

Specification for

Hoses and hose assemblies for liquefied petroleum gas

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Committees responsible for this British Standard

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- British Rubber Manufacturers' Association
- Energy Industries Council
- Engineering Equipment and Materials Users' Association
- Liquefied Petroleum Gas Industry Technical Association (UK)
- Ministry of Defence
- Petrol Pump Manufacturers' Association
- United Kingdom Petroleum Industry Association Ltd

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Foreword

This revision of this British Standard has been prepared under the direction of the Piping Systems Components Standards Policy Committee at the request of the Liquefied Petroleum Gas Industry Technical Association. It supersedes BS 4089:1966 which is withdrawn. In addition to rubber hoses and hose assemblies this standard now includes specifications for composite and flexible metallic hose assemblies. The standard also includes an option by agreement between purchaser and manufacturer for type 5 and 6 hoses to be electrically discontinuous. In view of the arduous duty required of hose and hose assemblies, only well proven designs are specified. The type approval tests are now included and are separated from the production proof tests.

This standard is being published to meet the needs of the liquified petroleum gas industry which requires a more modern standard than BS 4089:1966. However, to take account of more recent developments a review of this standard is being started.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, 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

1.1 Scope

This British Standard specifies requirements for the design, construction, inspection and testing of hoses and hose assemblies used for the transfer of liquefied petroleum gas (LPG) (see 1.2.15) under pressure or refrigerated.

Section 2 specifies requirements for four types of rubber hose and six types of hose assembly, two types of which are available as electrically continuous or electrically discontinuous hose assemblies. Section 3 specifies requirements for composite hose assemblies. Section 4 specifies requirements for flexible metallic hose assemblies.

NOTE 1 Appendix A gives recommendations on the packing and storage of hoses.

NOTE 2 Appendix B gives the type number equivalents for rubber hoses and hose assemblies specified in BS 4089:1989 and BS 4089:1966.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

1.2 Definitions

For the purposes of this standard the following definitions apply.

1.2.1

tube

a plain uncorrugated metal cylinder which may be processed during manufacture to become flexible metallic hose

1.2.2

flexible metallic hose

the flexible leak-tight metal element of a flexible metallic hose assembly without fittings or covering

1.2.3

braid

a layer (or layers) of cylindrically woven wires covering the hose and attached to the flexible metallic hose ends and fittings, serving the functions of:

- a) restraining the hose against elongation; and
- b) damping vibration of the hose.

1.2.4

flexible metallic hose assembly

a flexible metallic hose with end fittings attached, complete with braid and/or covering, if required ready for service

1.2.5

nominal size

a numerical designation of size which is common to all components in a piping system other than components designated by outside diameters or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions

1.2.6

design pressure

the maximum pressure at which a flexible metallic hose assembly is designed to be serviceable

1.2.7

pressure class

the class of the flexible hose assembly determined from the design pressure and temperature

1.2.8

burst pressure

the pressure at which any part of the hose assembly fails

1.2.9

cyclic life

the minimum number of complete cycles which, at the test conditions, the flexible metallic hose is designed to withstand without failure

1.2.10

flexibility type

the type of flexible metallic hose determined from the cyclic life

1.2.11

additional outer cover/protective coil

a device used to provide protection to the external surface of the hose against mechanical damage and/or against corrosion from the external environment

1.2.12

maximum working pressure

the maximum pressure at which a rubber or composite hose is designed to be serviceable

1.2.13

composite hose

a flexible leak tight element of a composite hose assembly consisting of a synthetic film and fabric carcass built up on a helix of wire and secured by an outer helix of wire

1.2.14

composite hose assembly

a composite hose with end fittings attached complete with protective coil or additional outer cover, if required, ready for service

1.2.15**liquefied petroleum gas (LPG)**

commercial butane and commercial propane complying with BS 4250 and any mixtures thereof

1.2.16**ageing**

irreversible change of material properties after exposure to an environment for a period of time

1.2.17**cord**

consists of a number of strands of textile or metallic filaments twisted together and used as a reinforcement in rubber products such as tyres, belts and hoses

1.2.18**elongation**

increase in length of a test piece produced by a tensile stress

NOTE This property is usually expressed as a percentage of the original test length.

1.2.19**elongation at break**

percentage elongation of the test length of a test piece at the moment of rupture

1.2.20**lining**

innermost layer of a hose

1.2.21**ply**

layer of rubber-coated parallel cords

1.2.22**porosity**

as applied to a defect, the accidental presence of numerous small cavities

1.2.23**rough bore construction**

where a hose is constructed containing a concentric helix of wire or other material substantially exposed in the bore

1.2.24**rubber**

a solid material with elastic properties made from latex from living plants, or made synthetically, and used in the manufacture of rubber products

1.2.25**rubber hose**

flexible pipe made of rubber with a reinforcement, generally textile or metallic

1.2.26**rubber hose assembly**

a rubber hose with end fittings attached complete with protective coil or additional outer cover, if required, ready for service

1.2.27**swelling**

change in volume or linear dimensions of a test piece immersed in a liquid or exposed to a vapour

1.2.28**synthetic rubber**

man-made rubber prepared by polymerization from lower relative molecular mass materials

1.2.29**tear strength**

maximum force required to tear a specified test piece, the force usually acting substantially parallel to the major axis of the test piece

1.2.30**tensile strength**

maximum tensile stress applied during stretching a test piece to rupture

1.2.31**vulcanization**

normally irreversible process in which rubber, through a change in its chemical structure, usually brought about by cross-linking, is converted to a condition in which the elastic properties are conferred, re-established, improved or extended over a greater range of temperatures

Section 2. Rubber hoses and hose assemblies

2.1 Hose types

The individual hose types shall be suitable for duties as follows.

- a) Types 1, 2, 3 and 4 hoses and hose assemblies shall be suitable for use permanently full of liquid or vapour in normal operation and shall be designed for a temperature range of $-20\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$.

NOTE 1 These types are primarily for use with rail and road tankers.

NOTE 2 Means for the dissipation of static electricity are incorporated in the construction of rubber hose assemblies types 1, 2, 3 and 4.

- b) Types 5 and 6 hose assemblies shall be suitable for use in refrigerated installations and where venting of the hose will take place and shall be designed for a temperature range of $-50\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$. They shall be suitable also for use under the conditions described in a).

NOTE 3 These types are primarily for ship to shore duties and for use with rail tankers.

NOTE 4 Type 5 and type 6 hoses are not available without end fittings, i.e. only as a type 5 or type 6 hose assembly.

NOTE 5 Type 5 and type 6 hose assemblies are available as electrically continuous or electrically discontinuous; the purchaser should inform the manufacturer if he requires an electrically discontinuous hose assembly.

WARNING. Careful consideration should be given before the use of electrically discontinuous hose for transferring liquids known to generate static charges. In no circumstances should more than one length of electrically discontinuous hose be used in an individual transfer pipeline and effective electrical continuity to earth from both ends of the electrically discontinuous hose should be maintained.

For hoses and hose assemblies required to comply with the IMO Code¹⁾, which requires a factor of safety of 5 : 1, the maximum working pressure shall be 20 bar²⁾; for other hoses and hose assemblies the maximum working pressure shall be 25 bar.

NOTE The stated maximum working pressures should not be exceeded under surge conditions.

2.2 Construction

2.2.1 General

The working temperature, maximum working pressure, minimum burst pressure and use for each hose type shall be as given in Table 1. Each hose type shall be vulcanized uniformly. Each type of hose shall be constructed as specified in 2.2.2 to 2.2.7. The component layers of the hose shall be constructed from the materials specified in 2.3.

NOTE A brief description of the reinforcement for each hose type is given in Table 1.

2.2.2 Type 1 hoses

Type 1 hoses shall be constructed as follows.

- a) An inner lining of rubber resistant to LPG which shall be smooth, uniform and free from porosity and other defects which may adversely affect the performance of the hose or hose assembly.
- b) A reinforcement consisting of one or two layers of braided or spirally lapped wire. If more than one layer is used, each shall be separated by an insulating layer of rubber. The wire braiding shall be free from any defects likely to puncture the lining or outer cover. Additional plies of either braided fabric or rubber may be applied immediately under or over the wire braid(s).
- c) A uniform outer cover of synthetic rubber or synthetic rubber-impregnated textile fabric which shall be resistant to ageing, abrasion, atmospheric exposure and to LPG. Perforations in the outer cover are permitted in order to eliminate "lifting" which can result from gas permeating the inner lining.

2.2.3 Type 2 hoses

Type 2 hoses shall be constructed as follows.

- a) An inner lining of rubber resistant to LPG which shall be smooth, uniform and free from porosity and other defects which may adversely affect the performance of the hose or hose assembly.
- b) Reinforcement plies consisting of textile in cord, woven or braided form. Two or more electrical bonding wires of corrosion and fatigue resisting material, each of not less than nine strands attached to the end fittings. These wires shall be free from defects likely to puncture the lining or cover.
- c) A uniform outer cover of synthetic rubber or synthetic rubber-impregnated textile fabric which shall be resistant to ageing, abrasion, atmospheric exposure and to LPG. Perforations in the outer cover are permitted in order to eliminate "lifting" which can result from gas permeating the inner lining.

¹⁾ International Marine Organization Code for the construction equipment of ships carrying liquefied gases in bulk, obtainable from International Maritime Organization, Publications Section, No 4 Albert Embankment, London SE1 7SR.

²⁾ 1 bar = 10^5 N/m^2 = 100 kPa.