



**International
Standard**

ISO 10665

**Ships and marine technology —
Ship design — CNG and LNG
propulsion system**

*Navires et technologie maritime — Conception maritime —
Système de propulsion GNC et GNL*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document specifies requirements for the installation of equipment for the use of compressed natural gas (CNG) and liquefied natural gas (LNG) in the propulsion systems of ships and crafts.

This document includes procedures which the use substances and procedures that can be injurious to health if adequate precautions are not taken. This document refers only to technical suitability.

Natural gas, either in gaseous (CNG) or liquid phase (LNG), is a very efficient and ready-to-use solution which can facilitate compliance with the more stringent environmental regulations as well as the compliance with the principles of the circular economy. Regulations can concern the impact of a product on the environment during its entire life cycle, including the expenditure of energy and during all phases such as use, scrapping and recycling of materials. Some parts of this document also address environmental aspects.

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Ships and marine technology — Ship design — CNG and LNG propulsion system

1 Scope

This document specifies the requirements for the installation of compressed natural gas (CNG) and liquefied natural gas (LNG) propulsion systems and components on ships and crafts.

This document does not apply to large sea-going ships covered by SOLAS Chapter II-1 vessels.

This document does not cover appliances with directly attached gas cylinders, such as portable container.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9094, *Small craft — Fire protection*

ISO 10240, *Small craft — Owner's manual*

ISO 11105, *Small craft — Ventilation of petrol engine and/or petrol tank compartments*

ISO 11439, *Gas cylinders — High pressure cylinders for the on-board storage of natural gas as a fuel for automotive vehicles*

ISO 11591, *Small craft — Field of vision from the steering position*

ISO 12217-1, *Small craft — Stability and buoyancy assessment and categorization — Part 1: Non-sailing boats of hull length greater than or equal to 6 m*

ISO 12217-2, *Small craft — Stability and buoyancy assessment and categorization — Part 2: Sailing boats of hull length greater than or equal to 6 m*

ISO 12217-3, *Small craft — Stability and buoyancy assessment and categorization — Part 3: Boats of hull length less than 6 m*

ISO 12614 (all parts), *Road vehicles — Liquefied natural gas (LNG) fuel system components*

ISO 12617, *Road vehicles — Liquefied natural gas (LNG) refuelling connector — 3,1 MPa connector*

ISO 12991, *Liquefied natural gas (LNG) — Tanks for on-board storage as a fuel for automotive vehicles*

ISO 13297:2020, *Small craft — Electrical systems*

ISO 14469, *Road vehicles — Compressed natural gas (CNG) refuelling connector*

ISO 15500 (all parts), *Road vehicles — Compressed natural gas (CNG) fuel system components*

ISO 23684, *Road vehicles — Technical personnel dealing with natural gas vehicles (NGVs) — Training and qualification*

ISO 24671, *Road vehicles — Qualification and certification of technical personnel dealing with natural gas vehicles (NGVs)*

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IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

EN 3-7:2004+A1:2007, *Portable fire extinguishers — Part 7: Characteristics, performance requirements and test methods*

EN 14291, *Foam producing solutions for leak detection on gas installations*

EN 28846, *Seagoing vessels — Aluminum alloy castings for machinery and general engineering use - Chemical composition and mechanical properties*

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

accessible

capable of being reached for inspection, removal or maintenance without removal of permanent ship/craft structures

Note 1 to entry: Hatches are not regarded as permanent ship/craft structures in this sense, even if tools such as wrenches or screwdrivers are needed to open them.

3.2

appliance

device designed for heating, cooking, lighting, refrigeration, hot water production or electricity production (fuel cell or generator), using natural gas as its energy source

3.3

automatic valve

valve which is not operated manually

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3.4

bi-fuel engine

engine that has two independent fuel systems (one of them for natural gas) and can run alternatively on either fuel, but only on one fuel at a time

3.5

check valve

automatic valve (3.3) which allows gas to flow in only one direction

3.6

cockpit

volume open to the air intended for the accommodation of people

Note 1 to entry: For the purpose of this document, the term "cockpit" is used either for a proper cockpit or for any recess as clarified in Note 2.

Note 2 to entry: Bulwarks can create a large cockpit, open crafts can effectively comprise a cockpit which includes nearly all the craft, cockpit(s) can be situated anywhere in the craft, and a cockpit can open aft to the sea.

Note 3 to entry: Cockpits can retain water, however briefly, due to rain, waves, ship heeling, etc.

3.7

compressed natural gas propulsion system
CNG propulsion system

fuel system which includes cylinder or cylinders, the assembly, one or more refuelling connectors, and the components described in ISO 10665

Note 1 to entry: Cylinders are replaceable items and cannot be supplied with the boat system

Note 2 to entry: See ISO 11439 for information on cylinders; see ISO 14469 for information on the assembly; and see the ISO 15500 series for the components listed.

3.8

compressed natural gas
CNG

natural gas which has been compressed and stored for use as a fuel

3.9

connector

fitting used to join a conduit, tubing, or hose systems

3.10

container

cryogenic vessel used for the storage of *liquefied natural gas* (3.28)

3.11

container housing

ventilated enclosure intended solely for storage of one or more *compressed natural gas* (3.8) *cylinders* (3.13) or *liquefied natural gas* (3.28) *containers* (3.10), pressure regulators and safety devices, which is located on the exterior of the ship or craft where any leakage would flow overboard

3.12

container locker

gas-tight enclosure on a ship or craft with an overboard drain, where any leakage would flow overboard, intended solely for storage of one or more *compressed natural gas* (3.8) *cylinders* (3.13) or *liquefied natural gas* (3.28) *containers* (3.10) in a cockpit or recessed into the ship or craft

3.13

cylinder

transportable, refillable *container* (3.10) with a water capacity from 0,5 l up to and including 150 l for the storage of *compressed natural gas* (3.8)

3.14

design pressure

highest pressure related to the circumstances for which the system has been designed and is intended to be used

3.15

dual-fuel engine

engine system that is designed to simultaneously operate with liquid fuel and a gaseous fuel, both fuels being metered separately, where the consumed amount of one of the fuels relative to the other one may vary depending on the operation

[SOURCE: ISO 8178-4:2020, 3.17]

3.16

excess flow valve

valve which automatically shuts off or limits the gas flow when the flow exceeds a set design value

3.17

filler valve

valve system for fill service

3.18

filter

component containing a screen or media that is intended to remove foreign debris from the gas stream

3.19

fixed container

compressed natural gas (3.8) *cylinder* (3.13) or *liquefied natural gas* (3.28) *container* (3.10) permanently installed to the structure of the ship and craft

3.20

fuel pipeline

tubing or hose through which natural gas flows

Note 1 to entry: Flexible fuel lines are also part of fuel pipeline.

3.21

gas/air mixer

device for mixing the gaseous fuel and intake air for the engine

3.22

gas detection

revealing of the presence of natural gas due to exposure outside the natural gas containment system

3.23

gas flow adjuster

gas flow restricting device, installed downstream of a pressure regulator, controlling gas flow to the engine

3.24

gas injector

device for introducing gaseous fuel into the engine or associated intake system

3.25

gas-tight housing

device which vents gas leakage to outside the vehicle including the gas ventilation hose, the clear opening of which is at least 450 mm²

3.26

installer

organization or person, who by qualification, training, experience and resources can assume technical responsibility for the installation of a *compressed natural gas* (3.8) or *liquefied natural gas* (3.28) propulsion system

3.27

level indicator

fuel content gauge based on the pressure difference between the top and bottom of the fuel in LNG tank or the pressurized device (a gauge or a sensor) which indicates the gas pressure inside the CNG cylinder

Note 1 to entry: The system measures the weight of the liquefied gas in case of LNG.

Note 2 to entry: Other systems can be used to measure the level of LNG inside the tanks.

3.28

liquefied natural gas

LNG

natural gas which has been liquefied after processing for storage, transportation, or use as a fuel

[SOURCE: ISO 12614-1:2021, 3.11]

3.29

liquefied natural gas propulsion system

LNG propulsion system

fuel system using liquefied natural gas (LNG) which includes container(s), mounting, one or more fuelling connectors and the components described in ISO 10665

Note 1 to entry: LNG containers are replaceable items; it is not possible to supply them with the ship system.

Note 2 to entry: See ISO 12991 for further details on containers; see ISO 21593 for further details on connectors; and see ISO 22547 and ISO 22548 for details on the components described.

3.30

manual valve

valve which is operated manually and controls the flow of gas to the fuel system

3.31

mono-fuel engine

engine which operates on natural gas only

3.32

natural gas

NG

complex gaseous mixture of hydrocarbons comprising primarily methane, but generally includes ethane, propane and higher hydrocarbons, and some non-combustible gases such as nitrogen and carbon dioxide

3.33

permanently installed

securely fastened so that it is necessary to use for removal

3.34

pressure indicator

pressurized device that indicates the gas pressure; it can be an indicator or a sensor

3.35

pressure regulator

device used to control the delivery pressure of gaseous fuel to the engine

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3.36

pressure relief device

PRD

safety device that releases gases or liquids above a specified pressure value in cases of emergency or abnormal conditions

Note 1 to entry: PRDs can be activated by pressure or another parameter, such as temperature, and can be either re-closing devices (such as valves) or non-re-closing devices (such as rupture disks and fusible plugs). Common designations for these specific types of PRDs are as follows:

- Pressure safety valve (PSV): pressure activated valve that opens at specified set point to protect a system from rupture and re-closes when the pressure falls below the set point.
- Thermally-activated pressure relief device (TPRD): a PRD that opens at a specified temperature to protect a system from rupture and remains open.

[SOURCE: ISO 19880-1:2020, 3.59, modified — Note 2 to entry removed.]

3.37

pressure relief valve

PRV

discharge valve

self-closing device which opens to prevent a pre-determined pressure being exceeded