BRITISH STANDARD

BS 669 :
Part 2 : 1997

Flexible hoses, end fittings and sockets for gas burning appliances

Part 2. Specification for corrugated metallic flexible hoses, covers, end fittings and sockets for catering appliances burning 1st, 2nd and 3rd family gases

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GSE/1, Gas fittings and connections, upon which the following bodies were represented:

British Combustion Equipment Manufacturers' Association
British Gas plc
British Rubber Manufacturers' Association Ltd.
British Turned-parts Manufacturers' Association
Council for Registered Gas Installers
Energy Industries Council
Health and Safety Executive
LP Gas Association
Society of British Gas Industries
The Association of Catering Equipment Manufacturers and Importers
The Employers' Association of Catering Equipment Engineers Ltd.

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Contents

Foreword

This Part of BS 669 has been prepared by Technical Committee GSE/1. It supersedes BS 669 : Part 2 : 1995, which is withdrawn. The standard was first published in 1936 and revised in 1952 and 1960. Since then, three major changes have occurred, namely the introduction of 2nd and 3rd family gases and the adoption of the metric system. In addition the King report[1], published in 1977, preferred that connections to gas cooking appliances should be flexible and should incorporate a plug and socket that seals automatically when the plug is withdrawn.

The 1960 edition of BS 669 was reviewed under the direction of the Gas Standards Committee and the revised standard was published in two Parts:

Part 1 : *Specification for strip-wound metallic flexible hoses, covers, end fittings and sockets for domestic appliances burning 1st and 2nd family gases*

Part 2 : *Specification for corrugated metallic flexible hoses, covers, end fittings and sockets for catering appliances burning 1st and 2nd family gases*

This Part of BS 669 deals with corrugated metallic flexible connections for catering equipment.

The 1995 revision included requirements for 3rd family gases.

This revision is introduced to permit alternative types of construction.

Attention is drawn to the stated manufacturing tolerances and the need for careful quality control as outlined in BS EN ISO 9000.

Guidance on the use of flexible connections is given in BS 6173 for gas-fired catering appliances.

Pressure class 1, type B corrugated hoses specified in BS 6501 : Part 1 in general meet the requirements of this standard.

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 14, an inside back cover and a back cover.

Section 1. General

1.1 Scope

This Part of BS 669 specifies the minimum requirements for corrugated metallic flexible hoses, covers, end fittings and quick disconnect couplings or sockets for use with catering appliances burning 1st, 2nd and 3rd family gases at a nominal inlet pressure not exceeding 50 mbar[1)].

1.2 References

1.2.1 Normative references

This Part of BS 669 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 14. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this British Standard only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

1.2.2 Informative references

This Part of BS 669 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 669 the definitions given in BS 1179 : 1967 and in BS 1179 : Part 6 apply together with the following.

1.3.1 braid

A layer (or layers) of cylindrically woven wires covering the hose.

1.3.2 corrugated metallic flexible hose

The flexible gas-tight metal element of an assembly without end fittings or covering.

1.3.3 cover

Any tubular outer cover used to improve the cleanliness of a flexible hose.

1.3.4 end fitting

A component permanently factory-fitted to a flexible hose that allows gas-tight connection to other pipework and can be a plug or a thread conforming to BS 21 : 1985, with a swivel, for fitting into the appropriate wall socket or appliance.

1.3.5 end fitting assembly

An assembled plug and socket or union complete with swivel.

1.3.6 flexible connection

The corrugated metallic flexible hose with braid, where fitted, cover and end fittings attached.

1.3.7 flexible connection assembly

The complete assembly comprising flexible connection and any matching socket.

1.3.8 flow rate

The rate of flow of gas through a flexible connection assembly under standard conditions.

1.3.9 inside diameter

The diameter of the largest sphere that can pass freely through the corrugated hose.

1.3.10 cover material

A synthetic material used to cover the flexible hose.

1.3.11 overall length

The length of a flexible connection assembly, measured while it is lying straight on a flat horizontal surface.

1.3.12 plug and socket or quick disconnect coupling

A two part fitting that provides quick connection and disconnection of an appliance at the gas supply, where the plug is an end fitting of the flexible connection and the socket is an installation fitting which is self-sealing as the plug is withdrawn.

NOTE. The phrase 'quick disconnect coupling' may be used interchangeably with 'plug and socket'. A quick disconnect coupling enables 360° axial rotation of the flexible hose with respect to the installation pipe fitting.

1.3.13 swivel (or rotary joint)

A permanently factory-fitted device other than fittings defined in **1.3.12** that enables a continuous axial rotation of the flexible hose with respect to the installation pipe fitting or to the appliance as appropriate without reducing the gas-tightness of the flexible connection assembly.

1.3.14 restraining device

A device that prohibits movement of the appliance away from the wall beyond the maximum extension of the device.

[1)] 1 mbar = 100 N/m^2 = 100 Pa.

Section 2. Flexible connection

2.1 General

2.1.1 Size

The nominal sizes of the flexible connection assembly shall be ¼, ⅜, ½, ¾, 1, 1¼, and 1½, in accordance with BS 21 : 1985.

2.1.2 Flow rate

The flow rate through the flexible connection assembly when passing air shall not be less than that given in table 1 at the appropriate pressure drop.

2.2 Design and dimensions

2.2.1 Corrugated metallic flexible hose

The hose shall be without circumferential joins and shall be manufactured from:

a) seamless tube; or

b) single longitudinally butt-welded tube.

The corrugations shall be annular and shall be of uniform height and pitch and continuous along the length of the hose, except for that section of the hose at the terminals required for transition. After forming the corrugated hose, the surface shall be free from any defects, e.g. scores or dents, which might cause premature failure.

Helical hoses shall only be used in designs which incorporate a transition section of plain tube. The transition section shall be supported by the fitting and used with both welded joints and mechanical fittings.

2.2.2 Braid

The flexible connection shall be either braided or unbraided. Where braid is used it shall conform to the requirements in **2.3.3** and **2.4.1**.

2.2.3 Cover

For the purpose of cleanliness, a smooth outer cover of synthetic material shall be fitted to each flexible connection. This cover shall:

a) extend over all parts of the flexible metallic hose that are capable of being bent or flexed and be a tight fit on the end connections;

b) have no adverse effect on the performance of the metallic hose;

c) have a minimum wall thickness of 0.5 mm after fitting;

d) be coloured yellow ochre in accordance with BS 4800 : 1989, colour code 08C35 or 10E53.

Table 1. Flow rate through flexible connection assemblies

Nominal size of flexible connection assembly (inlet connection)	Diameter (min.)	Overall length of flexible connection assembly	Tolerance on length	Air flow rate (min.)	Air pressure drop (max.)
	mm	mm	mm	m^3/h	mbar
¼	6	1000	$^{+55}_{-15}$	0.3	0.58
⅜	8	1000	$^{+55}_{-15}$	0.6	0.58
½	10	1000	$^{+55}_{-15}$	1.3	0.58
¾	15	1000	$^{+55}_{-15}$	3.0	0.58
1	20	1000	$^{+55}_{-15}$	5.0	0.58
1¼	25	1000	$^{+55}_{-15}$	9.0	0.58
1½	32	1000	$^{+55}_{-15}$	12.0	0.58

Table 2. Dimensions of flexible connection assemblies

Nominal size of flexible connection assembly (inlet connection)	Inside diameter (min.)	Overall length of flexible connection assembly				Tolerance on length	Wall thickness[1] (min.)
	mm	mm	mm	mm	mm	mm	mm
¼	6	500	1000	1250	1500	+ 55 −15	0.13
⅜	8	500	1000	1250	1500	+ 55 −15	0.20
½	10	500	1000	1250	1500	+ 55 −15	0.20
¾	15	—	1000	1250	1500	+ 55 −15	0.20
1	20	—	1000	1250	1500	+ 55 −15	0.20
1¼	25	—	1000	1250	1500	+ 55 −15	0.25
1½	32	—	1000	1250	1500	+ 55 −15	0.25

[1] Measured at three positions over the length of the corrugated tube.

2.2.4 Dimensions

The dimensions of the flexible connection assemblies shall be as given in table 2.

2.3 Materials

2.3.1 Corrugated metallic flexible hose

Where welded fittings are used, the hose shall be manufactured from:

– grade number 1.4306, 1.4404, or 1.4541 austenitic stainless steel, as specified in BS EN 10088-2 : 1995.

Where mechanically attached end fittings are incorporated in the assembly, the hose shall be manufactured from either:

– grade number 1.4306, 1.4404, or 1.4541 austenitic stainless steel, as specified in BS EN 10088-2 : 1995; or

– stainless steel that meets or exceeds the requirements for grade number 1.4301 of BS EN 10088-2 : 1995, vacuum annealed after forming, and the finished product, including any formed part of the hose, being production tested in accordance with BS 5903 : 1980, Method A.

2.3.2 Covers

The properties of covers and their methods of test shall be as given in table 3. Covers shall conform to the requirement of **2.5.3**. The covers material shall not react with the corrugated metallic hose to the detriment of the hose or cover.

Non-chlorinated materials shall contain not more than 50 ppm of chlorides (total content). For covers manufactured from other materials, the free chloride content shall not exceed the value given in table 3, when measured using chemically suppressed ion chromotography (CSIC). The cover sample for this test shall have a minimum length of deconvoluted surface of 100 mm and be held in suspension at 60 °C for 24 h to ascertain the free ion content.

NOTE. Calculation of the surface area should take account of the fact that leaching will occur from both inner and outer surfaces.

The cover shall have a minimum wall thickness of 0.5 mm after fitting.

Table 3. Properties and methods of test for synthetic covers

Property	Non-chlorinated requirement[1)]	PVC requirement	Method of test
Tensile strength (min.)	10 MPa	6 MPa	BS 903 : Part A2 : 1995 Type 2 dumb-bell test pieces
Elongation at break (min.)	200 %	350 %	BS 903 : Part A2 : 1995 Type 2 dumb-bell test pieces
Ozone resistance	No cracks	No cracks	BS 903 : Part A43 : 1990 300 pphm ozone; 20 % strain for 72 h at (38 ± 2) °C
Heat ageing	No cracks	No cracks	BS 903 : Part A19 : 1986 168 h at (175 ± 2) °C
Free chloride content	—	< 0.4 μg/cm^2	See **2.3.2**

[1)] Cover normally compounded from a polyolefin, pigment and stabilizer.

2.3.3 Braid

Where the braid is to be welded it shall be manufactured from fully annealed austenitic stainless steel wire conforming to grade 316S31, 321S31, as specified in BS 1554 : 1990 or 304S31 (0.045 % carbon max.), as given in table 1 of BS 6501 : Part 1 : 1991.

Where the braid is not to be welded, i.e. where the flexible connection incorporates mechanically attached end fittings, the braid shall be manufactured from austenitic stainless steel of grade 304S31 conforming to BS 1554 : 1990; or fully annealed austenitic stainless steel wire conforming to grade 316S31, 321S31, as specified in BS 1554 : 1990 or 304S31 (0.045 % carbon max.) as given in table 1 of BS 6501 : Part 1 : 1991.

2.3.4 Ferrules

Where ferrules are used, they shall be manufactured from the stainless steel specified in **3.2.1**a.

2.3.5 Restraining device

The restraining device shall withstand a minimum tensile load of 500 kg and shall be covered for cleanliness. The necessary mounting hardware to attach the restraining device to both the appliance and the fixed mounting point shall be provided with the restraining device.

2.4 Methods of assembly

2.4.1 Braided assemblies

Construction shall be by one of the following methods.

a) The braid shall be passed through a ferrule and shall be welded to the end of the corrugated hose and to the ferrule so that the braid is bonded securely. The end fitting shall then be introduced and welded to the hose by a second weld. Surface oxidation of the first weld shall be removed prior to commencement of the second weld.

b) The end fitting shall be welded to the end of the corrugated hose and the braid added to this assembly. A ferrule shall then be placed around the braid at the end fitting. The braid and ferrule shall then be welded to the end fitting, this second weld being spaced at a distance from the first weld, so that the braid is bonded securely.

c) Where a mechanically attached end fitting design is utilized, the braid shall be mechanically attached to the fitting so that the braid is secured.

2.4.2 Unbraided assemblies

Where a ferrule is fitted, it shall be placed around and near to the end of the hose. The ferrule and hose shall then be welded to the end fitting.

Where a flared fitting design is utilized, the end fitting shall be mechanically joined to the flexible metallic hose, in accordance with **3.1.4**.

2.5 Performance

2.5.1 Requirements

When tested in accordance with **2.5.2**, a flexible connection shall satisfy the requirements of **2.5.2.2** and any additional requirements specified in the individual test methods given in **2.5.2.3** to **2.5.2.7**.

2.5.2 Test methods

2.5.2.1 *General*

The flexible connection shall be subjected to the tests described in **2.5.2.3** to **2.5.2.7**. A new flexible connection shall be used for each test.

Before and after each test the flexible connection shall be subjected to the soundness test (see **2.5.2.2**) and a flow rate test to satisfy the requirements specified in **2.1.2**.

2.5.2.2 *Soundness*

The flexible connection shall be subjected to an internal air pressure of 3 bar; the leakage rate shall not exceed 15 cm^3/h.

After the flexible connection has been tested by one of the methods given in **2.5.2.3** to **2.5.2.7**, its cover shall be removed and it shall be subjected again to an internal air pressure of 3 bar. The leakage rate shall not exceed 15 cm^3/h.

Table 4. Test conditions

Nominal size of flexible connection assembly (inlet connection)	Hose inside diameter (min.)	Flexibility test (see 2.5.2.3)		Rolling bend fatigue test (see 2.5.2.6 and figure 1)		Torsional loading test (see 2.5.2.7 and figure 2)	
		Diameter of cylindrical former	Mass of end load	Bending diameter (distance between centres)	Free length of flexible connection between end fittings	*A*	Overall length of flexible connection assembly
	mm	mm	kg	mm	mm	mm	mm
¼	6	220	2	200 ± 2	$490\ ^{+15}_{0}$	200 ± 2	$1000\ ^{+55}_{-15}$
⅜	8	245	3	300 ± 2	$595\ ^{+15}_{0}$	250 ± 2	$1000\ ^{+55}_{-15}$
½	10	280	4	300 ± 2	$670\ ^{+15}_{0}$	300 ± 2	$1000\ ^{+55}_{-15}$
¾	15	340	6	400 ± 2	$855\ ^{+15}_{0}$	400 ± 2	$1000\ ^{+55}_{-15}$
1	20	400	8	400 ± 2	$880\ ^{+15}_{-0}$	400 ± 2	$1000\ ^{+55}_{-15}$
1¼	25	460	10	500 ± 2	$910\ ^{+15}_{-0}$	450 ± 2	$1000\ ^{+55}_{-15}$
1½	32	520	12	600 ± 2	$1070\ ^{+15}_{-0}$	450 ± 2	$1000\ ^{+55}_{-15}$

2.5.2.3 ***Flexibility test***

The flexible connection shall be placed over a cylindrical former and a load shall be hung freely from each end. The diameter of both the former and the mass of the load shall be as in table 4. The flexible connection shall be sufficiently flexible to make contact with the cylindrical former for at least 110° of its circumference.

2.5.2.4 ***Crushing test***

The flexible connection with the cover removed shall be subjected to a crushing load of 100 kg applied evenly over a length of 50 mm for 30 s. The connection shall not collapse or show signs of permanent deformation.

2.5.2.5 ***Fire resistance test***

The flexible connection with cover removed shall be subjected to a furnace temperature of 500 ± 10 °C for 30 min. After the flexible connection has been removed from the furnace, it shall satisfy the soundness test, as given in **2.5.2.2**.

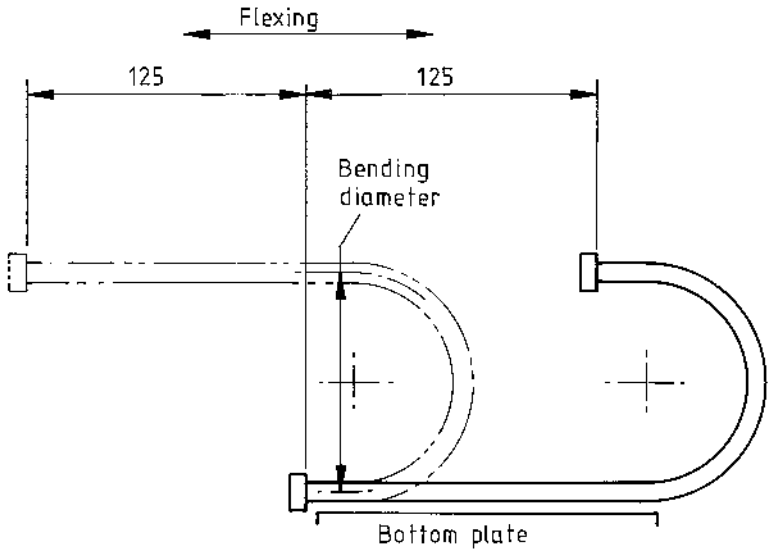
2.5.2.6 ***Rolling bend fatigue test***

A flexible connection assembly shall be mounted in the rolling bend fatigue test apparatus, as shown in figure 1 and given in table 4. The test shall be conducted using a flexible connection, mounted for the test by fixing the bottom end fitting and forming a vertical loop with the top end fitting, and which can move as shown in figure 1. Both end fittings shall be in the horizontal position. A bottom plate shall be fixed to support the lower limb of the flexible connection at all times during the test.

The flexible connection shall be pressurized at 2 bar and shall then be subjected to a repeated movement of 250 mm at a rate of 40 cycles per min to 50 cycles per min in a direction parallel with the axis of the hose, as shown in figure 1.

The number of cycles before failure shall be not less than 5000.

A cycle shall consist of a 250 mm movement away from its original position and return. The number of cycles before failure shall be not less than 2500 at a maximum of 10 cycles per min.



All dimensions are in millimetres

Figure 1. Rolling bend fatigue test

2.5.2.7 ***Torsional loading test***

The flexible connection assembly shall be fitted into the test apparatus as shown in figure 2. The axis of each end fitting shall be vertical and parallel to each other such that the flexible connection assumes a natural 'U' shape. The distance between the end fittings at the beginning of the stroke shall be dimension *A* as given in table 4.

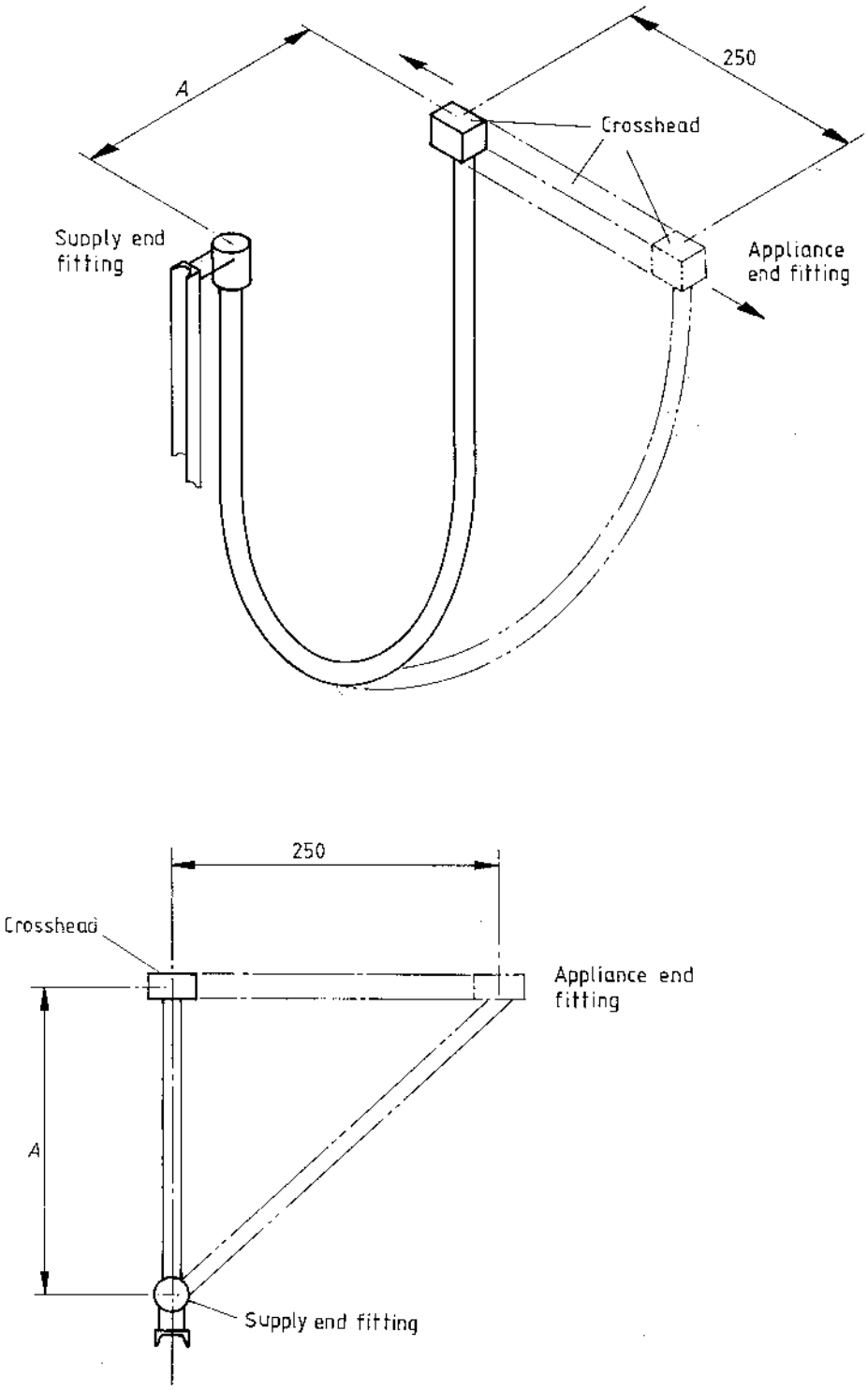
The swivel end shall be rigidly attached to the test apparatus in a manner which allows the flexible connection to rotate in its swivel fitting. The other end fitting shall be rigidly fixed to the crosshead of the test apparatus.

The crosshead of the test apparatus shall move 250 mm horizontally to the axis of the flexible connection as shown in figure 2.

A cycle shall consist of a 250 mm movement away from its original position and return. The number of cycles before failure shall be not less than 2500 at a maximum of 10 cycles per min.

2.5.3 Cover

The cover shall remain a tight fit on the end fittings on completion of the test in **2.5.2.3**, **2.5.2.6** and **2.5.2.7**.



All dimensions are in millimetres

Figure 2. Torsional loading test

Section 3. Requirements for end fittings and sockets

3.1 General

3.1.1 Basic designs of end fitting

The gas supply end fitting of the flexible connection shall consist of either a plug or a union assembly with a tapered thread conforming to BS 21 : 1985. A swivel shall be incorporated in this end fitting or fitted adjacent to it.

The appliance end fitting shall be a fixed tapered thread, which conforms to BS 21 : 1985.

3.1.2 Surface finish

All fittings shall have a smooth external surface without prominent imperfections. Machined surfaces shall have a fine finish free from scores and tool marks with special attention being paid to sealing surfaces.

3.1.3 Sharp edges

There shall be no burrs, flashings, sharp edges or swarf.

3.1.4 Mechanical fittings

Threaded components shall be locked in position prior to despatch, such that they are attached to the hose and are capable of withstanding the applied torque, as listed in table 5, when tested in accordance with **3.3.7**. If jointing material is used it shall conform to BS 6956 : Part 7.

Table 5. Minimum locking torques

Size	Minimum torque Nm
¼	82
⅜	102
½	136
¾	170
1	204
1¼	240
1½	273

3.1.5 Plug and socket connectors (quick disconnect couplings)

3.1.5.1 All sockets shall incorporate a self-sealing valve. Plug and socket connectors that are engaged by a rotating action shall be so constructed as to be prevented from continued rotation and consequent disengagement.

3.1.5.2 The flexible connection assembly shall be gas-tight within the limits specified in **3.3.1**.

When the plug and socket are partially disengaged they shall automatically (e.g. by springs) prevent gas flow.

3.1.5.3 Plugs and sockets shall be designed so that mating parts cannot be incorrectly joined.

3.1.5.4 Flexible connection assemblies using a mechanical fitting design shall be provided only with end fittings supplied by the original manufacturer.

3.2 Materials

3.2.1 The following shall be used for components listed in **3.2.2**:

a) stainless steel conforming to grades 304S11, 316S11 or 321S31 as given in table 11 of BS 970 : Part 1 : 1991;

b) carbon steel with the phosphorus and sulfur contents not exceeding 0.05 % (see **1.7.2.2** of BS 970 : Part 1 : 1991);

c) brass conforming to grades CZ 112, CZ 121 or CZ 131 of BS 2874 : 1986 or brass conforming to grade CZ 122 of BS 2872 : 1989.

d) carbon steel conforming to BS 970 : Part 1 : 1991, 220M07 which may be protected with an appropriate corrosion resistant finish.

3.2.2 End fitting parts shall be manufactured from appropriate materials as follows.

a) Plugs shall be manufactured from materials listed in **3.2.1**a and **3.2.1**c.

b) Sockets shall be manufactured from materials listed in **3.2.1**a and **3.2.1**c.

c) Socket valves shall be manufactured from materials listed in **3.2.1**a and **3.2.1**c.

d) Other threaded parts conforming to BS 21 : 1985 shall be manufactured from materials listed in **3.2.1**a and **3.2.1**b where welded or mechanical assemblies are used, or **3.2.1**c and **3.2.1**d where mechanical assemblies are used.

3.2.3 Circlips shall be made of steel conforming to BS 1449 : Part 1 or stainless steel spring-wire conforming to BS 2056 : 1991.

NOTE. Dimensions should be as specified in BS 3673 : Part 1 or Part 4.

3.2.4 'O'-ring seals shall conform to BS 1806 : 1989 or BS 4518 : 1982. The 'O'-ring material shall conform to BS EN 549 : 1995, temperature class D2 or E2.

3.2.5 Springs shall be made of stainless steel conforming to BS 2056.

3.2.6 Sealing washers shall be made of hard fibre.

3.2.7 Lubricating grease shall conform to BS EN 377 : 1993, or comprise 90 % petroleum jelly and 10 % graphite.

NOTE. For maintenance purposes pure petroleum jelly may be used.

3.2.8 Welding rod, if used, shall conform to:

a) grade 316S92 or 316S96 as specified in BS 2901 : Part 2 : 1990 for stainless steel fittings;

b) grade 308S92, 309S94 or 310S94 as specified in BS 2901 : Part 2 : 1990 for carbon steel fittings.

3.3 Performance of the end fitting assembly

3.3.1 Internal leakage of socket valve

When the socket is subjected to an internal pressure of up to and including 150 mbar, there shall be no leakage for the first 10 s. Any subsequent leakage shall not exceed 15 cm^3/h over a period of 1 min.

3.3.2 External leakage of the end fitting assembly

The assembled end fitting, in any position, shall conform to the limits specified in **3.3.1**.

3.3.3 Pull test

3.3.3.1 *Requirement*

The end fitting assembly shall remain intact and shall meet the soundness requirement of **3.3.2**, both during and after the tests specified in **3.3.3.2**. After the tests, any socket shall conform to the requirement of **3.3.1**.

3.3.3.2 *Method of test*

The inlet of the end fitting assembly shall be rigidly supported so that any hose hangs vertically from it (see figure 3). The assembly shall be pressurized to 150 mbar. The outlet of the assembly shall then be pulled horizontally about the axis of the mating parts for 1 min in each of four directions at 90° to each other and then pulled vertically downwards. The force applied for each of these five 'pulls' shall be as specified in table 6.

This test shall be repeated at a pressure of 15 mbar.

NOTE. The vertical pull can be applied to the end of the hose or to the end fitting. A convenient method of applying the horizontal pulling force is to loop a length of thin wire rope around the end fitting adjacent to the hose connection.

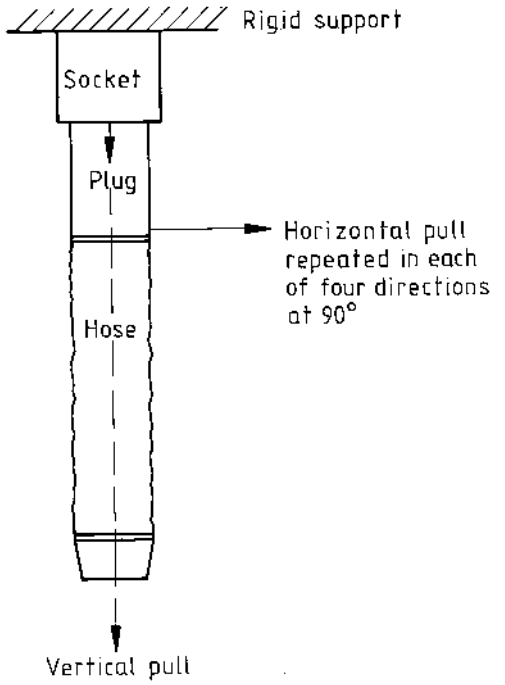
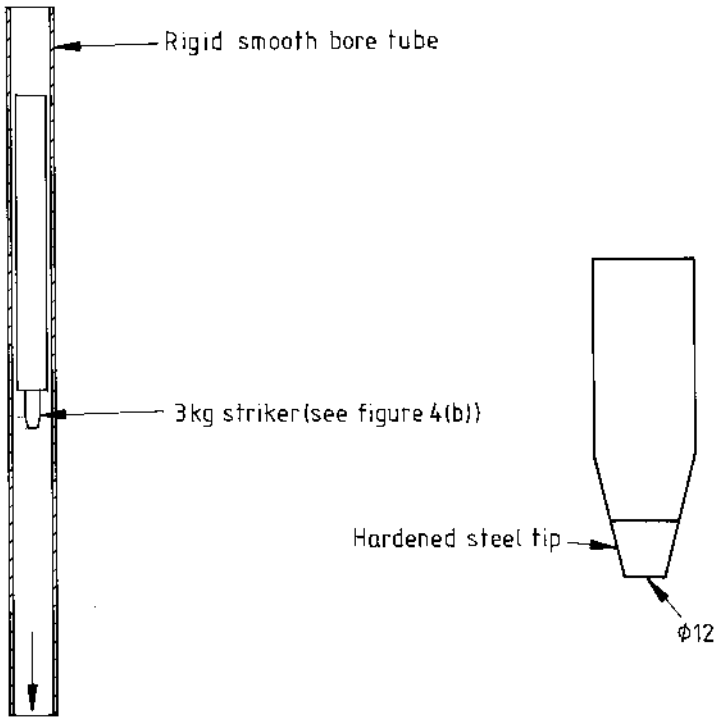


Figure 3. Pull test

Table 6. Strength and impact tests

Nominal size	Force (test as in 3.3.3) N	Impact energy (test as in 3.3.4) J
below ½	290	13.5
½	440	27.0
¾	590	27.0
1	690	27.0
1¼	800	27.0
1½	900	27.0



a) Impact test apparatus

b) Typical striker used in impact test (not to scale)

NOTE. Total mass of striker is 3 kg.

Dimension is in millimetres.

Figure 4. Impact test apparatus

3.3.4 Impact test

3.3.4.1 *Requirement*

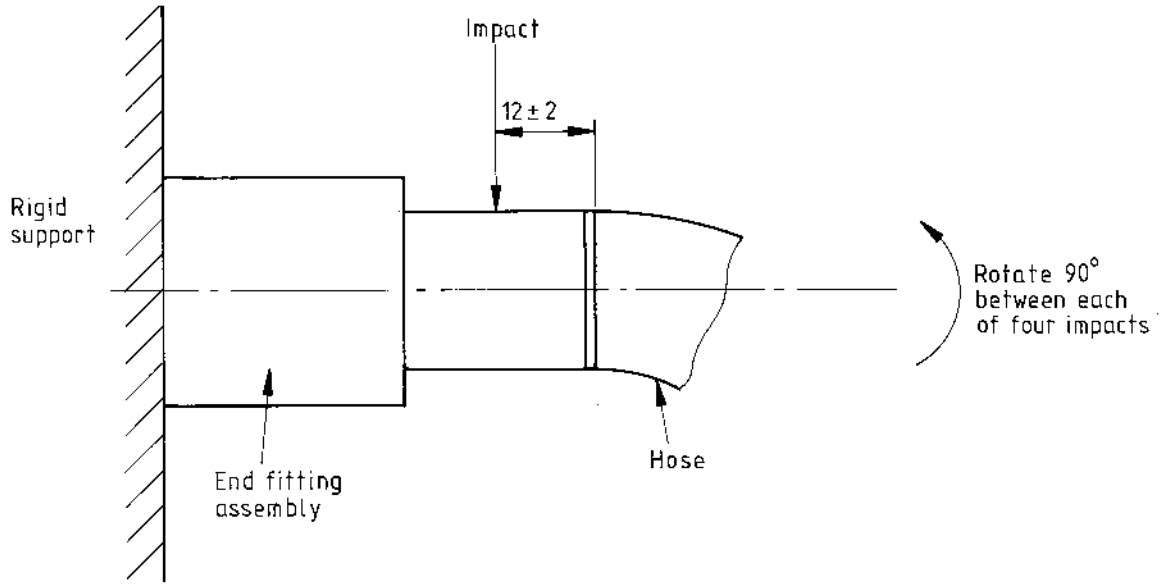
When tested in accordance with **3.3.4.3**, and using the apparatus described in **3.3.4.2**, the end fitting assembly shall conform to the requirements of **3.3.2** and any socket shall conform to the requirements of **3.3.1**. There shall be no cracks visible when inspected by eye corrected, where necessary, for normal vision.

3.3.4.2 *Test apparatus*

The test apparatus shall consist of a hardened steel striker with a mass of 3 kg, a 12 mm diameter flat end, together with a rigid smooth bore tube in which the striker, with not more than 0.5 mm clearance, is free to slide (see figure 4).

3.3.4.3 *Method of test*

The inlet of the end fitting assembly shall be rigidly supported, such that the axis of the mating parts is horizontal (see figure 5). Using the apparatus described in **3.3.4.2**, and with the end of the guide tube rigidly fixed in relation to, and resting on, the end fitting assembly, apply vertical blows to the end fitting, with the point of impact centrally on the end fitting (12 ± 2) mm from the hose. The striker shall fall freely and vertically on to the end fitting through the tube: from a height of 460 mm for fittings below ½; and 920 mm for ½ fittings and above. The impact energy shall be as specified in table 6 and the end fitting assembly shall be subjected to four successive impacts, the assembly being rotated 90° about the horizontal axis between each impact.



Dimension is in millimetres

Figure 5. Impact test

NOTE. The impact energy is calculated as follows:

$E = m \times g \times h$

where

E = impact energy, in joules;
m = mass of striker, in kilograms;
g = acceleration due to gravity, in metres per second squared;
h = height of fall, in metres.

Example 1, for fittings below ½

$E = 3\ \text{kg} \times 9.81\ \text{m/s}^2 \times 0.460\ \text{m}$

$= 13.5\ \text{J}$

Example 2, for fittings of ½ and above

$E = 3\ \text{kg} \times 9.81\ \text{m/s}^2\ 0.920\ \text{m}$

$= 27\ \text{J}$

3.3.5 Drop test

3.3.5.1 *Requirement*

When tested in accordance with **3.3.5.2** the function of the end fitting assembly shall not be impaired and it shall meet the soundness requirement of **3.3.2**.

3.3.5.2 *Method of test*

A 1000 mm length of flexible connection shall be mounted in the test apparatus, as shown in figure 6. The height h shall be adjusted, such that the sealing surfaces of the end fitting strike the steel plate when released from the position shown. Without varying the height, the end fitting shall then be released and allowed to strike the steel plate a total of 25 times.

3.3.6 Durability

A plug and socket assembly shall show no evidence of undue wear and shall meet the requirements of **3.3.1** after the application of 2000 connecting and disconnecting cycles.

The assembly shall not be further lubricated or serviced in any manner during this test.

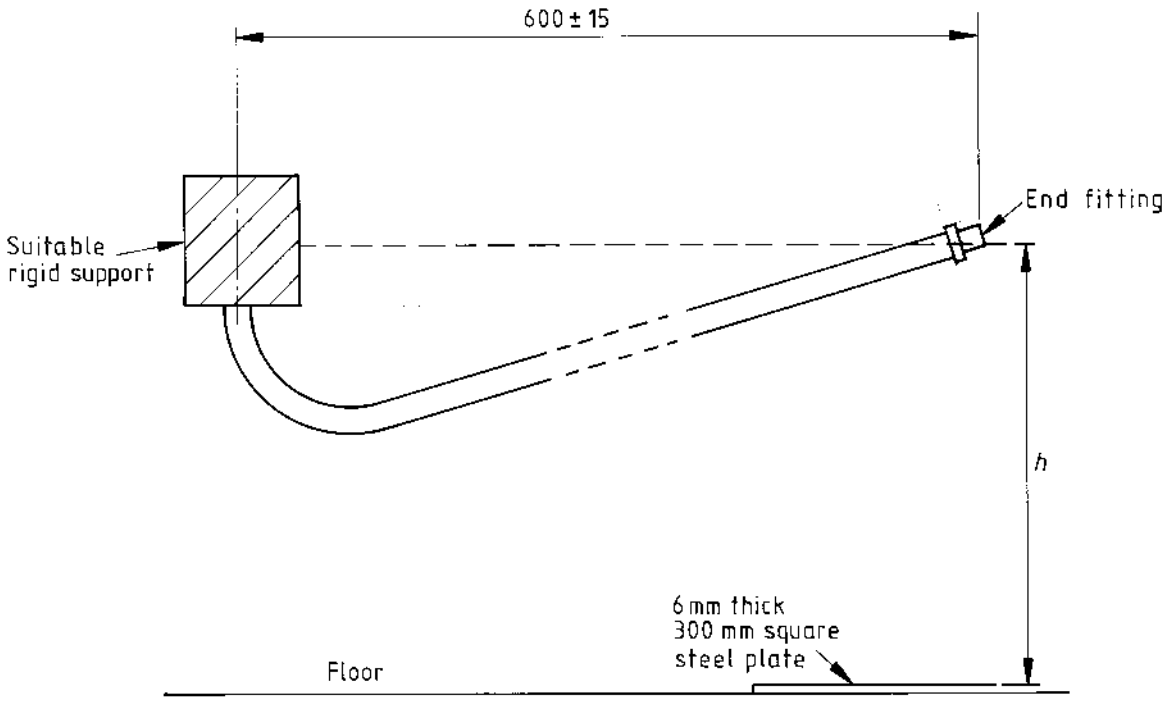
3.3.7 Mechanical torque test

3.3.7.1 *Requirement*

When tested in accordance with **3.3.7.2**, the assembly shall remain intact and no movement of the nut shall be detected.

3.3.7.2 *Method of test*

The locked parts shall be placed in an oven for a period of 12 h at a temperature of $110 \pm 2\ ^\circ\text{C}$. After ageing, the assembly shall be fixed in a rigid clamp and the torque, as specified in table 5, shall be applied in the direction to loosen the fixing.



Dimension is in millimetres

Figure 6. Drop test

3.4 Installation instructions

3.4.1 Requirement

The manufacturer shall state, with each flexible connection supplied, that the installation shall be in accordance with BS 6173 : 1990.

3.4.2 Instructions to be supplied

Instructions covering proper installation and use shall be attached to each flexible connection assembly. The instructions shall include, as a minimum, the following.

a) 'Flexible connections are suitable for use with 1st, 2nd and 3rd family gases only, on piping systems operating at a pressure not exceeding 50 mbar.'

b) 'Ensure that the gas supply and all the appliance controls knobs are turned off before connecting to the gas supply.'

c) 'An accessible, manually operated shut-off valve shall be installed in accordance with BS 6173 : 1990.'

d) 'The gas outlet, to which connection is to be made, shall be located in the same room as the appliance and the flexible connection shall not be concealed within, or run through, any wall, floor or partition.'

e) 'On completion, the final assembly shall be tested for leaks.

CAUTION. A naked flame shall not be used for this purpose!

Leak test solutions can cause corrosion, so thorough rinsing with water after the test is required.'

f) 'Flexible gas connections shall not come into contact with sharp edges or wiring.'

g) 'Flexible connections shall not be pinched, twisted or taut when installed. The installation shall be such as to avoid excessive flexing, bending or vibration in service.'

h) 'Restraints shall be fitted of such a length as to prevent movement of the appliance, which would cause damage to the flexible connection. Restraints shall not be attached to gas supply pipes, to the flexible connection or to any point that is insufficiently anchored. Restraining devices shall be inspected as part of the maintenance and safety procedures.'

i) 'Data that include the capacity of the flexible hose (indicated by specifying the nominal size of the connection), the pressure drop, the heating value, and the specific gravity of the reference gas and a statement that the capacity was determined under the test conditions specified in this standard.'

3.5 Marking

3.5.1 Information to be marked on flexible connection assembly

The information specified in the following items shall be clearly marked on the components of each flexible connection assembly.

a) The socket or quick disconnect coupling shall be marked with the direction of flow, the manufacturer's name or trade mark and, if practicable, the number and date of this British Standard, i.e. BS 669 : Part 2 : 1997.

b) Where practicable, one end fitting shall be marked with the manufacturer's name or trade mark, the date of manufacture, which may be encoded, and the number and date of this British Standard. Where it is impracticable to mark the end fittings, this marking shall be on the hose or on a self-adhesive label attached to the hose.

3.5.2 Durability of marking

All markings specified in **3.5.1** shall be indelible and labels and marking shall be capable of remaining intact and lasting the life of the flexible connection.

List of references (see clause **1.2**)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 21 : 1985	*Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*
BS 903 :	*Physical testing of rubber*
BS 903 : Part A2 : 1995	*Method for determination of tensile stress–strain properties*
BS 903 : Part A19 : 1986	*Heat resistance and accelerated ageing tests*
BS 903 : Part A43 : 1990	*Method for determination of resistance to ozone cracking (static strain test)*
BS 970 :	*Specification for wrought steels for mechanical and allied engineering purposes*
BS 970 : Part 1 : 1991	*General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels*
BS 1179 : 1967	*Glossary of terms used in the gas industry*
BS 1179 : Part 6 : 1980	*Combustion and utilization including installation at consumers' premises*
BS 1449 :	*Steel plate, sheet and strip*
BS 1449 : Part 1 (series)	*Carbon and carbon-manganese plate, sheet and strip*
BS 1554 : 1990	*Specification for stainless and heat-resisting steel round wire*
BS 1806 : 1989	*Specification for dimensions of toroidal sealing rings ('O'-rings)and their housings (inch series)*
BS 2056 : 1991	*Specification for stainless steel wire for mechanical springs*
BS 2872 : 1989	*Specification for copper and copper alloy forging stock and forgings*
BS 2874 : 1986	*Specification for copper and copper alloy rods and sections (other than forging stock)*
BS 2901	*Filler rods and wires for gas-shielded arc welding*
BS 2901 : Part 2 : 1990	*Specification for stainless steels*
BS 4518 : 1982	*Specification for metric dimensions of toroidal sealing rings ('O'-rings) and their housings*
BS 4800 : 1989	*Schedule of paint colours for building purposes*
BS 5903 : 1980	*Method for determination of resistance to intergranular corrosion of austenitic stainless steels: copper sulphate–sulphuric acid method (Moneypenny Strauss test)*
BS 6173 : 1990	*Specification for installation of gas-fired catering appliances for use in all types of catering establishments (1st, 2nd and 3rd family gases)*
BS 6501 :	*Flexible metallic hose assemblies*
BS 6501 : Part 1 : 1991[2)]	*Specification for corrugated hose assemblies*
BS EN 377 : 1993	*Lubricants for applications in appliances and associated controls using combustible gases except those designed for use in industrial processes*
BS EN 549 : 1995	*Specification for rubber materials for seals and diaphragms for gas appliances and gas equipment*
BS EN 1088 :	*Stainless steels*
BS EN 10088-2 : 1995	*Technical delivery conditions for sheet/plate and strip for general purposes*

[2)] Referred to in the foreword only.

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 669 :	*Flexible hoses, end fittings and sockets for gas burning appliances*
BS 669 : Part 1 : 1989[2)]	*Specification for strip-wound metallic flexible hoses, covers, end fittings and sockets for domestic appliances burning 1st and 2nd family gases*
BS 3673 :	*Specification for spring retaining rings*
BS 3673 : Part 1 : 1968	*Carbon steel circlips*
BS 3673 : Part 4 : 1977	*Carbon steel circlips — metric series*
BS 6956 : Part 7 : 1992	*Specification for anaerobic jointing compounds for use with 1st, 2nd and 3rd family gases*
BS EN ISO 9000 (series)	*Quality management and quality assurance standards*

Other references

[1] P.H. King. Report of the enquiry into serious gas explosions. June 1977. London: HMSO.

[2)] Referred to in the foreword only.

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