



**International
Standard**

ISO 10239

**Small craft — Liquefied petroleum
gas (LPG) systems**

*Petits navires — Installations alimentées en gaz de pétrole
liquéfiés (GPL)*

**Fourth edition
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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 188, *Small craft*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 464, *Small Craft*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 10239:2014), which has been technically revised.

The main changes are as follows:

- the Scope has been clarified;
- new definitions for “room-sealed appliance” and “open-flued appliance” have been added;
- new definitions for “cylinder locker” and “cylinder housing” have been added, including some examples in a new [Annex E](#);
- [Clause 9](#) on the location and installation of LPG cylinders has been revised;
- a new [Clause 12](#) has been added with details of a commissioning label;
- the location of pressure regulating devices has been clarified;
- [Annex C](#) has been revised to update the instructions to be included with the owner's manual;
- a new [Annex E](#) has been added to provide examples of cylinder lockers and cylinder housings.

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.

Small craft — Liquefied petroleum gas (LPG) systems

1 Scope

This document specifies requirements for the installation of permanently installed liquefied petroleum gas (LPG) systems and LPG-burning appliances on small craft.

This document is applicable to portable cooking appliances with internal LPG cartridges, with a capacity of 225 g or less (see [Annex D](#)).

This document is applicable to the storage of all LPG cylinders.

NOTE 1 National regulations can apply to the technical requirements of LPG cylinders.

This document does not contain procedures for commissioning new LPG installations or system maintenance or upgrades.

This document does not apply to LPG-fuelled propulsion engines or LPG-driven generators.

NOTE 2 National codes and procedures appropriate to the country concerned can be available.

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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 8434-1:2018, *Metallic tube connections for fluid power and general use — Part 1: 24° cone connectors*

ISO 8666, *Small craft — Principal data*

ISO 8846, *Small craft — Electrical devices — Protection against ignition of surrounding flammable gases*

ISO 9094, *Small craft — Fire protection*

ISO 11812, *Small craft — Watertight or quick-draining recesses and cockpits*

EN 751-2, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 2: Non-hardening jointing compounds*

EN 751-3, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 3: Unsintered PTFE tapes and PTFE strings*

EN 1254-2, *Copper and copper alloys — Plumbing fittings — Part 2: Compression fittings for use with copper tubes*

EN 1949, *Specification for the installation of LPG systems for habitation purposes in leisure accommodation vehicles and accommodation purposes in other vehicles*

EN 15266, *Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to 0,5 bar*

EN 16129:2013, *Pressure regulators, automatic change-over devices, having a maximum regulated pressure of 4 bar, with a maximum capacity of 150 kg/h, associated safety devices and adaptors for butane, propane, and their mixtures*

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

craft

small craft

recreational boat, and other watercraft using similar equipment, of up to 24 m length of hull (L_H)

Note 1 to entry: The measurement methodology for the length of hull (L_H) is defined in ISO 8666.

[SOURCE: ISO 8666:2020, 3.15, modified — Note 1 to entry added.]

3.2

liquefied petroleum gas

LPG

mixture of light hydrocarbons, gaseous under conditions of normal temperature and pressure, and maintained in the liquid state by increase of pressure or lowering of temperature

Note 1 to entry: The principal components are propane, propene, butanes or butenes.

Note 2 to entry: LPG can be obtained as commercial butane, commercial propane or a mixture of the two.

[SOURCE: EN 624:2011, 3.1.7, modified — Note 2 to entry added.]

3.3

permanently installed

securely fastened so that tools are required for removal

[SOURCE: ISO 10088:2022, 3.3]

3.4

cylinder housing

ventilated enclosure with or without a door which is vapour tight to the interior of the *craft* (3.1), intended solely for storage of one or more *liquefied petroleum gas* (3.2) cylinders, *pressure regulating devices* (3.12) and safety devices, and located so that leakage flows overboard unimpeded

3.5

cylinder locker

enclosure which is vapour-tight to at least the height of the cylinder valve and other high-pressure components and is completely vapour tight to the interior of the *craft* (3.1), intended solely for storage of one or more *liquefied petroleum gas* (3.2) cylinders, *pressure regulating devices* (3.12) and safety devices, and fitted with a drain so that leakage flows overboard unimpeded

3.6

liquefied petroleum gas system

LPG system

system consisting of an arrangement of cylinder(s), safety device(s), *pressure regulating device(s)* (3.12), connection(s), valve(s), *pipng* (3.23), *hose assembly(ies)* (3.20), fitting(s) and devices intended to store, supply, monitor or control the flow of *LPG* (3.2) up to and including the appliance

Note 1 to entry: The cylinders are replacement items and are sometimes but not always supplied with the LPG system in the *craft* (3.1).

3.7

habitable space

space surrounded by permanent structure in which there is provision for any of the following activities: sleeping, cooking, eating, washing/toilet, navigation and steering

Note 1 to entry: Spaces intended exclusively for storage, open cockpits with or without canvas enclosures and *engine compartments* (3.21) are not included.

[SOURCE: ISO 11105:2020, 3.1, modified — “engine compartments” replaced “engine rooms” in Note 1 to entry.]

3.8

readily accessible

capable of being reached quickly and safely for effective use under emergency conditions without the use of tools

[SOURCE: ISO 9094:2022, 3.2]

3.9

unattended appliance

device intended to function without the constant attention of an operator and which can cycle on and off automatically

EXAMPLE Water heaters, refrigerators, cabin heaters.

Note 1 to entry: Stoves, ovens and gas lamps are not considered to be unattended appliances.

3.10

high pressure side

part of an installation between the cylinder valve and the inlet of a *pressure regulating device* (3.12) in a *liquefied petroleum gas system* (3.6)

Note 1 to entry: Vapour pressure at 20 °C for propane = 700 kPa and for butane = 175 kPa.

Note 2 to entry: 100 kPa = 1 bar.

3.11

low pressure side

part of an installation exposed to the regulated pressure of the *liquefied petroleum gas (LPG)* (3.2) *pressure regulating device* (3.12) in an *LPG system* (3.6)

3.12

pressure regulating device

device to reduce, in a controlled manner, the high pressure of the *liquefied petroleum gas system* (3.6) to the required *operating pressure* (3.16) of the appliances

3.13

appliance shut-off valve

device to isolate an appliance from the gas supply

3.14

main shut-off valve

device to isolate the entire *liquefied petroleum gas system* (3.6) from the *high pressure side* (3.10) of the supply

3.15

flame supervision device

device that has a sensing element that causes the inlet of the *liquefied petroleum gas* (3.2) supply to a burner to be open in the presence of a flame and closed in the absence of a flame

3.16

operating pressure

inlet pressure of the *liquefied petroleum gas* (3.2) appliance(s)

3.17

ventilator

device that allows air to pass into and out of *habitable spaces* (3.7)

3.18

room-sealed appliance

appliance having a combustion system in which incoming combustion air and outgoing products of combustion pass through ductwork sealed to *habitable spaces* (3.7) and connected to an enclosed combustion chamber

3.19

open-flued appliance

appliance where combustion air is drawn from the space containing the appliance and the outgoing products of combustion pass through a flue incorporating a draught diverter

3.20

hose assembly

length of hose equipped with permanently attached fittings on both ends, such as a swaged sleeve or sleeve and threaded insert

3.21

engine compartment

compartment of the *craft* (3.1), containing spark or compression ignition internal combustion engine(s)

[SOURCE: ISO 9094:2022, 3.3]

3.22

critical bilge water level

level at which bilge water contacts metallic fuel tanks, couplings, engine pans, non-submersible machinery, or non-watertight electrical circuits and connections, with the *craft* (3.1) in the static upright floating position at maximum load condition (m_{LDC})

[SOURCE: ISO 15083:2020, 3.6]

3.23

pipng

rigid metallic pipe or semi-rigid, pliable corrugated stainless-steel tubing

4 General provisions

4.1 An LPG system and all its components shall be capable of withstanding storage at -30 °C to $+60\text{ °C}$.

4.2 LPG systems shall be of the vapour withdrawal type, i.e. LPG released only under gas phase conditions.

4.3 All LPG appliances installed on a single LPG system shall be designed for use at the same operating pressure and the same LPG type, e.g. propane, butane or a mixture of the two. The operating pressure shall

be labelled in the vicinity of the LPG cylinder enclosure and be clearly visible when the cylinder(s) is/are installed.

The cylinder(s) selected and other supply equipment shall be of sufficient capacity to ensure safe and satisfactory operation of all appliances simultaneously. The cylinder enclosure shall be capable of accommodating the capacity of cylinders needed.

4.4 Where an additional LPG system is installed:

- there shall be no connection between each of the LPG supplies;
- the cylinder(s) for each gas supply may be installed in the same cylinder enclosure.

If an additional cylinder enclosure is used, there shall be a warning sign inside each cylinder enclosure which indicates that there is an additional LPG supply.

Inside the cylinder enclosure it shall be clearly indicated which appliances are supplied by each LPG supply. This shall also be stated in the owner's manual.

4.5 Each LPG system shall be fitted with simple means to test the LPG system for leakage before use of any appliances (e.g. a pressure gauge, bubble leak detector).

Where a bubble leak detector is fitted in the LPG system, it shall be securely mounted and installed in accordance with the manufacturer's instructions in the low pressure side of the LPG system and in the cylinder enclosure.

If pressure gauges are used, they shall read the cylinder pressure side of the pressure regulating device. The gauge scale shall have a pressure range from 0 kPa to a maximum of between 1 000 kPa and 1 600 kPa to be able to show pressure drops during the LPG system check (see [Clause C.3](#)).

5 Pressure regulating device

5.1 Each LPG system shall be equipped with, or have provision for the installation of, a pressure regulating device. This pressure regulating device shall be designed to provide a defined operating pressure suitable for the consuming appliances, but not more than 5 kPa.

5.2 The pressure regulating device shall have an overpressure unit to prevent uncontrolled pressure increase in the low pressure side to a value above 15 kPa. Any LPG discharge of the overpressure unit shall be inside the cylinder enclosure, or shall be separately vented outside the craft. The overpressure unit may be a pressure relief governor, a pressure relief valve or an automatic safety shut-off valve.

5.3 The operating pressure shall be marked on the pressure regulating device.

5.4 The setting of pressure regulating devices shall be fixed and shall not have external manual output pressure adjustment.

5.5 The pressure regulating device shall be located within the cylinder enclosure.

5.6 If not rigidly connected to, and supported by, the cylinder connection, the pressure regulating device shall be separately secured within the cylinder enclosure to protect it from damage and exposure to dirt and water. Pressure regulating devices not rigidly connected to, and supported by, the cylinder connection shall be connected to the cylinder by a high-pressure hose assembly as specified in [Clause 6](#).

5.7 Pressure regulating devices shall be located such that the inlet to them is at or above the level of the cylinder outlet connection.

5.8 Pressure regulating devices shall be made of corrosion-resistant metallic material or have an effective coating against external corrosion. Fasteners used shall be of corrosion-resistant material or have a corrosion-resistant plating or coating.

5.9 First and single stage pressure regulating devices with a cylinder valve connection shall be fitted with an integral filter.

The filter shall be situated on the regulating devices inlet upstream of the valve pad. The filter mesh shall not exceed the recommended dimensions for the nominal size of opening 125 (in micrometre) in accordance with ISO 565, or exceed 0,14 mm diameter in cases of perforated sheet.

NOTE Pressure regulating devices in accordance with EN 16129:2013, Annex M, meet these requirements and are marked with "Marine."

6 LPG supply line

6.1 General

6.1.1 The LPG supply line from the cylinder enclosure to the appliance(s) shall be:

- piping in accordance with [6.2](#), or
- a continuous hose assembly from the cylinder enclosure to each appliance in accordance with [6.3](#).

The layout of each supply line shall be such that the length of piping and/or hose assemblies are as short as practicable.

6.1.2 Hose assemblies shall be used to connect:

- gimballed appliances to any LPG supply line piping;
- cylinders to pressure regulating devices (high pressure side of the system) where the pressure regulating device is not connected directly to the cylinder; in such arrangements, the hose assembly shall be within the cylinder enclosure;
- cylinder mounted pressure regulating devices to any LPG supply line piping (low pressure side of the system); in such arrangements, the hose assembly shall be within the cylinder enclosure.

NOTE Hose assemblies can be used to connect appliances that are not gimballed to their LPG supply line piping if installed in accordance with the appliance manufacturer's instructions.

6.1.3 Piping and hose assemblies shall be sized so that any pressure drop does not reduce the operating pressure at any appliance below that required by the appliance manufacturer when all appliances are operating simultaneously.

NOTE [Annex A](#) provides design guidelines for pressure drop due to hose/pipe resistance for various connected appliance kW ratings.

6.2 Piping

6.2.1 Piping shall be solid drawn copper or drawn stainless steel pipe, or semi-rigid, pliable corrugated stainless steel tubing.

Wall thickness for copper or stainless steel pipe shall be equal or greater than 0,6 mm for pipe up to 12 mm outside diameter and a minimum of 0,8 mm for pipe with an outside diameter greater than 12 mm.

Semi-rigid, pliable corrugated stainless steel tubing (PCT) shall conform to EN 15266.

6.2.2 Fittings for connections and joints in piping shall be metallic and of any of the following types:

- welded, hard soldered and brazed connections;
- cutting ring fittings in accordance with ISO 8434-1:2018, Table 4 (where cutting ring fittings are used in conjunction with copper pipe, a brass insertion sleeve and brass cutting ring shall be fitted);
- copper rings on copper piping and compression fittings in accordance with EN 1254-2;
- stainless steel rings on stainless steel piping;
- connections in accordance with EN 16129:2013, Annex M;
- PCT fittings in accordance with EN 15266.

All threaded connections required to ensure gas tightness of the LPG system shall be of taper pipe thread type conforming to ISO 7-1 or fittings conforming to EN 1949, with sealants conforming to EN 751-2 or EN 751-3. Sealants shall be applied to the male thread only, before assembly.

Jointing compound for flared fittings or flared rings and gas tightness by compression of ductile joints, except connections in accordance with EN 16129:2013, Annex M, shall not be used.

6.2.3 Piping shall be made up with as few fittings as practicable. Joints and fittings shall be capable of being reached for inspection, removal or maintenance without removal of any permanent craft structure.

6.3 Hose assemblies

6.3.1 A hose shall only be used when part of a hose assembly. Materials and components of hose assemblies shall be designed to be suitable for LPG and to withstand the stresses and exposures found in the marine environment.

Hose assemblies in accordance with one or more of the relevant standards given in [Table 1](#) meet this requirement.

Table 1 — Hose assembly manufacturing standards

Manufacturing standard	Max. operating pressure	Application
Hose assembly to EN 16436-2 incorporating hose to EN 16436-1 Class 2	10bar ^a	Regulated, appliance operating pressure only
Hose assembly to EN 16436-2 incorporating hose to EN 16436-1 Class 3	30 bar	Unregulated cylinder pressure and regulated appliance operating pressure
Hose assembly to EN 14800	0,5 bar	Regulated, appliance operating pressure only
Hose assembly to ISO 10380	0,5 to 450 bar (depending on marked specification on individual hose assembly)	Unregulated cylinder pressure and/or regulated appliance operating pressure (depending on marked specification on individual hose assembly)

^a 1 bar = 0,1 MPa = 10⁵ Pa; 1 MPa = 1 N/mm².

6.3.2 Hose assemblies, including connections, shall be:

- capable of being reached for inspection, removal or maintenance without removal of any permanent craft structure;
- installed so as to avoid stress or tight radius turns;
- installed so that they are not subject to tension or kinking under any conditions of use.