

Code of practice for

Domestic butane — and propane — gas-burning installations —

**Part 3: Installations in boats, yachts and
other vessels —**

[formerly CP 339-3]

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Cooperating organizations

The Gas Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations

British Combustion Equipment Manufacturers' Association
 British Gas Corporation*
 Chartered Institution of Building Services
 Department of Energy (Gas Standards)
 Department of the Environment (PSA)
 Department of the Environment (Housing and Construction)*
 Heating and Ventilating Contractors' Association
 Institution of Gas Engineers
 Liquefied Petroleum Gas Industry Technical Association (UK)*
 National Association of Plumbing, Heating and Mechanical Services Contractors
 Society of British Gas Industries*
 Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Compressed Gases Association
 British Fire Services' Association
 Chief and Assistant Chief Fire Officers' Association
 Consumer Standards Advisory Committee of BSI
 Department of the Environment (Building Research Establishment, Fire Research Station)
 Department of Trade (Marine Division)
 Fire Protection Association
 Fire Offices Committee
 Home Office
 Institution of Fire Engineers
 National Caravan Council Limited
 Ship and Boat Builders' National Federation

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Foreword

This British Standard code of practice is a revision of CP 339-3:1956, and in its preparation the opportunity has been taken of incorporating the propane gas requirements and to express values in metric (SI) units. In line with the policy to bring codes of practice into the numbering series for British Standards, this code is being published under the number BS 5482.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

This code of practice represents a standard of good practice but compliance with it does not confer immunity from relevant legal requirements, regulations and byelaws.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This Part of BS 5482 deals with the gas burning installations in boats, yachts and other vessels¹⁾ of up to 500 tons, of domestic systems using liquefied petroleum gases from cylinders, and operating at a pressure of 28 mbar²⁾ for commercial butane and 37 mbar for commercial propane, but it excludes the use of liquefied petroleum gas for the propulsion of the craft. It gives guidance on the selection of materials, appliances and components, on design considerations, on installation requirements, on inspection and testing and on consumer instructions.

Appendix A gives basic user guidance on safe practice for inclusion in the instructions.

This standard does not cover the installation of bulk supplies of LPG or portable LPG-burning appliances.

2 References

The titles of the standards publications referred to in this code are listed on the inside back cover.

3 Definitions

For the purposes of this Part of this code, the following definitions apply together with the relevant terms in BS 1179 and BS 5264.

3.1

liquefied petroleum gas (LPG)

this term means and includes commercial butane and commercial propane as defined in BS 4250

NOTE See A.1 for some general properties.

3.2

high pressure stage

that part of the installation between the valve of the cylinder and the inlet of the pressure regulator

3.3

low pressure stage

that part of the installation between the outlet of the single stage pressure regulator and the inlet of the appliance

3.4

cylinder

a portable and refillable vessel of approved design and designed to contain liquefied petroleum gas under pressure

3.5

low pressure regulator

an apparatus for automatically maintaining a constant gas outlet pressure at the level recommended for the appliances in use

3.6

atmosphere sensitive cut-off valve

an item of equipment designed to shut off the gas supply to an appliance when the CO₂ content of the surrounding atmosphere exceeds a given level

3.7

safety valve

an automatic valve incorporated to protect a cylinder or system against excessive pressure. It will vent to atmosphere when a predetermined maximum pressure is attained

3.8

diffusive catalytic space heater

an appliance in which neat gas diffuses through a catalytic bed and is flamelessly oxidized by oxygen which has diffused into the bed from the surrounding atmosphere at a temperature below that at which combustion would occur in the absence of the catalyst

NOTE This definition does not include catalytic heaters in which complete premixing of gas and air is effected before the catalytic bed is reached, nor does it include appliances employing after-burners in which products of incomplete combustion from normal flames are further oxidized over a catalyst.

3.9

low bed-temperature cut-off device

a device that cuts off the gas supply to an appliance when the catalytic bed ceases to operate satisfactorily

3.10

locker

a storage space accessible from the top unless it is on deck

3.11

compartment

a housing enterable by personnel

¹⁾ In British registered ships the provisions of the various Merchant Shipping Acts also apply.

²⁾ 1 mbar = 10² N/m² = 100 Pa.

Section 2. Materials, components and appliances

4 Materials

4.1 Pipework materials

4.1.1 Recommended. The following materials are recommended for general use for installation pipework.

- a) Solid drawn copper tube used with copper or copper alloy fittings.
- b) Stainless steel tube and appropriate compression or screwed fittings.

4.1.2 Not recommended. The following materials are *not* recommended for general use for installation pipework for the reasons shown.

- a) Aluminium (corrosion and low melting point).
- b) Composition and lead (creep).
- c) Brass tubing (subject to season cracking).
- d) Steel tubing (corrosion).
- e) Plastics (low melting point and low-temperature embrittlement).

NOTE Tubing of the type fabricated from sheet steel, coated internally and externally and wrapped should not be used externally because it is subject to atmospheric corrosion.

4.2 Selected materials. The materials used should comply with the requirements of the relevant British Standards, e.g.

BS 143 & BS 1256, *Malleable cast iron and cast copper alloy screwed pipe fittings for steam, air, water, gas and oil.*

BS 864, *Capillary and compression fittings of copper and copper alloy — Part 2 Metric units.*

BS 2871, *Copper and copper alloys, tubes — Part 1 Copper tubes for water, gas and sanitation — Part 2 Tubes for general purposes.*

BS 3212, *Flexible rubber tubing and hose (including connections where fitted and safety recommendations) for use in LPG vapour phase and LPG/air installations.*

BS 3605, *Seamless and welded austenitic stainless steel pipes and tubes for pressure purposes.*

BS 4368, *Carbon and stainless steel compression couplings for tubes — Part 1 Heavy series — Part 3 Ligh series (metric).*

BS 5292, *Jointing materials and compounds for water, low-pressure steam installations, 1st, 2nd and 3rd family gases.*

NOTE Gas cock lubricants should be suitable for use with LPG, e.g. those having a 25 % molybdenum disulphide base.

5 Components

Components should comply with the requirements of the relevant British Standards, e.g.

BS 1552, *Control plug cocks for low-pressure gases.*

BS 3016, *Pressure regulators and automatic changeover devices for liquefied petroleum gases.*

BS 5045, *Transportable gas containers — Part 2 Steel containers up to 130 litres water capacity with automatically welded circumferential seams.*

Where no British Standard exists, components should be of standard types recommended by manufacturers or wholesale gas distributors.

6 Selection of appliances

6.1 General. Appliances should comply with the requirements of the relevant British Standards, in particular BS 5258.

It is essential that any permanent pilot should be protected by a flame failure device.

6.2 Selection of cooking appliances. Cooking appliances should comply with the relevant requirements of:

BS 2491, *Domestic cooking appliances for use with liquefied petroleum gases.*

BS 4104, *Catering appliances burning liquefied petroleum gases.*

BS 5258, *Safety of domestic gas appliances — Part 2 Cooking appliances.*

BS 5314, *Specification for gas heated catering equipment.*

6.3 Selection of fixed space heaters. In selecting fixed space heaters, each of the following points should be taken into consideration.

- a) Space heaters should comply with the relevant requirements of BS 2773, and with the safety requirements for gas fires given in BS 5258-5.
- b) The mode of heat dissipation and physical size of the appliance should be suited to the application and siting. Preference should be given to flued heaters.
- c) A catalytic heater should comply with the requirements of BS 5258-11³⁾. It should be selected only if it is provided with a low bed-temperature cut-off device.
- d) Other than a catalytic heater, a flueless heater should be selected only if it is fitted with an atmosphere sensitive cut-off device to shut off the gas supply at a CO₂ concentration of not more than 1.5 % by volume.

³⁾ In course of preparation.

An open fronted radiant fire or a radiant convector is not recommended.

6.4 Selection of water heaters. In selecting water heaters, each of the following points should be taken into consideration.

- a) Water heaters should also comply with the relevant requirements of BS 5386-1.
- b) A water heater that serves only a sink or wash basin does not generally require a flue; any other water heater should be connected to a flue. However, it is essential that an instantaneous sink water heater be flued if fitted in a confined space. (See **12.5** on the use of water heaters with showers.)
- c) Preference should always be given to the use of room-sealed appliances; this is essential when they are installed in bathrooms.
- d) A water heater should be selected only if it is fitted with a flame-failure device arranged to shut off the main and pilot (where fitted) gas supplies in the event of flame failure. (See BS 5386-1)

6.5 Selection of central heating systems

6.5.1 *Water filled and ducted air systems.* As an alternative to individual appliances providing separate heating and hot water services, consideration may be given to the installation of a wet type central heating and/or hot water system that should comply with the requirements of BS 5258-1.

6.5.2 *Ducted warm air systems.* A ducted warm air system that should comply with the requirements of BS 5258-4 may be considered instead of individual space heating appliances.

6.6 Selection of refrigerators. Each of the following points should be taken into consideration.

- a) Refrigerators should comply with the requirements of BS 5258-6.
- b) The following three main types are recommended:
 - 1) free-standing
 - 2) wall-mounting
 - 3) built-in

Refrigerators of type 3) can have either integral inlet and outlet ventilating louvres or inlet and outlet louvres positioned remote from the refrigerator, provided there is adequate provision for air circulation (see clause **14**).

- d) A refrigerator should be selected only if it is fitted with a flame failure device.

6.7 Selection of lighting appliances. Lighting appliances should comply with the requirements of BS 2977.

Section 3. Installation design considerations

7 Basic layout of supply system

Layout should be such that the length of pipe from the cylinder to the highest rated appliances is as short as possible. All pipe runs should be made as short as practicable (see clause 11), and carried as high as possible in the vessel. They should not run through bilges.

8 Cylinder requirement design considerations

Guidance given in Table 1 on the number of cylinders that should be provided in parallel to supply the installation is based on the evaporative capacity of the cylinders specified and on gas rates for different appliances. To ensure continuity of gas supply it is also advisable to carry the same number of replacement cylinders.

Table 1 — Appliance rates, number of cylinders and cylinder offtakes^a (See clauses 8, 10 and 11)

Appliance	Gas rate range				Number of cylinders required							
	Butane		Propane		Butane			Propane				
	m ³ /h	kg/h	m ³ /h	kg/h	4.5 kg	7 kg	14.5 kg	3.9 kg	13 kg	19 kg	47 kg	
Cooker (large domestic)	0.57 to 0.71	1.39 to 1.74	0.74 to 0.93	1.37 to 1.74	2.92	2.50	1.75	2.31	1.15	0.88	0.49	
Cooker (normal domestic)	0.34 to 0.42	0.83 to 1.04	0.42 to 0.57	0.79 to 1.05	1.75	1.49	1.05	1.40	0.70	0.56	0.31	
Cooker (small domestic)	0.23 to 0.25	0.56 to 0.63	0.28 to 0.31	0.53 to 0.58	1.00	0.91	0.63	0.77	0.38	0.31	0.17	
Hotplate (2 burner)	0.11 to 0.14	0.28 to 0.35	0.14 to 0.20	0.26 to 0.37	0.83	0.721	0.50	0.70	0.35	0.28	0.15	
Hotplate (3 burner)	0.14 to 0.20	0.35 to 0.49	0.20 to 0.25	0.37 to 0.47	1.16	1.01	0.70	0.90	0.45	0.36	0.20	
Hotplate (2 burner and grill)	0.20 to 0.23	0.49 to 0.56	0.25 to 0.28	0.47 to 0.53	1.33	1.15	0.80	1.00	0.50	0.40	0.22	
Boiling ring	0.06 to 0.08	0.14 to 0.21	0.08 to 0.11	0.16 to 0.21	0.50	0.43	0.30	0.40	0.20	0.16	0.09	
Space heater, large (including boilers and air heaters)	0.14 to 0.23	0.35 to 0.56	0.20 to 0.28	0.37 to 0.53	1.33	1.15	0.80	1.00	0.50	0.40	0.22	
Space heater, small	0.04 to 0.06	0.10 to 0.14	0.06 to 0.08	0.11 to 0.16	0.33	0.29	0.20	0.30	0.15	0.12	0.07	
Lighting appliance	0.007 to 0.02	0.017 to 0.049	0.009 to 0.03	0.016 to 0.047	0.12	0.10	0.07	0.09	0.04	0.03	0.02	
Sink storage water heater	0.06 to 0.08	0.14 to 0.21	0.08 to 0.11	0.16 to 0.21	0.5	0.43	0.30	0.40	0.20	0.16	0.09	
Sink instantaneous water heater	0.31 to 0.37	0.77 to 0.90	0.40 to 0.48	0.74 to 0.90	2.00	1.85	1.30	1.70	0.85	0.68	0.38	
Multipoint instantaneous water heater	0.68 to 0.91	1.67 to 2.23	0.88 to 1.19	1.64 to 2.22	5.35	4.58	3.20	4.20	2.10	1.68	0.93	
Refrigerator	0.006 to 0.008	0.014 to 0.021	0.008 to 0.011	0.016 to 0.021	0.05	0.04	0.03	0.04	0.02	0.02	0.002	
Iron	0.04 to 0.06	0.10 to 0.14	0.06 to 0.08	0.11 to 0.16	0.33	0.29	0.20	0.30	0.15	0.12	0.07	

The recommended offtakes for temperate climate are:

Butane		Propane	
Cylinder size	Offtake	Cylinder size	Offtake
4.5 kg	0.418 kg/h	3.9 kg	0.527 kg/h
7.0 kg	0.487 kg/h	13.0 kg	1.054 kg/h
14.5 kg	0.696 kg/h	19.0 kg	1.319 kg/h
		47.0 Kg	2.373 Kg/h

^a This table is based upon the maximum gas rates and a 70 % diversity factor for cookers.

Example: suppose an installation is to consist of a normal domestic cooker, a small space heater, three lighting appliances, a sink instantaneous water heater and a refrigerator. Then:

Appliance	Number of cylinders required			
	Butane (14.5 kg)	Propane (13 kg)	Propane (19 kg)	Propane (47 kg)
1 cooker, normal domestic	1.05	0.70	0.56	0.31
1 space heater, small	0.20	0.15	0.12	0.07
3 lights	0.21	0.12	0.09	0.06
1 sink instantaneous water heater	1.30	0.85	0.68	0.38
1 refrigerator	0.03	0.02	0.02	0.002
	2.79	1.84	1.47	0.82

Therefore, the number of cylinders required for normal use is either three 14.5 kg butane cylinders or 2×13 kg or 2×19 kg or 1×47 kg propane cylinders. In choosing the type of cylinder consideration should be given to the likely usage and the time that the cylinder contents will be expected to last. For severe winter conditions additional cylinders would be required.

Alternatively, the number of cylinders required can be calculated by totalling the kg/h rate for each appliance and dividing this total by the recommended offtake for the size of cylinder chosen.

9 Installation design considerations

9.1 General. Wherever possible liquefied petroleum gas cylinders should be stowed on the open deck either completely in the open air or in a deck locker or compartment which should be vented at low level and high level, so that any leakage of gas can disperse rapidly and be prevented from entering the hull interior. Such lockers or compartments should not be used for storage of any equipment other than liquefied petroleum gas cylinders and pressure regulators. Unconnected reserve or empty cylinders should be stowed similarly to those in service. Cylinder valves should be kept closed when appliances are not in use, and when the cylinders are regarded as empty. Cylinders should never be stowed below the deepest loaded water line.

NOTE Health and Safety Executive recommendations indicate that under no circumstances should the temperature of the cylinder exceed 45 °C. For butane cylinders, satisfactory service may not be obtained below 10 °C; the most suitable temperature range is from 13 °C to 30 °C (but a temperature of 13 °C will not always be maintained). For low temperature service, the use of propane should be considered.

9.2 Stowage on deck. The siting of the deck stowage area or deck locker or compartment should be such that:

- the possibility of cylinders sustaining mechanical damage is reduced to the minimum;
- neither the cylinders nor the compartment should form an obstruction;
- the site is well away from the hatches or other openings or possible sources of ignition;
- the cylinders are secured in an upright position and the possibility of movement is avoided;
- the cylinders are easily accessible and readily removable in an emergency;
- any electrical equipment in a compartment is of flame-proof construction (refer to BS 4683) or it should be intrinsically safe.

9.3 Stowage within a vessel. Stowage within a vessel is defined as any location within the hull of the vessel including the cockpit of launches or recesses in decks as well as below decks or within the superstructure of larger vessels.

In all the above cases cylinders should be stowed in either a separate locker or compartment. Lockers are suitable for cylinders up to 15 kg capacity, whereas compartments may be required for larger cylinders.

9.4 Construction of cylinder lockers and compartments. The construction and location of cylinder lockers or compartments should be such that there is an adequate separation of the cylinder compartment and/or the compartment sited in a low risk position in the boat. Alternatively, a remote operated cut-off valve should be fitted close to the cylinders. In addition, the following conditions should be complied with.

- Cylinders should be secured in an upright position and the possibility of movement avoided.
- A locker or compartment should be vapour-tight to the hull interior and openable only from the top except in the case of a deck locker which may be openable from the side.
- The materials used in the construction of a locker or compartment should have a fire resistance of 30 min (see BS 476-8).
- The locker or compartment should be ventilated at low and high level to outside the hull. The low-level ventilation should be from the locker or compartment bottom above the deepest loaded water line. Drainage/vent pipes should be of not less than 13 mm internal diameter for cylinders having a combined capacity of up to 15 kg but they should be enlarged pro rata where additional gas is carried.