
British Standard

Flexible hoses, end fittings and sockets for gas burning appliances

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

Bâtiments et structures agricoles

Partie 81. Code de bonne pratique pour la conception et la
construction des magasins chimiques

Landwirtschaftliche Gebäude und Bauwerke

Teil 81. Leitfaden für Bemessung und Bau von Chemikalienlagern

Foreword

This Part of BS 669 has been prepared under the direction of the Gas Standards Policy Committee and it supersedes BS 669 : Part 1 : 1984, which is withdrawn.

This British Standard was first published in 1936 and revised in 1952 and 1960 and revised as BS 669 : Part 1 in 1984. The King report*, published in 1977, preferred that connections to gas cooking appliances should be flexible and should incorporate a plug and a socket that seals automatically when the plug is withdrawn.

This British Standard comprises the following 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 appliance burning 1st and 2nd family gases

BS 669 : Part 3 is in preparation and will specify rubber flexible hoses.

In order to avoid inhibition of design, this revision specifies strength and performance tests on end fitting assemblies and as a consequence only plugs and sockets of the type shown in figure 5 (this was figure 3 in BS 669: Part 1: 1984) need to have dimensions as given in that figure. Except for drawings showing essential mating dimensions of the type shown in figure 5, fully dimensioned drawings of plug and socket connections are not included.

As far as is reasonably practicable, manufacturers/designers of plug and socket end fittings need to be aware that it is important that their design is either compatible with other like designs or is obviously incompatible.

Size ½ in union connections have been deleted from figure 6; unions for this size are not included because the installation standard, BS 6172, which gives guidance on the use of flexible connections, requires the use of plug and socket fittings on domestic gas cookers.

Guidance on the use of flexible connections which comply with this Part of BS 669 is given in BS 6172 for domestic gas cooking appliances, CP 334: Part 3 for refrigerators, and CP 335: Part 1 for domestic laundering and miscellaneous appliances.

Attention is drawn to the stated manufacturing tolerances and the need for careful quality management as specified in BS 5750.

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

* P H King. *Report of the enquiry into serious gas explosions*. June 1977. HMSO.

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Section one. General

1 Scope

This Part of BS 669 specifies type test requirements for strip-wound metallic flexible hoses, covers, end fittings and sockets for use with domestic cookers and appliances burning 1st and 2nd family gases at a nominal inlet pressure of 20 mbar*.

The requirements for strip-wound flexible hoses with end fittings attached are specified in section two. Section three specifies additional requirements for the end fittings and sockets.

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

2 Definitions

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

2.1 cover. Any tubular outer cover used to improve the characteristics of the flexible hose.

2.2 end fitting. A component permanently attached to a flexible hose that allows gas-tight connection to other pipework and can be either a plug or BS 21 thread, with swivel if necessary, for fitting into the appropriate wall socket or threaded end on the appliance.

2.3 end fitting assembly. An assembled plug and socket or union assembly complete with swivel.

2.4 flexible connection. A strip-wound flexible hose with cover fitted and end fittings attached.

2.5 flexible connection assembly. The complete assembly comprising flexible connection and any matching socket.

2.6 flexible hose. A tube, made of strip-wound metal, and generally of small diameter section, that is able to support repeated bending without damage.

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

2.8 inside diameter. The diameter of the largest sphere that can pass freely through the flexible hose.

2.9 non-chlorinated material. A synthetic rubber material that does not include chlorine.

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

2.11 plug and socket. A two part fitting that provides quick connection and disconnection of an appliance to the gas supply. 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.

2.12 sealing thread†. Gauged thread of rubber used to assure soundness of a strip-wound flexible hose.

2.13 strip. Metal sheet suitable for cold forming into metallic hose.

2.14 strip-wound flexible hose. A pressure-tight flexible hose made from a spiral-wound, preformed steel strip, with a right-hand helix. The turns are interconnected by overlapping and incorporate a sealing thread to ensure soundness. Flexibility is achieved by sliding adjacent turns on each other.

2.15 swivel (or rotary joint). A device 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 mbar = 100 N/m² = 100 Pa.

† Also known as rubber packing.

Section two. Strip-wound flexible connections

3 General

3.1 Size

The nominal size of flexible connection assemblies shall be designated $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ and shall be determined by the flow rate given in table 1.

NOTE. The thread size of the end fitting may vary from the designation of the flexible connection assembly.

3.2 Length

NOTE. The overall lengths of flexible connections should be agreed between the manufacturer and the purchaser.

A tolerance on the agreed length of +25 mm, - 10 mm shall apply.

3.3 Flow rate

The flow rate through the flexible connection assembly when passing air shall be not less than that given in table 1 at the appropriate pressure drop. For the purposes of verifying compliance, a 900 mm long flexible connection shall be used.

Table 1. Flow rate through flexible connection assemblies			
Size designation (see table 2)	Pressure drop (max.)		Flow rate (min.)
	Gas	Air	Gas/air
	mbar	mbar	m ³ /h
$\frac{1}{8}$	0.35	0.583	0.1
$\frac{1}{4}$	0.35	0.583	0.5
$\frac{3}{8}$	0.35	0.583	0.5
$\frac{1}{2}$	0.35	0.583	0.9

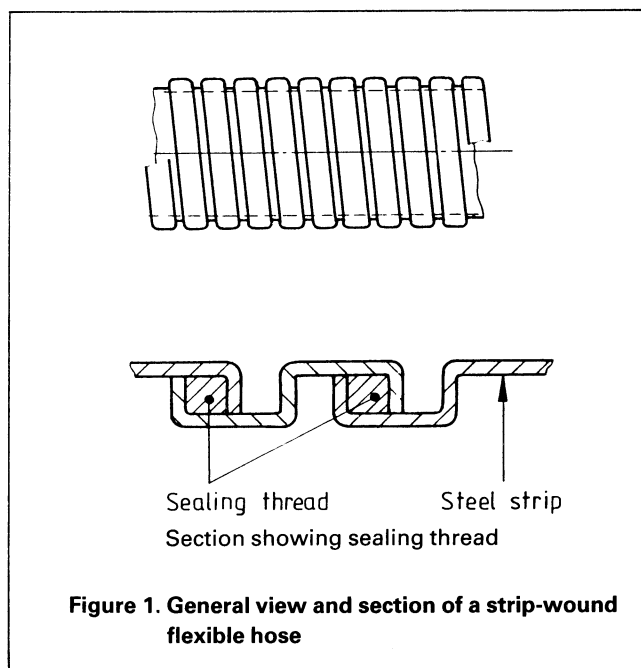
4 Design and dimensions

4.1 Strip-wound flexible hose

The hose shall be right-hand wound. The dimensions of the hose shall be as given in table 2.

NOTE. A suitable design is shown in figure 1.

Table 2. Dimensions of flexible hoses		
Nominal hose size	Inside diameter (min.)	Thickness of strip (min.)
	mm	mm
$\frac{1}{8}$	4	0.25
$\frac{1}{4}$	7	0.30
$\frac{3}{8}$	9.5	0.30
$\frac{1}{2}$	12.5	0.35



4.2 Cover

4.2.1 General. The flexible connection shall have a close-fitting cover complying with either 4.2.2 or 4.2.3.

4.2.2 Non-chlorinated synthetic rubber cover. The colour of the cover shall be black and its wall thickness shall be as given in table 3 (see 8.1 and 8.2).

4.2.3 PVC or chlorinated synthetic rubber cover. The colour of the cover shall not be black, white or orange. Its minimum wall thickness shall be as given in table 3 (see 8.3).

Table 3. Minimum wall thickness of covers		
Nominal hose size	Minimum wall thickness (mm)	
	Non-chlorinated synthetic rubber covers	PVC or chlorinated synthetic rubber covers
$\frac{1}{8}$	1.1	0.85
$\frac{1}{4}$	1.35	
$\frac{3}{8}$	2.0	Not permissible
$\frac{1}{2}$	2.0	

4.3 Soundness

The design of the flexible connection shall be such that it remains sound in the event of a rupture of the cover. This requirement shall be deemed to be met by compliance with 6.1.2.2.

4.4 Assembly markings

The cover shall be clearly marked prior to assembly to indicate the design depth to which the covered hose is to be inserted into the end fitting.

The position of the markings shall be such that, after insertion, they are visible beyond the swaged ends of the end fitting.

These markings shall be such as to remain visible after manufacture and assembly of the flexible connection and any subsequent performance test.

4.5 End reinforcement

NOTE. Where fitted, end reinforcements should not easily be dislodged from the end fittings.

End reinforcements shall not impede the use of a spanner for tightening as is required by 7.1.8.

5 Materials for strip-wound flexible hose

5.1 Steel strip

The flexible steel strip shall be of a CS grade in accordance with tables 5 and 8 of BS 1449: Part 1: 1983. The strip shall be electroplated with a zinc coating, which shall be not less than 0.0025 mm thick prior to forming.

5.2 Sealing thread/rubber packing

5.2.1 Requirements. The thread shall comply with 5.2.2, 5.2.3 and either 5.2.4.1 or 5.2.4.3.

5.2.2 Composition. The thread shall be made from a new first-grade natural, butyl or nitrile rubber or a blend of these materials, suitably compounded and vulcanized, and shall have a relative density not exceeding 1.02. The mix shall not contain any waste or reclaimed rubber.

NOTE. The composition may include accelerators and non-oxidants.

5.2.3 Elongation

5.2.3.1 Requirement. The average extension of a 150 mm gauge length in each of two test specimens of the thread measured immediately after the application of a 1.5 N/mm² stress shall be not less than 250 mm and not more than 650 mm when tested as described in accordance with 5.2.3.2. The cross-sectional area of the thread shall be measured in the unstressed condition.

5.2.3.2 Method. Suspend two 250 mm lengths of thread from a suitable grip. Gradually apply a load producing a stress of 1.5 N/mm² to each length. Closely monitor the application of the loads so that the extension rates of the lengths of the thread are approximately 40 mm/s. Measure the extension of a 150 mm gauge length of each test specimen. The temperature throughout the test shall be 20 ± 2 °C.

5.2.4 Accelerated ageing

5.2.4.1 Method 1

5.2.4.1.1 Requirement. When the thread is tested in accordance with 5.2.3.2 after being aged in accordance with 5.2.4.1.2, the test results shall not differ by more than ± 20 % from those obtained on the two lengths of unaged thread.

5.2.4.1.2 Method. Place two 250 mm lengths of the thread in a thermostatically controlled air oven at a temperature of 70 ± 1 °C. Suspend or otherwise support them so that they are free from stress, freely exposed to air and not touching each other or any part of the oven. Provide a continuous slow change of air in the oven during this treatment.

Withdraw both test samples after a period of 288 h in the oven. Immediately after removal from the oven, keep the test

samples for 24 h at a temperature of 20 ± 2 °C and shielded from light.

5.2.4.2 Method 2

5.2.4.2.1 Requirement. A 25 mm gauge length of thread, marked on each of two 100 mm test samples, aged in accordance with 5.2.4.2.2, shall be capable of being extended to 100 mm without breaking.

5.2.4.2.2 Method. Stretch two 100 mm lengths of the thread on a suitable frame, so that an initial 50 mm gauge length is elongated to 150 mm. Place them in a thermostatically controlled air oven at a temperature of 70 ± 1 °C. After 288 h, remove the test samples from the oven, immediately take them off the frame and keep them at a temperature of 20 ± 2 °C for 24 h and shielded from the light.

5.3 Sealant

Any sealant used in the construction shall not be affected by 1st or 2nd family gas, conditioning agents or any normal domestic cleansing agents.

NOTE. Compliance with these requirements should be declared by the sealant manufacturer.

5.4 Cover

5.4.1 All synthetic rubber covers. The properties of chlorinated or non-chlorinated synthetic rubber covers shall be as given in table 4.

5.4.2 Non-chlorinated synthetic rubbers.

5.4.2.1 Non-chlorinated synthetic rubbers shall comply with 5.4.2.2, 6.1.2.6 and 6.2.1.

5.4.2.2 With the cover freely exposed to atmosphere a non-chlorinated synthetic rubber cover shall not transmit an appreciable odour of gas to its outer surface when distributed 2nd family gas at a pressure of 20 mbar is continuously passed through the cover for 90 days.

Table 4. Properties and methods of test for synthetic rubber covers

Property	Requirement	Method of test in BS 903
Hardness	70 ⁺⁵ ₋₄ IRHD	Part A26 : 1969, method M
Tensile strength (min.)	10 MPa	Part A2. Type 2 dumb-bell test pieces
Elongation at break (min.)	200 %	Part A2. Type 2 dumb-bell test pieces
Tension set (max.)	7 %	Part A5. 100 % stretch for 10 min followed by 10 min relaxation
Ozone resistance	No cracks	Part A43. 200 p.p.h.m. ozone; 20 % strain for 72 h at 38 °C

5.4.3 PVC covers. PVC covers shall comply with class 3, type G3 of BS 2571.

NOTE. PVC covers should only be fitted to $\frac{1}{8}$ and $\frac{1}{4}$ size flexible connectors that are intended for use with portable appliances under manual supervision.

6 Performance

6.1 Strength and heat resistance

6.1.1 Requirements. When tested in accordance with 6.1.2, the flexible connection shall comply with 6.1.2.1 and any additional requirements specified in the individual test methods.

6.1.2 Test methods

6.1.2.1 General requirements. Test samples of the flexible connection shall be subjected to the tests described in 6.1.2.2 to 6.1.2.10, as applicable. A new test sample shall be used for each test.

After each test described in 6.1.2.3 to 6.1.2.8, the test samples shall comply with 6.1.2.2.

6.1.2.2 Soundness. The flexible connection with the cover cut away shall be subjected to an internal pressure of 50 mbar. There shall be no leakage for the first 10 s and the leakage rate shall not exceed $15 \text{ cm}^3/\text{h}$ over a period of 1 min.

NOTE. A convenient method of measuring the leakage rate is by the bubble leak indicator shown in figure 2. Six bubbles per minute is equivalent to a leakage rate of approximately $85 \text{ cm}^3/\text{h}$.

this position any leakage shall not exceed the limits specified in 6.1.2.2 nor shall the gas flow rate be reduced to less than 90 % of the flow rate specified in 3.3.

6.1.2.4 Resistance to crushing. The flexible connection shall be subjected to a load of 34 kg applied evenly over a 25 mm length of the strip-wound flexible hose for 30 s, and shall not show deformation or collapse after removal of the load.

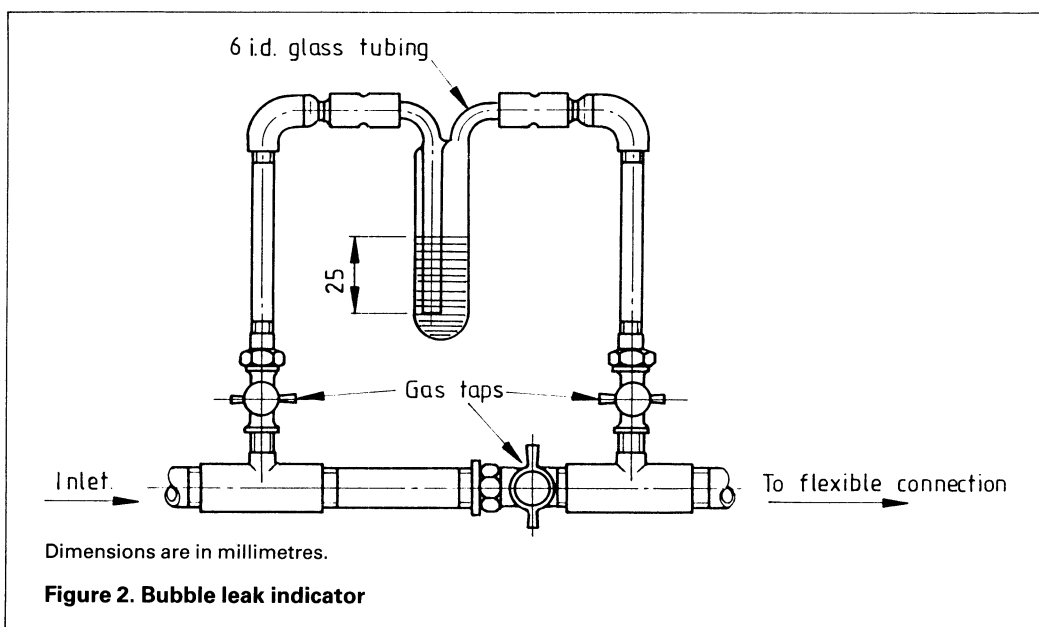
The flexible connection shall then be connected to an air supply at a constant inlet pressure of 20 mbar. A variable control shall be fitted on the outlet end of the connection and adjusted to give the flow rate specified in 3.3. A load of 34 kg shall then be applied evenly over another 25 mm length of the strip-wound flexible hose and after 30 s, while the load is still maintained, the air flow rate shall be not less than 90 % of its initial value.

6.1.2.5 Tensile strength

6.1.2.5.1 General. In each test method described in 6.1.2.5.2 to 6.1.2.5.4, screw one end of the flexible connection into a rigid fixing so that the flexible connection hangs vertically. Attach the load given in table 5 to the fitting at the free end so that the load hangs squarely.

6.1.2.5.2 Sustained load test. Attach the load given in table 5 to the free end for 5 min.

6.1.2.5.3 Non-sustained load test. Gradually increase the load at the free end from zero at a rate not exceeding 2.5 kg/s



6.1.2.3 Flexibility

6.1.2.3.1 Test 1. The flexible connection shall be placed over a cylindrical former of 80 mm radius and a mass of 1.6 kg hung freely from each end. The flexible connection shall be sufficiently flexible to make contact with the cylindrical former for at least 110° of its circumference.

6.1.2.3.2 Test 2. The flexible connection shall be passed round a cylindrical former of 80 mm radius and while held in

and release the load immediately it reaches the value given in table 5.

6.1.2.5.4 Shock load test. Attach the free end to a load of 4.5 kg while the load is supported. Raise the load through a vertical distance of 500 mm and allow it to fall from that height until its fall is arrested by the flexible connection.

6.1.2.6 Heat resistance. Subject the flexible connection, in an unstressed condition, to dry heat in a thermostatically

controlled oven at a temperature of 95 °C for 21 days. The rubber cover shall not melt or flow during this period. After cooling to room temperature it shall not show cracking, embrittlement or visible deterioration.

6.1.2.7 Resistance to bending. Screw one end of the flexible connection into a rigidly fixed adaptor so that the axis of the end fitting lies in the horizontal plane. Apply the load given in table 5 to the free end without shock and allow it to remain for 1 min. Then remove the load and rotate the end fitting in the adaptor through an angle of 180° and reapply the load for 1 min.

6.1.2.8 Flexing at end fittings. Secure the BS 21 end of a flexible connection having a hose length of 150 mm to the adjustable block in the test apparatus shown in figure 3. Attach the free end of the flexible connection by means of a rubber sleeve to a reciprocating member, having a vertical stroke of 100 mm, so that when the reciprocating member is

at the bottom of its stroke, the free end is at 90° to the end fitting. Subject the flexible connection to 1000 vertical 'pulls' of 3.2 kg at a rate of 30 pulls per minute.

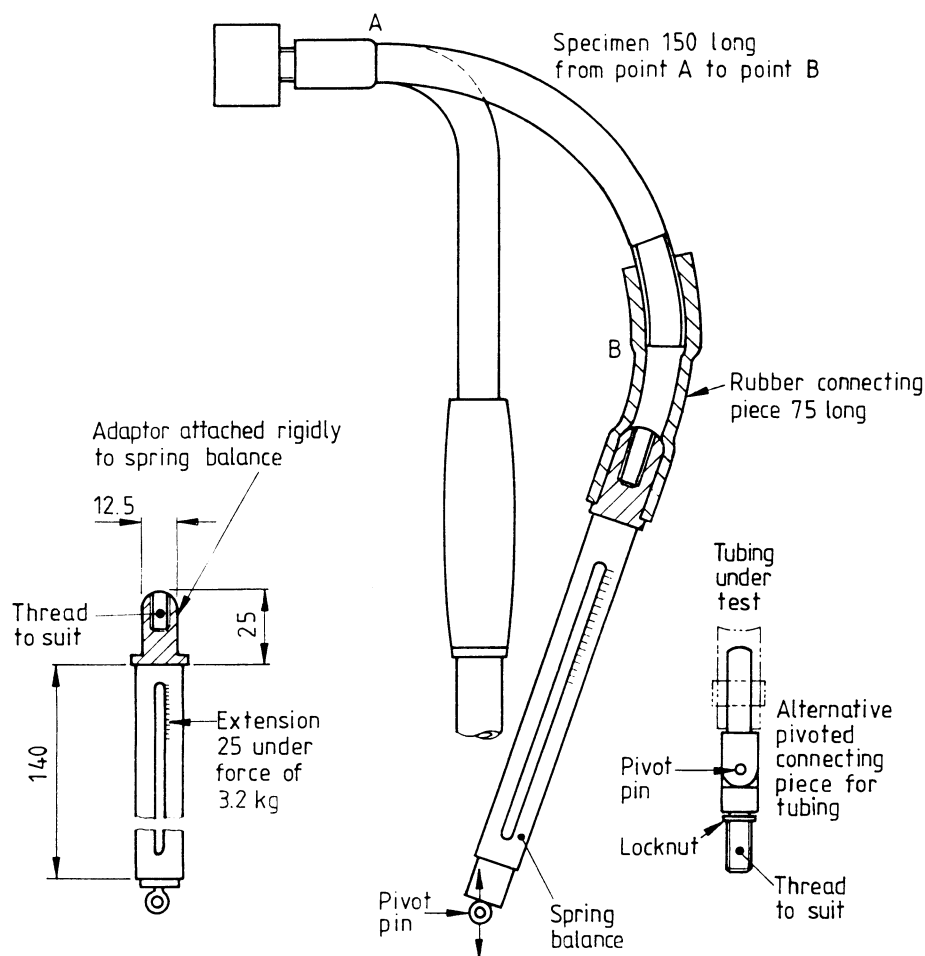
6.1.2.9 Resistance to torsion for 3/8 and 1/2 sizes. Securely hold one end fitting of a 160 ± 10 mm length of flexible connection while gradually applying a torque to the other end fitting.

The end fittings shall not unscrew when subjected to an anticlockwise torque up to the value given in table 5.

NOTE. It is permissible to use a mandrel within the hose during this test.

6.1.2.10 Resistance to tension. Securely hold both end fittings with the hose taut. Then increase the tension on the hose at a rate of loading not exceeding 2.5 kg/s.

The end fitting shall not become detached from the flexible connection at a load of less than that given in table 5.



Dimensions are in millimetres.

Figure 3. Flexing test