



BS 6448 : Part 1 : 1987

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British Standard

Gas governors

Part 1. Specification for pressure governors with nominal connection size up to 50 mm for gas appliances with inlet pressures up to and including 200 mbar

Régulateurs de pression de gaz

Partie 1. Régulateurs de pression de gaz de dimensions nominales de raccordement inférieurs ou égales à 50 mm pour appareils à gaz à pression d'alimentation inférieure ou égale 200 mbar

Gasregleinrichtungen

Teil 1. Druckregler mit Anschlußnenngrößen bis 50 mm für Gasverbrauchseinrichtungen mit Eingangsdrücken bis einschließlich 200 mbar

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Foreword

This Part of BS 6448 has been prepared under the direction of the Gas Standards Committee and supersedes BS 3554 : Part 1 : 1971 which is withdrawn. It has been based on prEN 88 Draft 2 which was prepared under the direction of the European Committee for Standardization (CEN) and sent to CEN members for second preliminary vote in Spring 1983. The UK has taken a significant part in the work of the CEN committees which produced prEN 88 Draft 2 and it is anticipated that when EN 88 is published it will be substantially the same as this Part of BS 6448. It is the intention that this Part of BS 6448 will be withdrawn and replaced with the corresponding European Standard when EN 88 is published. For this reason, some of the editorial conventions adopted in this standard are those normally associated with European Standards rather than British Standards.

*1 mbar = 100 N/m² = 100 Pa.

There are however two differences between this Part of BS 6448 and prEN 88 Draft 2.

- An additional requirement for the governor to pass the toluene test has been included in 3.10.
- In 4.3.1 the test pressure for the leak tightness test has been made 1.5 times the maximum permissible operating pressure without a minimum being specified. This should be regarded as an interim measure as EN 88 when published will almost certainly specify a minimum of 150 mbar* as the test pressure.

Another Part of BS 6448 is expected to be published as follows.

Part 2 Specification for pressure governors with nominal connection size up to 150 mm for gas appliances with inlet pressures up to and including 200 mbar.

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Gas governors

Part 1. Specification for pressure governors with nominal connection size up to 50 mm for gas appliances with inlet pressures up to and including 200 mbar

Section one. General

1.1 Object and field of application

1.1.1 Object. This standard specifies the safety, constructional and performance requirements for pressure governors, hereafter referred to as governors, intended for use with, or an integral part of, gas appliances. It also describes the test procedures for evaluating these requirements and information necessary for the purchaser and user.

1.1.2 Field of application

1.1.2.1 This standard applies to constant pressure governors for gas burning appliances of nominal connection size up to and including 50 mm and that may be used and tested independently of these appliances. These governors are suitable for one or more of the fuel gases of the 1st, 2nd and 3rd families, at inlet pressure up to and including 200 mbar.

NOTE. Where a standard exists for a gas appliance which includes a governor as an integral part then this standard may serve as the basis for the necessary tests. Where such a governor meets the requirements of this standard in isolation then it may not be necessary to repeat these tests with the governor installed in the appliance.

1.1.2.2 This standard does not cover:

- (a) governors connected directly to mains pipework or to a container that maintains a standard distribution pressure;
- (b) governors intended for gas appliances to be installed out-of-doors (in the open air).

1.2 References

ISO 7/1-1982	Pipe threads where pressure-tight joints are made on the threads Part 1. Designation, dimensions and tolerances
ISO 65-1981	Carbon steel tubes suitable for screwing in accordance with ISO 7/1
ISO 228/1-1982	Pipe threads where pressure-tight joints are not made on the threads Part 1. Designation, dimensions and tolerances
ISO 262-1973	ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts
ISO 274-1975	Copper tubes of circular section — Dimensions
ISO 301-1981	Zinc alloy ingots intended for casting

ISO 2084-1974 Pipe flanges for general use — Metric series — Mating dimensions

ISO 6708-1980 Pipe components — Definition of nominal size

NOTE. ISO 7/1-1982 is technically equivalent to BS 21 : 1985, ISO 262-1973 is technically equivalent to BS 3643 : Part 1 : 1981 and ISO 228/1-1982 is technically equivalent to BS 2779 : 1986. There are no corresponding British Standards for the other international standards.

1.3 Definitions

For the purposes of this Part of BS 6448 the following definitions apply.

1.3.1 reference conditions. Those conditions to which all measured values are corrected. The standard reference conditions are:

15 °C, 1013 mbar, dry.

1.3.2 Combustible gases

1.3.2.1 gas families. The families into which gases are divided according to the value of their Wobbe number are defined as follows:

- (a) 1st family: Wobbe number between:
23.8 MJ/m³ and 31.4 MJ/m³ on gross C.V.
21.5 MJ/m³ and 28.7 MJ/m³ on net C.V.
- (b) 2nd family: Wobbe number between:
41.3 MJ/m³ and 57.9 MJ/m³ on gross C.V.
37.1 MJ/m³ and 52.4 MJ/m³ on net C.V.
- (c) 3rd family: Wobbe number between:
77.4 MJ/m³ and 92.4 MJ/m³ on gross C.V.
72.0 MJ/m³ and 85.1 MJ/m³ on net C.V.

1.3.2.2 net calorific value (net C.V.). The quantity of heat produced by combustion at constant pressure of unit (volume or mass) of gas, the combustion products brought to 0 °C, but assumed to contain the water of combustion in the vapour state and the air necessary for the combustion considered as previously dry at 0 °C, the gas measured dry at 0 °C and under a pressure of 1013 mbar.

It is expressed in MJ/m³ of dry gas, measured at 0 °C and 1013 mbar, or per kg of dry gas.

1.3.2.3 gross calorific value (gross C.V.). The quantity of heat produced by the combustion, at a constant pressure, of unit (volume or mass) of the gas considered, the combustion water condensed, under the same reference conditions as for the net C.V.

It is expressed in MJ/m³ of dry gas, measured at 0 °C and 1013 mbar, or per kg of dry gas.

1.3.2.4 relative density. The ratio of the mass of unit volume of dry gas to that of unit volume of dry air under the same conditions.

1.3.2.5 Wobbe number. The ratio of the calorific value of the gas to the square root of the relative density of the same gas.

The Wobbe number is qualified as 'gross' or 'net' depending upon whether it is based on the gross or net calorific value.

1.3.3 Governors

1.3.3.1 governor (pressure regulator). A device that maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits (see appendix A).

1.3.3.2 adjustable governor. A governor provided with means for changing the outlet pressure setting.

1.3.3.3 class. Governors are classified as class A, class B or class C according to their function (see 1.4.1).

1.3.3.4 group. Governors are classified as group 1 or group 2 according to their construction (see 1.4.2).

1.3.4 Pressures

1.3.4.1 General

1.3.4.1.1 inlet pressure. The pressure at the inlet of the device.

1.3.4.1.2 outlet pressure. The pressure at the outlet of the device.

1.3.4.1.3 test pressure. The pressure to be applied during a test.

1.3.4.1.4 pressure difference. The pressure differential between inlet and outlet pressure at a specified flow rate.

1.3.4.2 Governor pressures

1.3.4.2.1 maximum inlet pressure ($p_{1,max}$). The maximum inlet pressure declared by the manufacturer.

1.3.4.2.2 minimum inlet pressure ($p_{1,min}$). The minimum inlet pressure declared by the manufacturer.

1.3.4.2.3 inlet pressure range. The range of inlet pressure between the maximum and minimum values.

1.3.4.2.4 maximum outlet pressure ($p_{2,max}$). The maximum outlet pressure declared by the manufacturer.

1.3.4.2.5 minimum outlet pressure ($p_{2,min}$). The minimum outlet pressure declared by the manufacturer.

1.3.4.2.6 outlet pressure range. The range of outlet pressure between the maximum and minimum values.

1.3.4.2.7 setting point. This refers to the inlet and outlet pressures declared by the manufacturer, at which the governor is set up for test purposes (see 3.6 and 4.6.3) at a declared flow rate. The respective pressures and flow rate are termed 'inlet setting pressure', 'outlet setting pressure' and 'setting flow rate'.

1.3.4.2.8 inlet setting pressure. See 1.3.4.2.7.

1.3.4.2.9 outlet setting pressure. See 1.3.4.2.7.

1.3.5 Governor flow rates

1.3.5.1 flow rate. The volume of the medium flowing through the device in unit time.

NOTE. The nominal connection size of a governor does not necessarily determine its flow rate range.

1.3.5.2 maximum flow rate (q_{max}). A maximum rate, as a function of inlet and outlet pressures, declared by the manufacturer and expressed in standard m³/h of air. For a non-adjustable governor there is only one maximum flow rate.

1.3.5.3 minimum flow rate (q_{min}). A minimum rate, as a function of inlet and outlet pressures, declared by the manufacturer and expressed in standard m³/h of air. For a non-adjustable governor there is only one minimum flow rate.

1.3.5.4 flow rate range. The range of flow rate between the maximum and minimum values.

1.3.5.5 setting flow rate. See 1.3.4.2.7.

1.3.6 Governor parts

1.3.6.1 breather hole. An orifice that allows atmospheric pressure to be maintained in a compartment of variable volume.

1.3.6.2 diaphragm. The flexible member that, under the influence of the forces arising from loading and pressure, operates the valve.

1.3.6.3 diaphragm plate. A stiffening plate fitted to the diaphragm.

1.3.6.4 valve. A device that varies the gas flow directly.

1.3.7 Operational terms

1.3.7.1 external leak tightness (soundness). The leak tightness of a gas-carrying compartment with respect to the atmosphere.

1.3.7.2 mounting position. A position declared by the manufacturer for mounting the device.

1.3.7.3 lock-up pressure. The outlet pressure at which a governor closes when the outlet of the governor is sealed. The increase in outlet pressure is expressed either in millibars or as a percentage.

1.3.7.4 to put out of action. To annul the operation of a governor and to seal the governor in that position.

1.3.8 Miscellaneous

1.3.8.1 nominal size (DN). A numerical designation of size that 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*.

1.3.8.2 maximum ambient temperature. The highest air temperature declared by the manufacturer at which the device may be operated.

1.4 Classification

1.4.1 Class of governor

1.4.1.1 General. A governor is classified as class A, class B or class C according to the inlet pressure range for which it is suitable (see 1.3.4.2) and the flow rate range within which the governor will act according to specification (see 1.3.5).

1.4.1.2 Class A governor. A class A governor is a governor for the control of the common gas supply to a number of independently operating burners of a single appliance within the limits given in table 4 (see 3.6). The minimum rate of flow is the minimum rate at which any one of the burners may operate, and the maximum rate of flow is the

*This definition is taken from ISO 6708—1980.

largest value of the sum of the rates of flow of burners which may operate at the same time.

1.4.1.3 Class B governor. A class B governor is a governor for the control of any burners that may operate between minimum and maximum flow within the limits given in table 4.

1.4.1.4 Class C governor. A class C governor is a governor that works within the limits given in table 4 at a fixed rate.

1.4.2 Group of governor

1.4.2.1 General. A governor is classified as group 1 or group 2 according to the bending stresses that it is required to withstand (see table 2).

1.4.2.2 Group 1 governor. A group 1 governor is a governor intended for use in a situation where it is not subjected to bending stresses imposed by installation pipework (e.g. by the use of rigid adjacent supports).

1.4.2.3 Group 2 governor. A group 2 governor is a governor for use in any situation, either internal or external to the appliance and without support.

1.4.3 Designation. A governor is designated by class and group, for example as 'A2' for a governor of class A, group 2.

Section two. Construction requirements

2.1 General

2.1.1 Governors shall be designed, manufactured and assembled so that they function correctly when installed and used according to the manufacturer's instructions.

2.1.2 All parts of a governor shall be free from sharp edges and corners which might cause damage, injury or incorrect operation.

The parts shall be clean internally and externally and shall be free from defects.

2.1.3 Holes for screws, pins, etc., which are used for the assembly of parts and for mounting, shall not penetrate gas-ways. The wall thickness between these holes and gas-ways shall be at least 1 mm.

2.1.4 Holes necessary in manufacture which connect gas-ways to the atmosphere but which do not affect the function of the device shall be permanently sealed by metallic means.

NOTE. Suitable sealing compounds may additionally be used.

2.1.5 Closure parts, including those of measuring and test points, which may be dismantled for servicing, adjustment and conversion shall be so constructed that tightness will be achieved by mechanical means (e.g. metal to metal joints and 'O'-rings); this excludes all jointing compounds such as liquids, pastes and tapes. Tightness shall also be maintained after dismantling and reassembling several times.

Jointing compounds, however, may be used for permanent assemblies and they shall remain satisfactory under normal operating conditions.

Closure parts that are not to be dismantled during servicing, adjustment and conversion shall be sealed by means which will show evidence of interference (e.g. lacquer).

2.1.6 Parts that require dismantling (e.g. for servicing) shall be capable of being dismantled and reassembled with common commercial tools and shall be so constructed or

marked that, following the instructions of the manufacturer, incorrect assembly is impossible.

Fastenings that may be removed during servicing shall have metric threads complying with ISO 68-1973 or ISO 262-1973.

Only self-tapping screws that form a thread and do not produce swarf shall be used. They shall permit replacement by metric machine screws complying with ISO 68-1973 and ISO 262-1973. Self-tapping screws that cut a thread and produce swarf shall not be used for connecting gas-carrying parts or parts that can be removed in servicing.

2.1.7 The function of moving parts (e.g. diaphragms and bellows) shall not be impaired by other parts.

2.1.8 Breather holes that are not provided with a connection for a vent pipe shall be so designed that when the diaphragm is damaged no more than 70 dm³/h of air shall flow through at the maximum inlet pressure; this requirement is considered to be met at inlet pressures up to 30 mbar if the diameter of the breather hole is not greater than 0.7 mm.

If the diameter of the breather hole exceeds 0.7 mm, a connection for a suitable vent pipe shall be provided and the installation and operation instructions shall specify that it is essential that the breather be vented to a safe place or, alternatively, an incorporated leakage rate limiter shall prevent the leakage from exceeding 70 dm³/h at the maximum inlet pressure. The leakage rate limiter shall be able to withstand three times the maximum inlet pressure. If a safety diaphragm is used as a leakage rate limiter it shall not take the place of the working diaphragm in case of a fault.

Breather holes shall be protected against blockage or shall be located so that they do not easily become blocked. They shall be so arranged that the diaphragm cannot be damaged by a sharp cleaning device inserted through the breather hole.

2.1.9 Sealing caps, if used, shall be capable of removal and replacement with standard tools and shall be capable of being sealed (e.g. by lacquer). A sealing cap shall not hinder adjustment within the whole range declared by the manufacturer.

2.1.10 The outlet pressure adjustment shall be readily accessible to authorized persons but there shall be provision for sealing after adjustment. Means shall be provided to discourage interference by unauthorized persons. Appropriate means shall be provided to put the governor out of action.

2.2 Materials

2.2.1 General material requirements. The quality and dimensions of materials used and the method of assembling the various parts shall be such that the construction and performance characteristics do not alter significantly during a reasonable life under normal conditions of installation and use. In addition, when the device is installed according to manufacturer's instructions, all components shall withstand any mechanical, chemical or thermal conditions to which they may be subjected during service.

2.2.2 Solder. Solder that has a melting point after application below 450 °C shall not be used for connecting gas-carrying parts.

2.2.3 Zinc alloys. Zinc alloys shall only be used if they are of quality ZnAl₄ complying with ISO 301-1981 and if the parts will not be exposed to a temperature above 100 °C.

80 °C. For main inlet and outlet threaded connections of governors, only external threads complying with ISO 228/1-1982 shall be permitted if these connections are made of zinc alloy.

2.2.4 Housing. (This clause is not intended to cover diaphragms, 'O'-rings and gasket seals.) Parts of the housing that directly or indirectly separate a gas-carrying compartment from the atmosphere shall be manufactured only of metallic materials.

Nevertheless, it shall be permitted for a gas-carrying part to be made of non-metallic material provided that upon removal or fracture of this non-metallic part, under all circumstances no more than 30 dm³/h of air can escape at the maximum inlet pressure.

2.2.5 Resistance to corrosion. Any part in contact with the gas or the surrounding atmosphere, and also springs, shall be manufactured from corrosion-resistant materials or shall be suitably protected. The corrosion protection for springs and other moving parts shall not be impaired by any movement.

2.2.6 Impregnation. The only method that shall be permitted for treating porous parts or cracks is impregnation with appropriate materials applied at the manufacturing stage by the vacuum method.

2.3 Connections

2.3.1 General. The inlet and outlet connections of a governor shall be threaded, flanged or provided with compression fittings.

2.3.2 Threads. When the inlet or outlet thread of a device is a pipe thread it shall comply with ISO 7/1-1982 or ISO 228/1-1982 and shall be chosen from the series:

$\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, and 2.

A governor intended for fitting by means of a threaded joint shall on its body have flat parts of such dimensions that the governor can be fitted using a common commercial tool. It shall be possible to exert the force required for fitting without inconvenience.

NOTE. If threads complying with ISO 228/1-1982 are used for union nuts they should be of the preferred sizes given in that standard.

2.3.3 Flanges. Flanges, incorporated in governors for connection purposes, shall comply with PN 6 or PN 16 of ISO 2084-1974 or suitable adaptors to ensure connection to standard flanges or threads shall be supplied or full details of mating parts made available upon request.

2.3.4 Compression fittings. Compression fittings shall be of the types to suit tubes complying with the outside diameters given in table 2 of ISO 274-1975, without tolerances. It shall not be necessary for the installer to form the tubes before connection is made. The olives shall be appropriate to the tubes for which they are intended. If conical non-symmetrical olives are used, it shall not be possible for them to be fitted incorrectly.

2.4 Seals for holes for moving parts

Manually adjustable packing glands shall not be used for sealing moving parts.

2.5 Pressure test nipples

Pressure test nipples shall have an external diameter of $9_{-0.5}^{+0}$ mm and a useful length of at least 10 mm for connection to tubing. The diameter of the hole in the pressure test nipple shall not be greater than 1 mm.

Section three. Performance requirements

3.1 General

3.1.1 Ambient temperature range. The device shall function correctly within the ambient temperature range declared by the manufacturer. The maximum ambient temperature shall be at least 60 °C and the minimum ambient temperature at most 0 °C.

3.1.2 Mounting position. The performance of the governor shall be satisfactory in all mounting positions declared by the manufacturer.

3.2 Putting the governor out of action

If it is claimed that a governor can be put out of action (e.g. for 3rd family gases), the method shall be given in the manufacturer's instructions and shall result in the valve being fixed in the fully open position.

When the governor is put back into operation, it shall comply with this standard.

3.3 External leak tightness

3.3.1 General. The device shall be leak tight. It shall be considered as leak tight if the leakage rates specified in 3.3.2 or 3.3.3 are not exceeded under the test conditions of 4.3.2 or 4.3.3 respectively.

Closure parts shall also be leak-tight after five dismantling and reassembling operations.

3.3.2 Governor: complete. The external leakage rate shall not exceed the value given in table 1 when the governor is tested as described in 4.3.2 in the following conditions:

- (a) in new condition;
- (b) when put out of action (see 3.2);
- (c) after the tests specified in 3.4, 3.5 and 3.6.

Table 1. Maximum permissible external leakage rates

Nominal size (inlet)	Leakage rate of air
DN	cm ³ /h
DN < 10	20
10 ≤ DN ≤ 25	40
25 < DN ≤ 50	60

3.3.3 Governor: without non-metallic part(s). (Diaphragms, 'O'-ring and gasket seals are excluded from this requirement.) When any non-metallic part(s) has been removed from the governor, the governor, when tested as described in 4.3.3 shall not have an external leakage rate greater than that specified in 2.2.4.

3.4 Torsion and bending

The governor shall be designed and constructed to withstand the torque and bending moment appropriate to group 1 or group 2 as given in table 2 without external leakage when tested as described in 4.4. After testing there shall be no permanent deformation.

A governor that complies with the requirements for group 2 governors shall be deemed to comply also with the requirements for group 1 governors.

Table 2. Torque and bending moment

Nominal size	Torsion	Bending moment		
	Group 1 and Group 2	Group 1		Group 2
	10 s	10 s	900 s	10 s
DN	N·m	N·m	N·m	N·m
6	15	15	7	25
8	20	20	10	35
10	35	35	20	70
15	50	70	40	105
20	85	90	50	225
25	125	160	80	340
32	160	260	130	475
40	200	350	175	610
50	250	520	260	1100

3.5 Durability

3.5.1 Durability of marking. Adhesive labels and all marking shall be resistant to abrasion. The labels shall not be affected by humidity and temperature and shall neither lift nor discolour so that the marking becomes illegible.

3.5.2 Protection against corrosion

3.5.2.1 Resistance to scratching. Surfaces exclusively protected with paint shall withstand the scratch test described in 4.5.2.1 before and after the humidity test described in 4.5.2.2 without the ball penetrating the protective coating to expose bare metal.

3.5.2.2 Humidity test. All parts with protected surface (e.g. coated with paint or plating) shall withstand the humidity test described in 4.5.2.2 without significant signs of corrosion, lifting, or blistering.

3.6 Governor performance

3.6.1 General. Governors shall be tested as described in 4.6 for outlet pressure variation over the range of inlet pressure from $p_{1,min}$ to $p_{1,max}$ or over the range of flow rate from q_{min} to q_{max} .

The inlet setting pressure shall be a nominal pressure as given in table 3 when the inlet pressure range includes the corresponding minimum and maximum values of inlet pressure given in that table. In other cases, the inlet setting pressure and the inlet pressure range shall be declared by the manufacturer.

The allowable tolerance on outlet pressure shall be not more than that given in table 4.

The pressure difference at maximum flow rate shall not be more than 10 % greater than that stated by the manufacturer.

3.6.2 Class A. Over the full range of inlet pressure and over the whole of the gas rate range from q_{max} to q_{min} , the outlet pressure variation from the set pressure shall not exceed the value given in table 4.

The declared minimum flow rate, q_{min} , shall not be greater than 10 % of q_{max} .

Table 3. Gas pressure at inlet to the appliance

Type of gas	Nominal pressure	Minimum pressure	Maximum pressure
	mbar	mbar	mbar
1st family gases	8 8	6 7.5	15 15
2nd family gases group H	18 20	15 18	23 25
2nd family gases group L	25 20	20 18	30 25
3rd family gases	28 30 37 50 67 112 148	20 25 25 42.5 50 60 100	35 35 45 57.5 80 140 180

Table 4. Tolerance on outlet setting pressure

Class of governor	Tolerance		
	1st family	2nd family	3rd family
	%	%	%
Class A			
q_{max} to q_{min} , and $p_{1,max}$ to $p_{1,min}$	± 15	± 15	± 15
Class B			
(a) By changing inlet pressure (all flows)	$\begin{Bmatrix} +15 \\ -20 \end{Bmatrix}$	$\begin{Bmatrix} +10 \\ -15 \end{Bmatrix}$	± 10
(b) By changing flows q_{max} to q_{min} (constant inlet pressure)	+40	+40	+40
Class C			
At constant q (within flow range)	$\begin{Bmatrix} +15 \\ -20 \end{Bmatrix}$	$\begin{Bmatrix} +10 \\ -15 \end{Bmatrix}$	± 10

3.6.3 Class B. At any given gas rate, within the inlet pressure range, the variation of the set outlet pressure shall not exceed the values given in table 4.

For a range of flow rates within the declared maximum and minimum limits, the change of outlet pressure produced by the change of rate between the two extremes shall not exceed 40 %.

3.6.4 Class C. At any rate of flow within the manufacturer's declared gas rate range, the variation of the set outlet pressure, over the full range of inlet pressure shall not exceed the value given in table 4.