

**Specification for
Low pressure regulators for
use with liquefied petroleum gas (LPG)**



Guyana National Bureau of Standards

GUYANA STANDARD

**Specification for
Low pressure regulators for
use with liquefied petroleum gas (LPG)**

INTENDED TO BE MADE COMPULSORY OCTOBER 2026

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Foreword

This Guyana Standard is a modified adoption of the **Indian Standard IS 9798:2013- 'Low Pressure Regulators for Use with Liquefied Petroleum Gas (LPG) – Specification'**.

It was revised by the Guyana National Bureau of Standards (GNBS) **Technical Committee (TC) – Gas Cylinders** in 2025.

The standard was adopted with modifications in Guyana in order to support the monitoring of the importation and sale of low-pressure regulators for use with Liquefied petroleum Gas (LPG) and is intended to be made compulsory.

INTENDED TO BE MADE COMPULSORY OCTOBER 2026

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Specification for Low pressure regulators for use with Liquefied Petroleum Gas (LPG)

1 Scope

This standard specifies materials, construction, performance and testing requirements for low pressure single or two-stage regulators for use with liquefied petroleum gas mixtures in vapour phase up to 4.903kN/m^2 (0.711PSI or 49.03mbar) [50gf/cm² or 500mm water column (WC) or 19.685inch WC] outlet pressure.

NOTE 1 Low pressure is considered to be any pressure below 6.894kN/m^2 (70.3gf/cm² or 1.0PSI or 68.947mbar). Domestic and commercial appliances normally operate at gas pressure of 2.942kN/m^2 (30gf/cm² or 0.427PSI or 29.37mbar or 300mmWC or 11.811inch WC).

2 Definitions

For the purpose of this standard, the following definitions shall apply:

2.1 liquefied petroleum gas

A hydrocarbon product composed predominantly of a mixture of butanes (n and iso) and/or butylene with propane, and/or propylene of maximum vapour pressure of 1653kPa (16.87kgf/cm²) at 65°C.

2.2 lock-up pressure

The outlet pressure of the regulator under 'no-flow' conditions, which shall be achieved within 60s after cessation of flow, with the inlet pressure to the regulator remaining on.

2.3 nominal outlet pressure

The basic outlet pressure desirable in a regulator set at 50 percent rated capacity at a specific inlet pressure. The nominal outlet pressure rating for domestic regulator is 2.942kN/m^2 (30gf/cm² or 0.427 PSI or 29.37mbar or 300mm WC or 11.811inch WC).

2.4 rated capacity

The standard rated capacity of LPG regulators for domestic use is up to 500l/h of LPG vapour. For purposes other than domestic, higher capacity regulators can be used. For performance tests, the flows are stated in terms of percentages of rated capacity, so as to cover all low pressure, whatever the rated capacity.

2.5 single stage regulator

Regulator in which the reduction of inlet pressure down to the desired regulated outlet pressure is achieved in one stage only.

2.6 two stage regulators

In this configuration, the inlet pressure is reduced to the desired outlet pressure in two stages by an arrangement in the same regulator only. The first stage regulation governs the reduction of the inlet pressure to an intermediate pressure, and the second stage regulation governs the reduction of this intermediate pressure to the desired outlet pressure. Both stages shall be incorporated in one body (See **Figure 2**). The operating gas pressure on the gasket is 0.3 to 16bar. Regulators with internal PRV shall not be used.

2.7 quick coupling

A connection system which allows the fitting of a regulator to a cylinder valve without a threaded connection and without use of tools.

2.8 threaded inlet

A connection system which allows the fitting of a regulator to a cylinder valve by means of a threaded connection and/or use of tools for fitment or removal.

3 Materials

3.1 All component parts shall be manufactured from or be treated with materials compatible with LPG as well as unaffected by chemical or thermal influences that may be encountered in normal use.

3.1.1 Brass parts shall not be susceptible to season cracking.

3.1.2 The body and cover of all regulators of rated capacity up to 1000l/h shall be manufactured from zinc-based alloys or aluminium by pressure die-casting. Chemical composition of the material of the pressure die-cast body and cover of the pressure regulator shall conform to a recognised national or international standard. The top of the regulator shall not be removable; the regulator shall be one complete unit.

3.2 Finish

3.2.1 The body and the cover of the regulator shall be electroplated or chemically treated (surface passivated) and painted or powder-coated to resist the effect of atmospheric conditions to which the pressure regulator is exposed during its working life. The type of finish shall be as agreed to between the manufacturer and the customer, provided that the regulator meets the requirements of this standard.

3.2.2 The surface-finished components shall be subjected to test for corrosion resistance.

3.2.3 The painted or powder-coated surfaces shall be tested for adhesion of paint by the method described in **Annex A**.

NOTE 2 During the die casting process, chromium gets added in the regulator body; the zinc is covered and re-used due to the high content of chromium that gets into the die punch. Hence, the permissible limit of chromium is 0.02 percent.

3.3 Diaphragm material

The material of the diaphragm shall be of synthetic rubber or any other material equally suitable for the application and shall satisfy the following requirements:

3.3.1 The material shall be free from porosity, pits and foreign particles and shall have a smooth, non-tacky surface with minimum talc or bloom.

3.3.2 The material shall not show change of more than 10IRHD (International Rubber Hardness Degree) when subjected to ageing of 72h at 70°C.

NOTE 3 For guidance purpose, comparison of Shore A and IRHD hardness are given below:

<i>Shore A:</i>	30	40	50	60
	70	80	90	100
<i>IRHD:</i>	28.9	39.5	50	60.5
	70	80	89.5	100

3.3.3 The material shall be capable of withstanding a clamping pressure of 490kPa (5kgf/cm² or 71.05PSI or 490.0mbar) whereby the material itself or the substance with which the fabric layer has been impregnated shall not be pressed away, flowed away, bruised or otherwise damaged.

3.3.4 The material shall be such that when an assembled regulator is subjected to the test as specified in **Annex B**, the diaphragm shall not pull out or burst at a pressure less than 275kPa (2.8kgf/cm² 39.88PSI or 275.0mbar).

3.3.5 The material shall, after immersion in *n*-pentane or octet commercial LPG for 72h, meet the appropriate requirements specified in **Annex C**. Changes in hardness, before and after the immersion shall not exceed 15IRHD.

NOTE 4 The tests at 3.3.1 to 3.3.5 are work batch tests. On initial selection of a diaphragm material, it shall also be tested in commercial LPG in vapour phase for 72h and shall not show a weight loss or volume change greater than 15 percent.

3.3.6 The material shall be such that the flexibility of the diaphragm shall not be impaired after the samples of the same have recovered completely to ambient temperatures from cooling to -20°C or heating to 65°C. For these tests, assembled regulators are cooled to -20°C or heated to 65°C and maintained at these temperatures for 10 minutes and then kept in the atmosphere to attain ambient temperature on its own (not by induced heating or cooling). After recovery, the setting and performance readings are taken. The readings shall be within the acceptable limits of performance as given in **Clause 7.9**.

3.3.7 The material shall have 25 percent max compression set when subjected to compression set test in accordance with the method prescribed in **Annex D**.

3.4 Valve pad material

Valve pad materials shall be of synthetic rubber or any other material equally suitable for the application and of a quality to satisfy the following minimum requirements.

3.4.1 The valve pad material shall be free from porosity, pits and foreign particles and shall have a smooth non-tacky surface with minimum talc or bloom. The material shall have low cold flow and creep characteristics, and compression set, as specified in **Clause 3.4.5**.

3.4.2 The material shall, after immersion in pentane or commercial LPG for 72h, meet the appropriate requirements given in **Annex C**. After this test, the change in hardness value observed before and after the test shall not exceed 15IRHD.

NOTE 5 The tests at 3.4.1 to 3.4.2 are work batch tests. On initial selection of a valve pad material, it shall also be tested in commercial LPG in vapour phase and shall not show any volumetric shrinkage or increase greater than 10 percent. The loss of plasticisers or other ingredients due to extraction shall not exceed 5 percent by weight.

3.4.3 The material shall not show change of more than 10IRHD when subjected to ageing of 72h at 70°C.

3.4.4 The valve pad fitted in its housing shall be immersed in pentane or commercial LPG in vapour phase for 72h after which the valve pad shall not show evidence of being forced out of position due to swelling or any other cause.

3.4.5 The material shall have 40 percent maximum compression set when subjected to compression set test in accordance with the method prescribed in **Annex D**.

3.5 Seals

O rings and rubber components other than diaphragm and valve pad shall withstand the requirements as laid down in **Clauses 3.4.1 to 3.4.3** and **Clause 3.4.5**.

NOTE 6 All rubber materials which come into contact with the LPG shall be tested.

4 Construction and workmanship

4.1 A typical regulator to match the self-closing valve is shown in **Figure 1** for illustration purposes.

4.2 The regulator, including all the component parts, shall be mechanically strong, of sound construction and of high standard workmanship and finish.

4.3 The components of a regulator shall be interchangeable with the corresponding components of any other regulator of the model and size.

4.4 Screw thread

Except for the screwed ends of regulators not fitted with inlet or outlet connectors, screw threads shall comply with the requirements of a recognised national or international standard.

4.5 Inlet connection

Where a screwed connection is not used, the inlet of the pressure regulator shall be cast integrally as an inseparable part of the body or so fixed that it cannot be separated without damaging the body. The size and the profile of the inlet connection shall match the outlet end of the spring-actuated self-closing valve of LPG cylinder to achieve a leak-proof coupled joint without use of a resilient packing or washer or gasket as a part of the regulator. However, the use of a gasket or packing shall be permitted, provided that there is a leak-proof joint with the valve, with the help of the gasket or packing as a part of the valve.

4.5.1 The inlet connection shall be designed to withstand a minimum hydrostatic pressure of 1.5 times the saturated vapour pressure of the gas at 50°C subject to a minimum of 18kgf/cm² or 255.2PSI or 1800mbar for 120s.

4.5.2 The inlet connection shall also be capable of withstanding a minimum pneumatic pressure equivalent to the maximum vapour pressure specified in **Clause 2.1** at ambient temperature.

4.5.3 Where screwed connections are used for inlet or outlet of a regulator, the following shall apply:

(a) Screwed ends- Where inlet or outlet connections are not fitted, the inlet and outlet of a regulator with screwed ends shall comply with the requirements of a recognised national or international standard.

(b) Inlet connections- Where used, any washer, connector and nut of a screwed inlet union shall comply with the applicable mating dimensions of a recognised national or international standard.

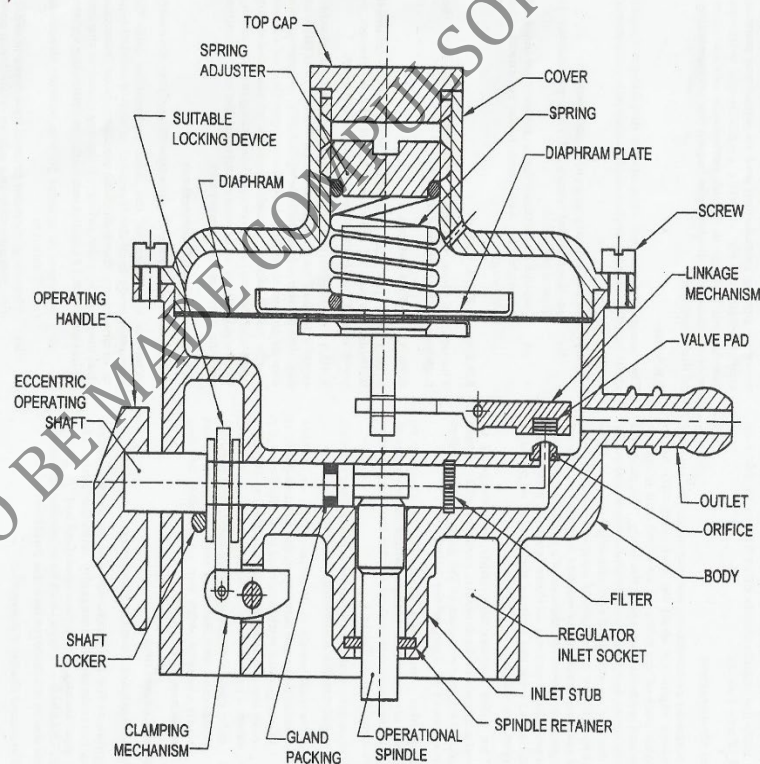


FIG. 1 DIAGRAMMATIC SECTIONAL ILLUSTRATION OF A PRESSURE REGULATOR USED WITH SELF CLOSING SPRING LOADED TYPE VALVE FOR LPG

Figure 1 Diagrammatic sectional illustration of a pressure regulator with self-closing spring-loaded type valve for LPG

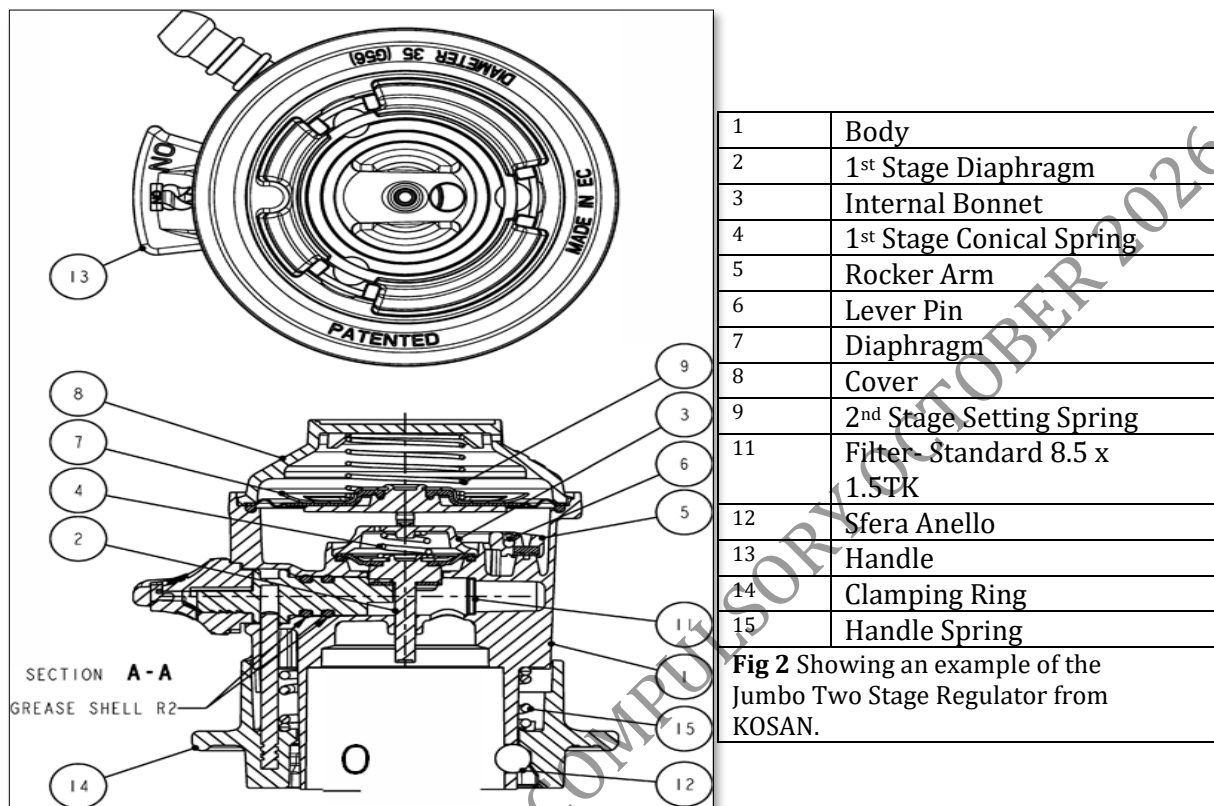


Figure 2 Showing an example of the Jumbo Two Stage Regulator from KOSAN.

4.6 Outlet connection

4.6.1 Non-threaded outlet connection

The outlet nozzle for regulators for domestic service shall be horizontally cast integrally with the body. The nozzle shall conform to either image in **Figure 3**. The choice of type shall be as per the agreement between the manufacturer and the purchaser, (provided that the LPG regulator meets the requirements of this standard) and subject to the approval of the regulatory authority.

4.6.2 Threaded outlet connection

Threaded outlet connection shall be as per the agreement between the manufacturer and the purchaser (provided that the LPG regulator meets the requirements of this standard), subject to approval from the regulatory authority. If there is no agreement, the outlet connection shall comply with European Standard DS EN 560, with G1/4"Lh for low pressure and G3/8"Lh for high pressure.

4.7 Body

The body and cover shall be strong enough to withstand the stress of connecting the regulator to the cylinder valve or piping installation and to withstand normal stress imposed by service conditions, without developing leakage at joints, permanent deformation or other damage which might impair the serviceability of the regulator.

4.8 Vent

The breather hole (air vent above diaphragm space) shall be of such size and at such location on the cover that:

- (a) it does not easily get clogged/blocked;
- (b) the accidental entry of foreign matter is minimised; and
- (c) it would be difficult for an instrument inserted through the air vent hole to reach the diaphragm.

4.9 Excess flow valve

The excess flow valve shall meet the requirements given in **Annex E**.

4.10 Valve pad fitting

4.10.1 A valve pad (resilient) shall be so retained without the use of adhesive that it cannot loosen or work out of position under service conditions.

4.10.2 The inlet orifice and the valve pad of the pressure regulator shall be protected by provision of a filter of suitable material compatible with LPG, of appropriate size of perforations that does not hamper flow of vapour but is yet effective against ingress of contaminating agents in the gas. Any acceptable arrangement meeting this requirement, as agreed to between the manufacturer and the purchaser is permitted (provided that the LPG regulator meets the requirements of this standard).

4.11 Strength of the connection/regulator assembly

4.11.1 The fixing of the inlet connection onto the regulator body, whether it is the threaded or non-threaded type or in one piece, shall withstand the following tests, under the conditions defined in Clause 7.11 (see **Table 1**).

- (a) a torque of at least 30Nm in both directions; and
- (b) a tensile strength test of 2000N

4.11.2 The fixing of the outlet connection onto the regulator body, whether it is the threaded, or non-threaded type or in one piece, shall resist the following tests, under the conditions defined in **Clause 7.11** (see **Table 2**):

(a) for non-threaded hose connection:

(i) a torque of at least 30Nm in one direction (verification not required for freely rotating connection);

(ii) bending moment of 10Nm; and

(iii) a tensile strength test of 2000N.

(b) for threaded unions:

(i) a torque of at least 30Nm in both directions (verification not required for freely rotating connections);

(ii) bending moment of 10Nm; and

(iii) a tensile strength test of 2000N.

4.11.3 For freely rotating connections, the torque necessary for the rotation of the connection shall not be greater than 0.5Nm for all the tests conducted.

4.11.4 No distortion or breakage shall be evident, and the regulators shall comply with the soundness test described in **Clause 5** after application of the forces.

4.12 Strength of regulator assembly when fitted onto a cylinder valve

4.12.1 The regulators, when installed as indicated in the installation instruction, shall resist the following tests under the conditions defined in **Clause 7.11** (**Table 3**):

(a) a torque in both directions:

(i) of at least 20Nm for non-threaded hose outlet connections (15Nm for quick coupling connections);

(ii) of at least 30Nm for threaded outlet connections; and

(iii) in addition, regulators with screwed unions intended to be vertically mounted onto the cylinder valve, shall resist a torque of at least 20Nm in the regulator plane (15Nm for quick coupling connections).

(b) a bending moment created by a force of 400N directed upwards, and whose application point is at the base of the outlet connection, and

(c) a tensile strength test of 500N, for quick coupling connections only.

4.12.2 The mechanical strength required shall be ensured for all the positions when fixing the regulator (as indicated in the installation instructions) onto the cylinder.

4.12.3 There shall be no distortion or breakage that can affect the safety of the regulator. The regulator shall comply with the soundness test described in **Clause 5** after application of the forces.

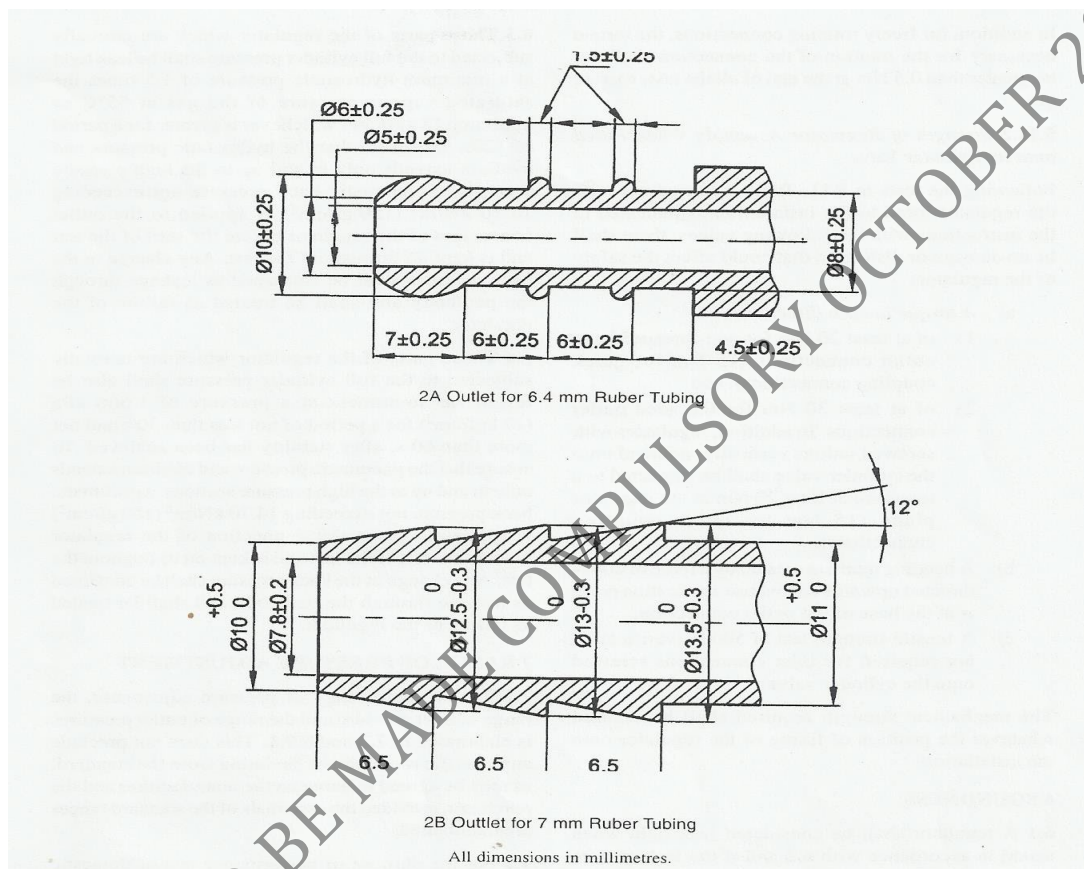


Figure 3 Outlets for Rubber Tubing

4.12.4 Advanced locking system

All LPG regulators to be used on LPG cylinders shall be equipped with an advanced locking system that ensures that the regulator cannot be connected or disconnected to the cylinder when in an "ON" position.

5 Soundness

5.1 A regulator shall be considered leak-tight when tested in accordance with **Clause 5.2** and if the leakage rate does not exceed 4Nm³/s (the symbol N indicates conversion to normal temperature and pressure conditions, NPT that is 760mmHg and 0°C).

5.2 The regulator shall be leak-tight when tested pneumatically at a pressure of 0.490kN/m^2 (5gf/cm^2 or 0.071PSI or 0.490mbar) below twice the nominal pressure when fitted with a relief valve or 14.70kN/m^2 (150gf/cm^2 or 2.13PSI or 14.70mbar) when not fitted with a relief valve, applied through the outlet connection of a fully assembled regulator and held for not less than 30s and not more than 60s after stability has been achieved. To get stability, adequate time is allowed between introduction of test medium and the start of observation, so that the internal parts have attained balanced positions.

5.3 Those parts of the regulator which are normally subjected to the full cylinder pressure shall be leak-tight at a minimum hydrostatic pressure of 1.5 times the saturated vapour pressure of the gas at 65°C or minimum 18kgf/cm^2 (255.2PSI or 1800mbar), whichever is greater for a period of 120s. To ensure the hydrostatic pressure and medium extends only in and up to the high-pressure sections, a pneumatic back pressure not exceeding 14.70kN/m^2 (150gf/cm^2 or 2.13PSI or 14.70mbar) is applied to the outlet connection of the regulator before the start of the test and is kept on throughout the test. Any change in the back pressure shall be construed as leakage through the pad/body and shall be treated as failure of the regulator.

5.4 Those parts of the regulator which are normally subjected to the full cylinder pressure shall also be tested for soundness at a pressure of 1666kPa (17kgf/cm^2 or 241.5PSI or 1666mbar) for a period of not less than 30s and not more than 60s, after stability has been achieved. To ensure pneumatic pressure section, a pneumatic back pressure (not exceeding 14.70kN/m^2 [150gf/cm^2 or 2.13PSI or 14.70mbar]) is applied to the outlet connection of the regulator before the start of the test and is kept on throughout the test. Any change in the back pressure shall be construed as leakage through the pad/body and shall be treated as failure of the regulator.

6 Range of pressure adjustment

6.1 The standard range of pressure adjustment, the range of inlet pressure and the range of outlet pressures are elaborated on in **Clauses 6.2** and **7.9.1**. This does not preclude any specific requirement deviating from the standard, as may be agreed to between the manufacturer and the purchaser, provided that the essentials of the standard ranges are maintained.

6.2 For the purpose of performance tests of domestic service regulators, the standard range of inlet pressures for use with LPG, shall extend from 49kPa (0.5kgf/cm^2 or 7.11PSI or 49mbar) to 1666kPa (17kgf/cm^2 or 241.5PSI or 1666mbar).

7 Setting and performance

7.1 Test gases

The performance tests shall be carried out using air, after making due provision for a factor of conversion, representing the flow of appropriate gas for which the regulator is designed, that is, butane, propane, or a mixture for the equivalent vapour condition.

The volume conversion factors for certain gases are given below:

Table 1
Table showing volume conversion factors for gases

Multiply flow of	By	To obtain flow of
Air	0.707 1.290 0.808 0.75	Butane Natural gas Propane 120 RVP Butane /Propane mixture
120 RVP Butane/Propane mixture	1.333	Air
Butane	1.414 1.826 1.140	Air Natural gas Propane
Natural gas	0.775 0.547 0.625	Air Butane Propane
Propane	1.237 0.874 1.598	Air Butane Natural gas

The above data also serves as a guide in cases where the percentage composition of constituents in an LPG mixture is known.

7.2 Chatter

A regulator, when tested, shall not chatter or vibrate while being tested for performance.

NOTE 7 It is improper to induce chatter by striking the regulator or by using an output in excess of the maximum rated capacity. Such conditions which may artificially induce vibrations of the internal components and give a false impression of chatter shall be avoided.

7.3 Orientation

A regulator shall be installed in such a way that the performance of the safety feature shall not be affected. The standard performance tests shall be carried out with the regulator in its recommended orientation.

7.4 Outlet pressure measurement

For measurement of outlet or delivery pressures of the regulator, a water-in-glass-tube manometer shall be used. The pipe between the outlet of the regulator and the outlet pressure gauge or manometer shall be of the bore and not less than the outlet of the regulator, and of length so as not to create a significant pressure drop.

7.5 Flow measurement shall be carried out using a direct indicating flow meter (rota-meter) Calibrated orifices may also be used.

7.6 Inlet pressure deviation

During the tests for performance, it may be noted that there is a slight deviation of the inlet pressure, especially at lower ranges and at varying outlet flows of the regulator under test. The inlet pressure should be readjusted appropriately when such deviation is experienced.

7.7 Lock up shall be achieved within 60s after cessation of flow.

7.8 Unless otherwise specified, performance tests shall be carried out at ambient temperatures.

7.9 Performance

7.9.1 The regulators shall be set with inlet pressure ranging from 49kPa (0.5kgf/cm² or 7.11PSI or 49mbar) to 1666kPa (17kgf/cm² or 241.5PSI or 1666mbar) on gas flow rate of 10 to 100 percent of rated capacity. The delivery pressure shall not be less than 2.206kN/m² (22.5gf/cm² or 319.7PSI or 2206mbar or 225m WC or 8858.27inch WC) and not more than 3.923kN/m² (40gf/cm² or 568.8PSI or 3923mbar or 400mmWC or 15.748inch WC). Static (lock up) pressure shall not exceed 4.412kN/m² (45gf/cm² or 568.8PSI or 3923mbar or 450mmWC or 17.716inch WC).

7.9.2 A regulator shall not chatter or vibrate while being tested at any flow or inlet pressure in the range prescribed for the performance tests or under conditions simulating normal service. If chattering or vibration occurs, the test shall be repeated.

7.10 The requirements of performance as given in **Clause 7.9** shall be satisfied before and after subjecting the regulator to tests specified in **Clauses 7.10.1, 7.10.2 and Clause 7.10.3**. Deviation in the initial setting after these tests have been conducted/completed is acceptable. If the regulator is fitted with an excess flow check device, the performance of the excess flow valve shall also be checked as per **Annex E**.

7.10.1 Cycle test

When assessing a new design, a type approval test in accordance with **Annex F** shall be carried out. A fully assembled regulator shall withstand a minimum of 100,000 cycles of opening and closing operations, after which it shall be subjected to a soundness test as in **Clauses 5.2, 5.3, 5.4** and performance as given in **Clause 7.9**.

7.10.2 Low temperature test

The regulator is exposed to a temperature of -20°C for a minimum period of 10min for the complete assembled unit to attain this temperature. It is then removed and left exposed to ambient conditions after which it is tested. The method of carrying out the test shall be as per **Annex G**. If the regulator is fitted with an excess flow check device, the performance of the excess flow check valve shall also

be checked as per **Annex E**.

7.10.3 Forced cooling shall not be applied to reach the ambient temperature.

7.10.3.1 Care shall be taken to avoid intrusion of fluid or moisture into the regulator assembly during heating and cooling. For this, the outlet nozzle, the inlet and the breather hole may be plugged.

7.11 Mechanical strength of connections

7.11.1 General

Tests for mechanical strength shall be carried out using a dynamometric device allowing the measurement of forces to within ± 5 percent accuracy. For the torque test, a system which neutralises bending moments shall be used (if a torque wrench is used, it is desirable that this is double handed). The duration of application of the torques, moments and forces shall be 60s each.

7.11.2 Regulator intended to be directly connected to a cylinder valve

The points where the device is held and the test values are shown in **Tables 2, 3 and 4**.

7.11.3 For the tests given in **Table 4**:

- (a) Devices with threaded connections, shall be mounted on the valve as indicated in the installation instructions; and
- (b) Devices with free rotating quick coupling connection, the torque test of 15Nm is not required.

Table 2
Mechanical Strength Test for Inlet Connections

Sl No. (1)	Test Diagram (2)	Type of Load (3)	Value (4)
i)		T F	30 Nm 2 000 N
ii)		T F	30 Nm 2 000 N
key ▼▲▲ Regulator holding points T = torque, F = pulling force, C = inlet connection (see 3.7)			

Table 3
Mechanical Strength Test for Outlet Connections

Sl No. (1)	Test Diagram (2)	Type of Load (3)	Value (4)
i)		T F M	30 Nm 2 000 N 10 Nm
ii)			
iii)		T F M	30 Nm 2 000 N 10 Nm
iv)			
key Regulator holding points T = torque, F = pulling force, M = bending moment. C = inlet connection (see 3.7)			

Table 4
Mechanical Strength Test for Device Assembly mounted on the Cylinder Valve

Sl No.	Test Diagram	Type of Load	Value for Threaded Inlet Connection	Value for Quick Coupling Connection
(1)	(2)	(3)	(4)	(5)
i)		T F F ₁	20 Nm — 400 N	15 Nm 500 N 400 N
ii)		T F F ₁	20 Nm — 400 N	15 Nm 500 N 400 N
iii)		T F F ₁	30 Nm — 400 N	30 Nm 500 N 400 N
iv)		T ₁ T ₂ F F ₁	30 Nm 20 Nm — 400 N	30 Nm 15 Nm 500 N 400 N
Key ▼▲▶▶▶ Regulator fixing points F = pulling force ○ Valve F₁ = bending force C = Inlet connection (see 3.7) T T₁ T₂ = Torque (T and T₂ are not applied if the regulator is freely turning on its cylinder valve)				

8 Sealing

8.1 If the regulator is not permanently crimped, the body and cover of each regulator shall be sealed to discourage interference with the internal mechanism as well as the pressure setting.

8.1.1 The manner of sealing shall be as agreed to between the purchaser and the manufacturer (provided that the LPG regulator meets the requirements of this standard).

9 Classification of tests

9.1 Type tests

The following shall constitute type test out of the various requirements:

- (a) diaphragm material (see **Clause 3.3**);
- (b) valve pad material (see **Clause 3.4**);
- (c) hydrostatic test (see **Clause 5.3**);
- (d) low and high temperature tests (see **Clauses 7.10.2 and 7.10.3**);
- (e) mechanical strength of connection (see **Clause 7.11**); and
- (f) tests for excess flow device, if provided (see **Clause 4.9**).

9.2 Routine tests

The following shall be conducted as routine tests:

- (a) pneumatic test (see **Clauses 5.2 and 5.4**); and
- (b) chatter and performance test (see **Clause 7.9**).

10 Marking

10.1 A regulator shall be clearly and permanently marked in English with the following:

- (a) manufacturer's and/or distributor's name or trademark;
- (b) month and year of manufacture (for example 12-10 for December 2010);
- (c) rated capacity, in m³/h of LPG;
- (d) certification or standards mark from a body recognised by the GNBS; and
- (e) any other markings as agreed to between the purchaser and the manufacturer.

10.2 LPG regulators shall be accompanied by instructions for use in English. These shall be affixed to the regulator, contained within the package of the regulator, or on the package of the regulator

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Annex A

(Normative)

Method of test for adhesion of paint

A.1 Procedure

A.1.1 Mark a square measuring 12-15mm sides on a plain surface (not having raised or sunk markings) of randomly selected specimen from the lot of painted or powder-coated components.

A.1.2 Cross lines at a distance of 1-1.5mm and inched at approximately 120° angle with each other. Label over the marked portion with a sharp pointed instrument.

A.1.3 Apply cellulose tape over the marked portion and leave for 2 minutes after which it shall be jerked free from the surface under test. If more than 3 percent of the squares are ripped from the surface under test, the specimen shall be deemed to have failed the test.

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Annex B

(Normative)

Bursting and pull-out test of diaphragm in an assembled regulator

B.1 General

B.1.1 The test shall be designed to give a practical result on an assembled regulator and is intended as a simple check method applied by the regulator manufacturer to the diaphragm material, which shall undergo previous testing.

B.1.2 The test shall take the form of a simple application of pressure (air or nitrogen is suitable) through the outlet connection to the underside of the diaphragm mounted in a regulator in a fully assembled condition (that is, as it would be supplied by the manufacturer to a buyer).

B.2 Test rig

B.2.1 Connect the outlet of the assembled regulator to a supply of air or nitrogen.

B.2.2 Incorporate a gauge in the test rig between the air or nitrogen supply and the regulator to indicate the applied pressure.

B.3 Test method

Apply the pressure at approximately 78kPa (0.8kgf/cm² or 11.32PSI or 780mbar) per second up to the level specified in **Clause 3.3.4** and maintained for 120s.

Annex C

(Normative)

Immersion test (resistance to hydrocarbons)

C.1 General

The test shall be designated to evaluate the rubber material vis-à-vis its resistance to hydrocarbons.

C.2 Procedure

C.2.1 Weigh sample W_o prior to test.

C.2.2 Immerse the sample in pressure or commercial LPG maintained at a temperature of $20 \pm 5^\circ\text{C}$ for 72h.

C.2.3 Remove the sample and expose it to the atmosphere. After 5 minutes, Weigh the sample W_1 .

Thereafter, have it exposed to the atmosphere for 24h, weigh W_2 and calculate the following:

- (a) Percentage of test gas absorbed = $\frac{(W_1 - W_o) \times 100}{W_o}$
- (b) Percentage of matter extracted = $\frac{(W_o - W_2) \times 100}{W_o}$

C.3 The results of the above test shall be in accordance with the values as given below:

Component (1)	Extractable Percent (2)	Absorbed Percent (3)
Diaphragm	+5 to -15	± 10
Valve pad	+5 to -12	+10 to -9
Seal	+5 to -12	+10 to -9

NOTE 8 It is permitted to wipe the component clean after removal from immersion.

Annex D

(Normative)

Method of compression set test for valve pad material, seal and diaphragms

D.1 General

The test is designed to differentiate between the original thickness of the test pieces and the thickness after recovery. This is expressed as a percentage of the initial applied compression.

D.2 Procedure

Test three mono-block test piece discs of 13 ± 0.5 mm diameter and 6.3 ± 0.3 mm thickness subjected to the following conditions:

- (a) Compression : 25% at $(27 \pm 2^\circ\text{C})$
- (b) Duration of test : 168 ± 2 h for valve pad and seal material and 24 ± 0.5 h for diaphragm
- (c) Test temperature : $70 \pm 1^\circ\text{C}$

D.3 Calculation

The compression set expressed as a percentage of the initial deflection shall be calculated from the following formula:

$$\text{Compression set percent} = \frac{t_o - t_1}{t_o - t_g} \times 100$$

where:

- t_o = initial thickness of the test piece in mm;
- t_1 = thickness of the test piece after recovery in mm; and
- t_g = height of the spacer in mm.

The results for the three test pieces shall be within 5 percent of the mean compression set value; if not, the test shall be repeated.

Annex E

(Normative)

Regulators fitted with an excess flow check valve

E.1 General

E.1.1 The excess flow check valve is a device, integral with the regulator, which causes the shut off of the gas flow for values of flow rate above the rated capacity of the regulator.

E.1.2 In the case of a manual device, the regulator device allowing the restoration of the flow can be a re-setting device or a valve appropriate for this type of regulator.

E.2 Performance characteristics

E.2.1 The excess flow check valve shall shut off the gas flow in all cases of disconnection of the flexible hose or tube fitted downstream of the regulator. This device shall operate for an increase in the rate between 120-200 percent of the rated capacity of the regulator at an angle of $\pm 10^\circ$ relative to its axis in the fixing position(s) of the regulator in the range and the rate obtained on hose or tube disconnections of minimum (-20°C) and maximum temperature ($+65^\circ\text{C}$) conditions.

E.2.2 The restoration of the gas flow shall only be possible by manual intervention when the conditions which caused the safety devices to operate have disappeared.

E.2.3 For manual resetting devices, a maximum residual leak of $15\text{cm}^3/\text{h}$ is permitted.

E.2.4 The regulator fitted with an excess flow valve in shut-off condition shall be checked for any leakage. The regulator shall be connected to the bubble indicator through a flexible piping (see **Figure 4**). The regulator shall be subjected to full inlet pressure after which an examination shall be done of the bubble indicator for the appearance of bubbles. The interval between successive bubbles passing through it shall not be less than 10s.

E.2.5 The presence of the device shall not modify the regulator's performance.

E.3 Additional test methods for the regulator

E.3.1 The closure caused by the excess flow check valve shall be obtained in the range defined between 120-200 percent of the rated capacity of the regulator.

E.3.2 For the endurance test, the device shall be subjected to a series of 100 cycles of opening/closing operations without change in operating force, sensitivity of positioning device and without apparent traces of pitting.

E.3.3 This test shall be carried out at ambient temperature.

E.4 User and maintenance instructions

In addition to the regulator working instructions, the manufacturer shall clearly indicate in the instructions the following information:

- (a) Do not move the cylinder during use;
- (b) Switch off in the event of operation of the excess flow valve;
- (a) Only turn on the regulator after having rectified the cause of the device operating; and
- (d) Instructions on manual resetting of the excess flow check valve.

When the regulator is tested, the excess flow check valve shall shut off the gas flow in all the cases of disconnection of the flexible hose fitted downstream of the regulator.

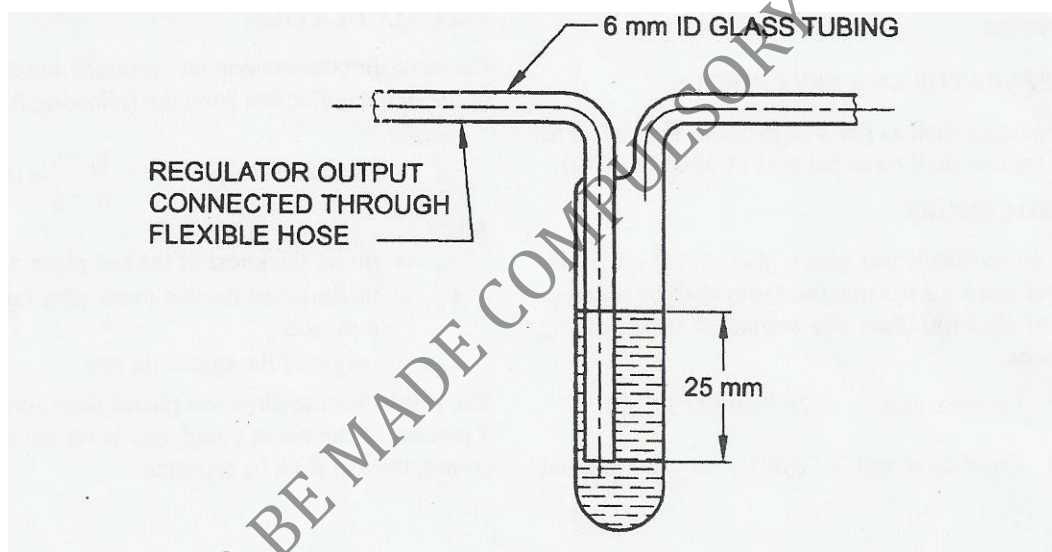


Figure 4
Bubble Indicator

Annex F

(Normative)

Cycle test (Endurance test)

F.1 Purpose

The purpose of the test is to evaluate the quality of various flexibles such as the valve pad, diaphragm and spring, vis-à-vis retention of critical properties relevant to function, resistance to deformation or degradation and loss of flexibility under conditions of flexing and unflexing. This test does not purport to check any mechanical requirements of the construction/assembly and should not be taken as representative of actual service conditions, and could introduce improper parameters of assessment of non-flexibles. The test should relate only to the flexibles referred to above.

F.2 Test

Mount the regulator on a valve or suitable inlet connection (whose outlet matches with the inlet of the regulator). Connect the outlet of the regulator to a system which shall indicate flow or lack of it (that is, a burner, flow meter or orifice parallel with a pressure indicating device such as a manometer column). Introduce air/gas into the regulator at an appropriate pressure, in such a manner that the diaphragm gets flexed and the valve pad is held on its seat for a minimum of 1s, after which shut off the inlet and expel (vent) the air/gas via the outlet of the regulator to the atmosphere.

F.2.1 One example of a set up to conduct this test is the installation of quick-acting valves upstream and downstream of the regulator, wherein the downstream valve exhausts to the atmosphere. The valves are connected to a suitable time switch so that as one opens the other closes; with a complete cycle time of approximately 5s.

F.2.2 Any other set up producing equivalent conditions and achieving the same objectives shall be acceptable.

F.3 After completion of the test mentioned in **F-2**, the regulator shall meet the requirements of soundness test as in **Clause 5.2**, hydrostatic test as in **Clause 5.3** and performance as in **Clause 7.9.1**. However, with the static (lock up) pressure not exceeding 110 percent of that allowable in the relevant lock up clause.

NOTE 9 If the tests are carried out using LPG vapour as the test medium, sufficient precaution should be taken to vent inflammable gas to an environment where there should be no danger of fire. Alternatively, the venting can be done via gas-burning devices.

Annex G

(Normative)

Low temperature and high temperature tests

G.1 Low temperature test

G.1.1 Place a fully assembled regulator (set as in **Clause 7.9**) in a sealed container.

G.1.2 Immerse the container in a bath of any convenient fluid (namely, methanol or any suitable freezing mixture of salt, ice and calcium carbide) and cool to a steady temperature at -20°C , maintain at this temperature by some reliable means (additions of dry ice).

G.1.3 Keep the container immersed long enough (10min) for the complete assembly to attain -20°C after which it is removed and exposed to the atmosphere so that the assembly returns to ambient condition. It is then tested in accordance with **Clause 7.9** for performance.

NOTE 10 Care should be taken to prevent the cooling fluid from entering the assembly or the moisture condensing inside. This may be avoided by ensuring that the sealed container lid is opened only after the assembly attains ambient conditions.

G.2 High temperature test

G.2.1 Place a fully assembled regulator (set as in **Clause 7.9**) in a sealed container. If the container is placed in a water bath, heat the container to a steady temperature of 65°C .

G.2.2 Keep the container immersed long enough (10min) for the complete assembly to attain 65°C , after which remove it and expose it to the atmosphere so that the assembly returns to ambient condition. Then test it in accordance with **Clause 8.9** for performance.

NOTE 11 Care should be taken to prevent the water bath from entering the assembly or moisture from forming inside. This may be avoided by ensuring that the sealed container is opened only after the assembly attains ambient conditions. Also, air shall not be forced through the assembly in an attempt to accelerate cooling, as this is likely to result in condensation of moisture inside the assembly.

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