.

Control station means those spaces defined in SOLAS chapter II-2 and additionally for this Code, the engine control room.

Double block and bleed valve means a set of two valves in series in a pipe and a third valve enabling the pressure release from the pipe between those two valves. The arrangement may also consist of a two-way valve and a closing valve instead of three separate valves.

Dual fuel engines means engines that employ fuel covered by this Code (with pilot fuel) and oil fuel. Oil fuels may include distillate and residual fuels.

Enclosed space means any space within which, in the absence of artificial ventilation, the ventilation will be limited and any explosive atmosphere will not be dispersed naturally.

ESD means emergency shutdown.

More definitions

Fuel containment system is the arrangement for the storage of fuel including tank connections. It includes where fitted, a primary and secondary barrier, associated insulation and any intervening spaces, and adjacent structure if necessary for the support of these elements. If the secondary barrier is part of the hull structure it may be a boundary of the fuel storage hold space.

The spaces around the fuel tank are defined as follows (see picture on the left):

1. *Fuel storage hold space* is the space enclosed by the ship's structure in which a fuel containment system is situated. If tank connections are located in the fuel storage hold space, it will also be a tank connection space;

2. *Interbarrier space* is the space between a primary and a secondary barrier, whether or not completely or partially occupied by insulation or other material; and

3. *Tank connection space* is a space surrounding all tank connections and tank valves that is required for tanks with such connections in the enclosed spaces.

Fuel preparation room means any space containing pumps, compressors and/or vaporizers for fuel preparation purposes.

Gas means a fluid having a vapour pressure exceeding 0.28 MPa absolute at a temperature of 37.8°C

Gas consumer means any unit within the ship using gas as a fuel.

Gas only engine means an engine capable of operating only on gas, and not able to switch over to operation on any other type of fuel.

Hazardous area means an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.

LNG means liquefied natural gas.

LEL means the lower explosive limit.

Low-flashpoint fuel means gaseous or liquid fuel having a flashpoint lower than otherwise permitted under paragraph 2.1.1 of SOLAS regulation II-2/4.

MARVS means the maximum allowable relief valve setting.

MAWP means the maximum allowable working pressure of a system component or tank.

Membrane tanks are non-self-supporting tanks that consist of a thin liquid and gas tight layer (membrane) supported through insulation by the adjacent hull structure.

Multi-fuel engines means engines that can use two or more different fuels that are separate from each other.

Secondary barrier is the liquid-resisting outer element of a fuel containment system designed to afford temporary containment of any envisaged leakage of liquid fuel through the primary barrier and to prevent the lowering of the temperature of the ship's structure to an unsafe level (see pictures below):

Functional requirements of ship design under the IGF Code

The goal of the Code 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 or low-flashpoint fuel.

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

The probability and consequences of fuel-related hazards shall 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 shall be initiated.

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

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

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

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

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

System components shall be protected against external damages.

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

It shall 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 shall be designed to prevent venting under all normal operating conditions including idle periods.

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

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

Fuel containment system and machinery spaces containing sources that might release gas into the space shall 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.

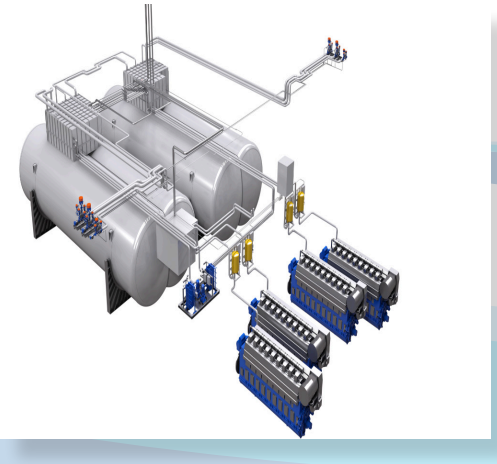
Suitable control, alarm, monitoring and shutdown systems shall be provided to ensure safe and reliable operation.

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

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

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

The technical documentation shall 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.



Fuel containment system

Operations

The goal of this IGF Code guidance on operations is to ensure that operational procedures for the loading, storage, operation, maintenance, and inspection of systems for gas or low-flashpoint fuels minimize the risk to personnel, the ship and the environment and that are consistent with practices for a conventional oil fuelled ship whilst taking into account the nature of the liquid or gaseous fuel.

Functional requirements

A copy of the Code, or national regulations incorporating the provisions of the Code, shall be on board every ship covered by the Code;

Maintenance procedures and information for all gas related installations shall be available on board;

The ship shall be provided with operational procedures including a suitably detailed fuel handling manual, such that trained personnel can safely operate the fuel bunkering, storage and transfer systems; and

The ship shall be provided with suitable emergency procedures.

Maintenance

Maintenance and repair procedures shall include considerations with respect to the tank location and adjacent spaces.

In-service survey, maintenance and testing of the fuel containment system are to be carried out in accordance with the inspection/survey plan specified by the Code.

The procedures and information shall include maintenance of electrical equipment that is installed in explosion hazardous spaces and areas. The inspection and maintenance of electrical installations in explosion hazardous spaces shall be performed in accordance with a recognized standard.

Regulations for bunkering operations

Before any bunkering operation commences, the master of the receiving ship or his representative and the representative of the bunkering source (Persons In Charge, PIC) shall (see pictures on the right):

1. agree in writing the transfer procedure, including cooling down and if necessary, gassing up; the maximum transfer rate at all stages and volume to be transferred in accordance with (IAW) Regulatory Industry Standard;
2. agree in writing action to be taken in an emergency; and
3. complete and sign the bunker safety checklist IAW Regulatory Industry Standard.

Upon completion of bunkering operations the ship PIC shall receive and sign a Bunker Delivery Note for the fuel delivered, containing at least the information specified in the Code, completed and signed by the bunkering source PIC (the sample shown at the end of this pamphlet).

Overview of control, automation and safety systems

The required fuel handling manual shall include but is not limited to:

1. overall operation of the ship from dry-dock to dry-dock, including procedures for system cool down and warm up, bunker loading and, where appropriate, discharging, sampling, inerting and gas freeing;

2. bunker temperature and pressure control, alarm and safety systems;

3. system limitations, cool down rates and maximum fuel storage tank temperatures prior to bunkering, including minimum fuel temperatures, maximum tank pressures, transfer rates, filling limits and sloshing limitations;

4. operation of inert gas systems;

5. firefighting and emergency procedures: operation and maintenance of firefighting systems and use of extinguishing agents;

6. specific fuel properties and special equipment needed for the safe handling of the particular fuel

7. fixed and portable gas detection operation and maintenance of equipment;

8. emergency shutdown and emergency release systems, where fitted; and

9. a description of the procedural actions to take in an emergency situation, such as leakage, fire or potential fuel stratification resulting in rollover.

A fuel system schematic/piping and instrumentation diagram (P&ID) shall be reproduced and permanently mounted in the ship's bunker control station and at the bunker station (see picutre below).

LNG-BUNKER DELIVERY NOTE LNG AS FUEL FOR

Ship Name: _____ IMO NO: _____ Delivery Date: _____

1. LNG - Properties

Methane number	--	
Lower calorific (heating) value	MJ/kg	
Higher calorific (heating) value	MJ/kg	
Wobbe Indices Ws / Wi	MJ/m3	
Density	kg/m3	
Pressure	MPa (abs)	
LNG temperature delivered	°C	
LNG temperature in storage tank(s)	°C	
Pressure in storage tank(s)	MPa (abs)	

2. LNG - Composition

Methane, CH4	% (kg/kg)	
Ethane, C2H6	% (kg/kg)	
Propane, C3H8	% (kg/kg)	
Isobutane, i C4H10	% (kg/kg)	
N-Butane, n C4H10	% (kg/kg)	
Pentane, C5H12	% (kg/kg)	
Hexane; C6H14	% (kg/kg)	
Heptane; C7H16	% (kg/kg)	
Nitrogen, N2	% (kg/kg)	
Sulphur, S	% (kg/kg)	
Negligible<5ppm hydrogen sulphide, hydrogen, ammonia, chlorine, fluorine, water		

Net Total delivered: _____t, _____ MJ _____ m3 Net Liquid delivery _____GJ

Signature(s): Supplier Company Name, Contact details: _____

_____

Signature: _____ Place/Port: _____

Date: _____ Receiver: _____

SOURCES:

International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended

International Code of Safety for Ships Using Gases or other Low-Flashpoint fuels (IGF Code)

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended

IMO Maritime Safety Committee Reports

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