BRITISH STANDARD

BS 4089:1999

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Specification for

Metallic hose assemblies for liquid petroleum gases and liquefied natural gases

ICS 23.040.70; 75.180.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee PSE/12, Flexible metallic hose and hose assemblies, upon which the following bodies were represented:

B G Technology
British Compressed Gases Association
British Rubber Manufacturers Association Ltd
Energy Industries Council
Engineering Equipment and Materials Users Association
L P Gas Association
Ministry of Defence
United Kingdom Petroleum Industry Association Ltd

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Contents

Foreword

This revision of BS 4089 has been prepared under the direction of the Engineering Sector Policy and Strategy Committee. It supersedes BS 4089:1989 which is withdrawn.

This new edition reflects the publication of BS EN 1762, *Rubber hoses and hose assemblies for liquefied petroleum gas, LPG (liquid or gaseous phase), and natural gas up to 25 bar (2,5 MPa) — Specification*, and the requirement to withdraw conflicting National Standards.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing product surveillance which may be coupled with assessment of a supplier's quality systems against the appropriate part of BS EN ISO 9000.

Enquiries as to the availability of third party certification schemes are forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

Annex A is informative and annex B is normative.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 5 and a back cover.

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1 Scope

This British Standard specifies requirements and test methods for metallic hose assemblies used for the loading and unloading of liquefied petroleum gases under pressure.

The metallic hose assemblies are suitable for use at a pressure of 25 bar and temperatures from −200 °C to 70 °C.

NOTE These hoses are primarily used for road and rail tankers or for ship to shore duties.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 6501-1:1991, *Flexible metallic hose assemblies — Part 1: Specification for corrugated hose assemblies.*

BS EN 10088-1:1995, *Stainless steels — Part 1: List of stainless steels.*

BS EN 10088-2:1995, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes.*

ISO 10806:1994, *Pipework — Non-alloyed and stainless steel fittings for corrugated flexible metallic hoses.*

3 Terms and definitions

For the purposes of this standard the definitions listed in BS 6501-1:1991 apply.

4 Information to be supplied by the purchaser

The purchaser shall state the following in all enquiries and orders:

a) intended service, application and environment;

b) product to be conveyed;

c) nominal size and hose assembly length;

d) movement required;

e) temperature of the product conveyed;

f) maximum ambient temperature;

g) type of end fitting required and, where applicable, specification of thread;

h) product velocity;

i) whether mechanical covering is required;

j) whether thermal insulation is required;

k) any special requirements for hydraulic test fluid;

l) any additional requirements for cleaning and post-test treatment;

m) requirements for test and material certificates;

n) any additional third party certification required;

o) if a coloured cover or other identification marking is required;

p) any special requirements for packaging.

5 Requirements

5.1 Materials

5.1.1 *Hose*

The hose material shall be either grade 1.4404 or grade 1.4541 in accordance with BS EN 10088-2.

5.1.2 *Braid wire*

The braid wire shall be soft annealed and shall be grade 1.4301, grade 1.4404 or grade 1.4541 in accordance with BS EN 10088-1.

5.1.3 *End fittings*

Dependent on the application, end fitting materials shall be one of those given in Table 1.

Table 1 — Types of end fitting

Temperature range	End fitting
−20 °C to 70 °C	Carbon steel
−200 °C to 70 °C	1.4541
−200 °C to 70 °C	1.4404

5.1.4 *Protection*

5.1.4.1 When a protective coating is used on a stainless steel, it shall not contain zinc, lead or tin.

5.1.4.2 If the material of a synthetic cover contains sulfur or chlorine care shall be taken to ensure that chlorine or sulfur is not released during the manufacturing process or in the conditions of service.

5.2 Hose dimensions

5.2.1 *Bore*

The nominal sizes, in mm, of the metallic hose assemblies shall conform to BS 6501-1:1991, with a maximum of 200 and the following preferred sizes: 40, 50, 80, 100, 150, and 200.

5.2.2 *Length*

The length of a metallic hose assembly shall be the overall length including end connections, and shall be manufactured to a tolerance of $^{+3}_{-1}$ %.

5.3 Pressure

5.3.1 The maximum design pressure shall be 25 bar.

5.3.2 Metallic hose assemblies shall have a minimum burst pressure of 100 bar.

5.4 Temperature

Depending on the end fittings, metallic hose assemblies shall be suitable for use over two temperature ranges: −20 °C to +70 °C and −200 °C to +70 °C.

5.5 Flexibility

For nominal sizes up to DN 100, metallic hose assemblies shall comply with the requirements for flexibility type B in accordance with BS 6501-1:1991.

For nominal sizes from DN 100 to DN 200, metallic hose assemblies shall comply with the requirements of annex B.

5.6 Construction

All hose assemblies shall consist of, as a minimum, a hose, braid and fittings.

All joining methods employed in the manufacture of hose and hose assemblies shall be by welding in accordance with qualified procedures.

The assembly procedure shall conform to the requirements for welded end fittings given in BS 6501-1: 1991, and joints shall be free from globular deposits, discontinuities, porosity and undercutting, and shall have a regular surface.

5.6.1 *Hose*

Metallic hoses shall be manufactured from seamless or longitudinally butt-welded tube, with annular corrugations, in accordance with BS 6501-1, and of the material specified in **5.1**. After forming the corrugated hose, the surface shall be finished smoothly and shall be free from any defects which might cause failure of the hose in service.

5.6.2 *Wire braid*

Metallic hoses shall be close covered by wire braid (see **5.1.2**), which is welded securely to the end fittings.

The manufacturer shall ensure that the wire braid is designed to fit the selected hose outside diameter.

5.6.3 *End fittings*

Fittings shall conform to ISO 10806:1994 unless otherwise agreed between the manufacturer and purchaser.

5.6.4 *Hose coverings*

Where used, covers shall be self extinguishing or not support combustion.

NOTE Covers are used for mechanical protection, thermal insulation and coding, see BS 6501-1.

5.6.5 *Clean conditions*

Before, during and subsequent to manufacture, components and hose assemblies shall be kept free from any foreign bodies or deleterious substances.

6 Type tests

Type approval tests shall be carried out, in accordance with the requirements of BS 6501-1, by the manufacturer on each new or modified type of metallic hose assembly.

When tested in accordance with BS 6501-1:1991, **14.5** the burst pressure of metallic hose assemblies shall be not less than 100 bar.

Where a manufacturer uses tube joints all type approval tests shall incorporate such a joint.

7 Production tests

7.1 General

After manufacture, each flexible metallic hose assembly shall be subjected to the following tests, in the order stated, (for safety reasons) during which there shall be no signs of leakage or other failure. After testing, the hydrostatic test medium shall be completely removed from each flexible metallic hose assembly and blank ends fitted.

7.2 Hydrostatic test

Gradually apply an internal hydrostatic pressure of 37.5 bar and maintain for a period of 5 minutes, then gradually release the pressure.

When under pressure, the increase in length of the assembly shall be not more than 3 %. Measurements shall be carried out over the full length of the hose assembly or on a gauge length of not less than 8 m.

7.3 Leak test

Apply a pneumatic pressure of 3.5 bar with the hose assembly submerged in water and, following the removal of any air trapped in the braiding, maintain it for a period of 5 minutes; then gradually release the pressure.

When tested the hose assembly shall show no signs of visible leakage.

NOTE Pneumatic testing is potentially a much more dangerous operation than hydraulic testing in that, irrespective of size, any failure during test is likely to be of a highly explosive nature. Attention is drawn to the Health and Safety Notice GS4, "Safety in Pressure Testing".

8 Test certificate

The manufacturer shall provide the purchaser with an individual test certificate for each metallic hose assembly incorporating the marking details specified in clause **9** in addition to the test results.

9 Marking

Each flexible metallic hose assembly shall be marked on one end fitting with the following information:

a) the number and date of this British Standard, i.e. BS 4089:1999;

b) the manufacturer's name or trade mark;

c) the hose assembly serial number;

d) the month and year of manufacture, e.g. 6/1989 representing June 1989;

e) for hose assemblies above 80 mm nominal size, the design pressure and the operating temperature range.

10 Cleaning and packaging

Cleaning and packaging shall be in accordance with BS 6501-1:1991, clause **17**.

11 Storage and handling

Guidance on storage and handling is given in annex A.

Annex A (informative)
Storage, handling and usage of hoses

A.1 Storage

The following recommendations should be adopted for flexible metallic hose assemblies that are not immediately placed in service.

a) Whenever possible assemblies should be stored straight. When requirements dictate that hoses are coiled, they should be stored in a horizontal plane. The diameters of the coils should be sufficient to prevent any kinking or distortion of the hoses.

b) Hose assemblies should be stored in such a way that they are not distorted by the weight of overlying objects.

c) Means shall be provided to prevent the ingress of foreign matter.

A.2 Handling and usage

In addition to the installation requirements in BS 6501-1:1991 further guidance on the use of larger hoses is given in Figure A.1.

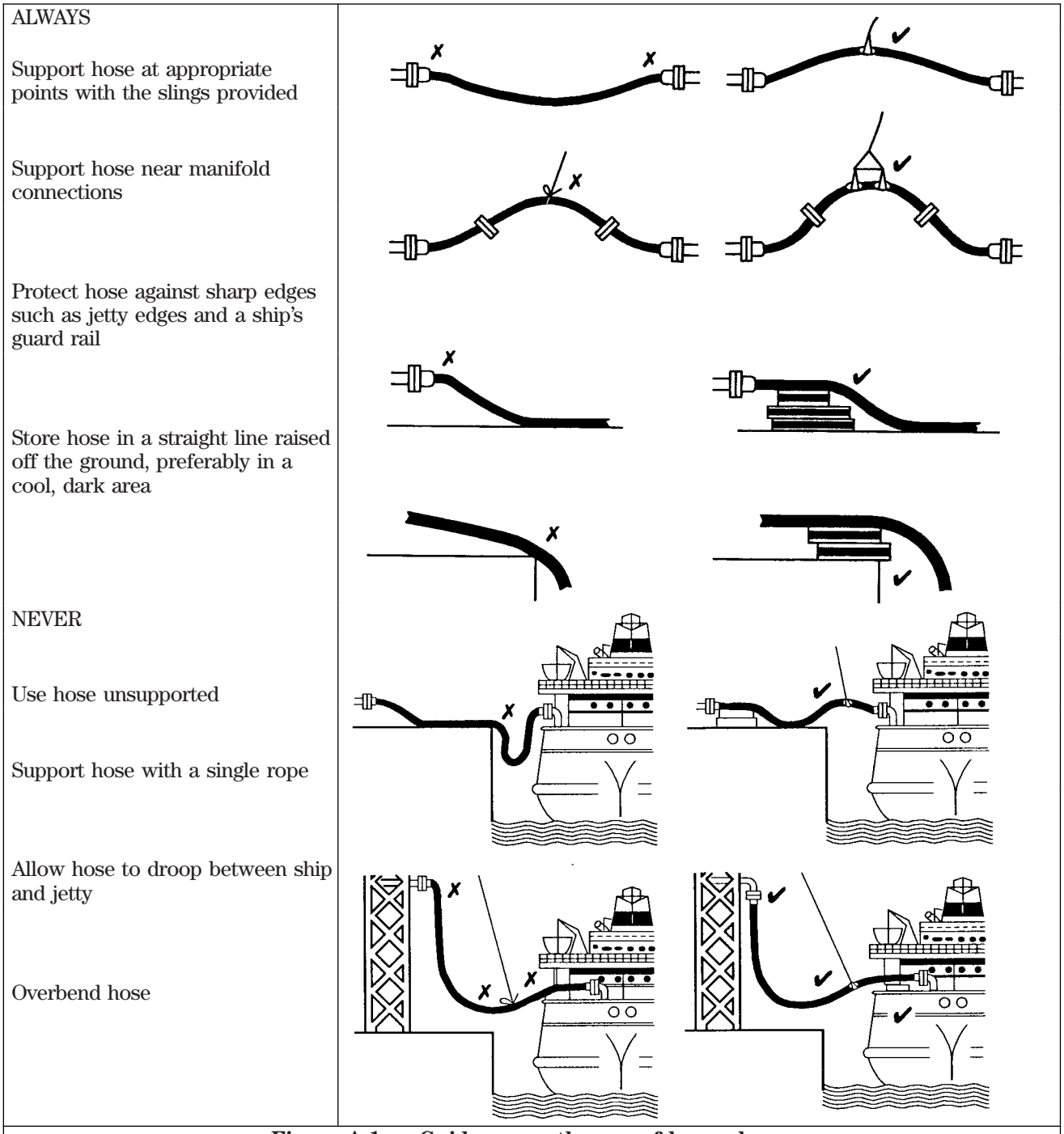

Figure A.1 — Guidance on the use of larger hoses

Annex B (normative)

Cyclic tests for metallic hoses from DN 100 to DN 200

B.1 Hose assemblies shall have an average life of 5 000 cycles but not less than 4 000 cycles when tested in accordance with **B.6** and Table B.1.

B.2 Prior to testing a hose assembly shall be degreased and dipped in a 20 % oil-water emulsion (ISO 6743-7 Family M oil). The hose assembly shall not be lubricated during the test.

B.3 Six hose assemblies per DN size, shall be subjected to the tests specified in **B.6**. If a DN size fails the test requirement (see **B.1**), five further samples of the same DN size shall be tested without failure (see **B.6**).

B.4 The test shall be conducted with the hose at a pressure of 25 bar.

B.5 Failure is defined as leakage of the hose or a permanent change in shape greater than $\pm$20 % of the nominal bend radius.

B.6 Cantilever bend test

The hose assembly shall be rigidly fixed at point A (see Figure B.1), the other end shall be moved by means of a lateral force applied at point P, located at the end of the flexible length, so that a stroke as given in Table B.1 will be achieved. The flexible length *"l"* shall be six times the nominal size.

The hose shall be subjected to repeated flexing at a sinusoidal rate of from 3 cycles/min to 15 cycles/min in a lateral direction to the axis of the hose.

Table B.1 — Cantilever bend test

Nominal size DN	100	150	200
Stroke (mm)	50	55	80

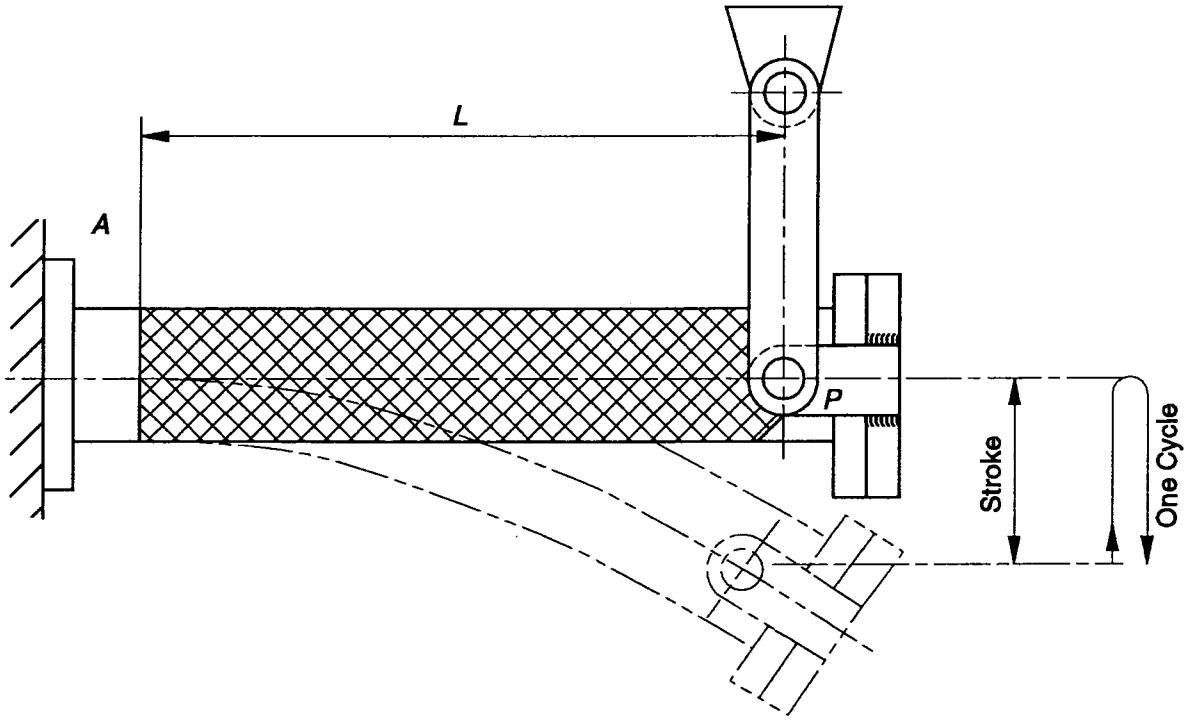

Figure B.1 — Test arrangement

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