ENQUIRY DRAFT

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

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ISO/IEC 17025:2017 ACCREDITED

Guyana National Bureau of Standards

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Foreword

This 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 reviewed and modified by the Guyana National Bureau of Standards (GNBS) Technical Committee (TC) 29 – Gas Cylinders in 2025.

The standard was adopted with modification 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 mandatory.

Members of the Technical Committee – Gas Cylinders

Specification for Low pressure regulators 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 (0.711 PSI or 4.903 mbar)[50gf/cm^2 or 500mm water column (WC) or 19.685 inch WC] outlet pressure.

NOTE 1 Low pressure is considered to be any pressure below 6.894kN/m^2 (70.3gf/cm^3 or 1.0 PSI or 68.947mbar). Domestic and commercial appliances normally operate at gas pressure of 2.942 kN/m^2 (30gf/cm^2 or 0.427 PSI or 29.37 mbar 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 butylenes with propane, and or propylene of maximum vapour pressure of 1653kPa (16.87kgf/cm^2) at 65^{0}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/cm^2 or 0.427 PSI or 29.37 mbar or 300mm WC or 11.8.11inch WC).

2.4 rated capacity

The standard rated capacity for LPG regulators for domestic use is up 500 l/h of LPG vapour. For purpose other than domestic, higher capacity regulators can be used. For purposes of performance tests, the flows are stated in terms of percentages of rated capacity, so as to cover all low pressure, whatever be 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. Fig 2.

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/removal.

3 Materials

3.1 All component parts shall be manufactured from or be treated with materials compatible with LPG as well as be 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 1000 l/h shall be manufactured from zinc-based alloys 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.

3.2.1 Finish

The body and the cover of the regulator shall be electroplated or chemically treated (surface passivated) and painted or powder coated so as 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.

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

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

NOTE 2 During dies casting process, chromium gets added in the regulator body; the zinc is covered and reused 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 diaphragm shall be of synthetic rubber or 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 10 IRHD (International Rubber Hardness Degree) when subjected to ageing of 72h at 70^0C.

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

Shore A: 30	40	50	60	
	70	80	90	100
IRHD:	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 490 kPa (5kgf/cm^2 or 71.05 PSI or 490.0 mbar)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 Appendix B, the diaphragm shall not pull out or burst at a pressure less than 275 kPa (2.8kgf/cm^2 39.88 PSI or 275.0 mbar).

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

NOTE 4 The tests at 4.3.1 to 4.3.5 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^{0}C or heating to 65^{0}C. For these tests, assembled regulators are cooled to -20^{0}C or heated to 65^{0}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 Appendix D.

3.4 Valve pad material

Valve pad materials shall be of synthetic rubber or 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 Appendix C. After this test, the change in hardness value observed before and after the test shall not exceed 15 IRHD.

NOTE 5 The tests at 4.4.1 to 4.4.2 are work batch tests. On initials 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 plasticizers 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 10 IRHD when subjected to ageing of 72h at 70^0C.

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 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 Appendix D.

3.5 Seals

O rings and rubber components other than diaphragm and valve pad shall withstand the requirement 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 self-closing valve is shown in Fig. 1 for illustration purposes.

4.2 The regulator, including all the component parts, shall be mechanically strong, of sound construction and of high standard of 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 recognized national or international standard.

4.5 inlet connection

Where 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 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 50^0C subject to a minimum of 18 kgf/cm^2 or 255.2 PSI or 1800 mbar 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 or 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.

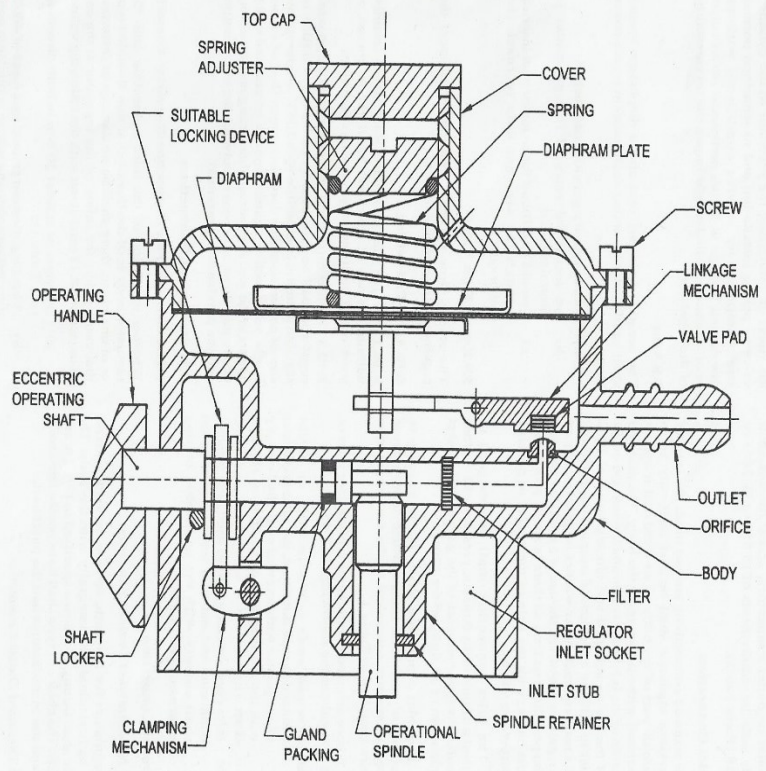
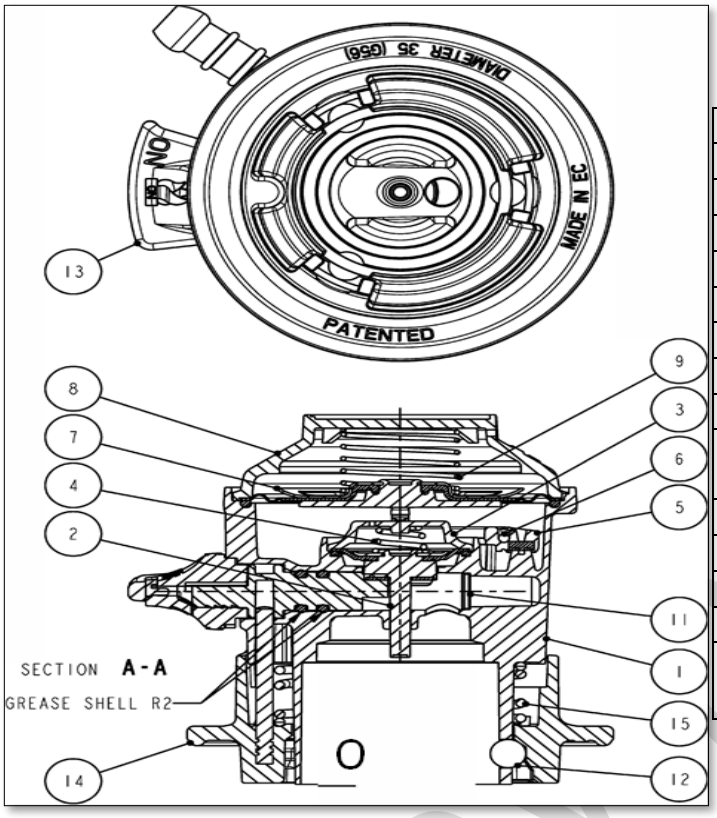


FIG. 1 DIAGRAMMATIC SECTIONAL ILLUSTRATION OF A PRESSURE REGULATOR USED WITH SELF CLOSING SPRING LOADED TYPE VALVE FOR LPG



1	Body
2	1st Stage Diaphragm
3	Internal Bonnet
4	1st Stage Conical Spring
5	Rocker Arm
6	Lever Pin
7	Diaphragm
8	Cover
9	2nd Stage Setting Spring
11	Filter- Standard 8.5 x 1.5TK
12	Sfera Anello
13	Handle
14	Clamping Ring
15	Handle Spring

Fig 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 Fig 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.

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, if provided shall meet the requirements given in Appendix 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 on to 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 on to 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 30Nn in one direction (verification not required for freely rotating connection);

(ii) Bending moment of 10 Nm; 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) A blending moment of 10 Nm; 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 0.5 Nm 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 (15 Nm for quick coupling connections); and

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

(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 500 N, for quick coupling connections only.

4.12.2 The mechanical strength required shall be ensured for all the positions of fixing of 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.

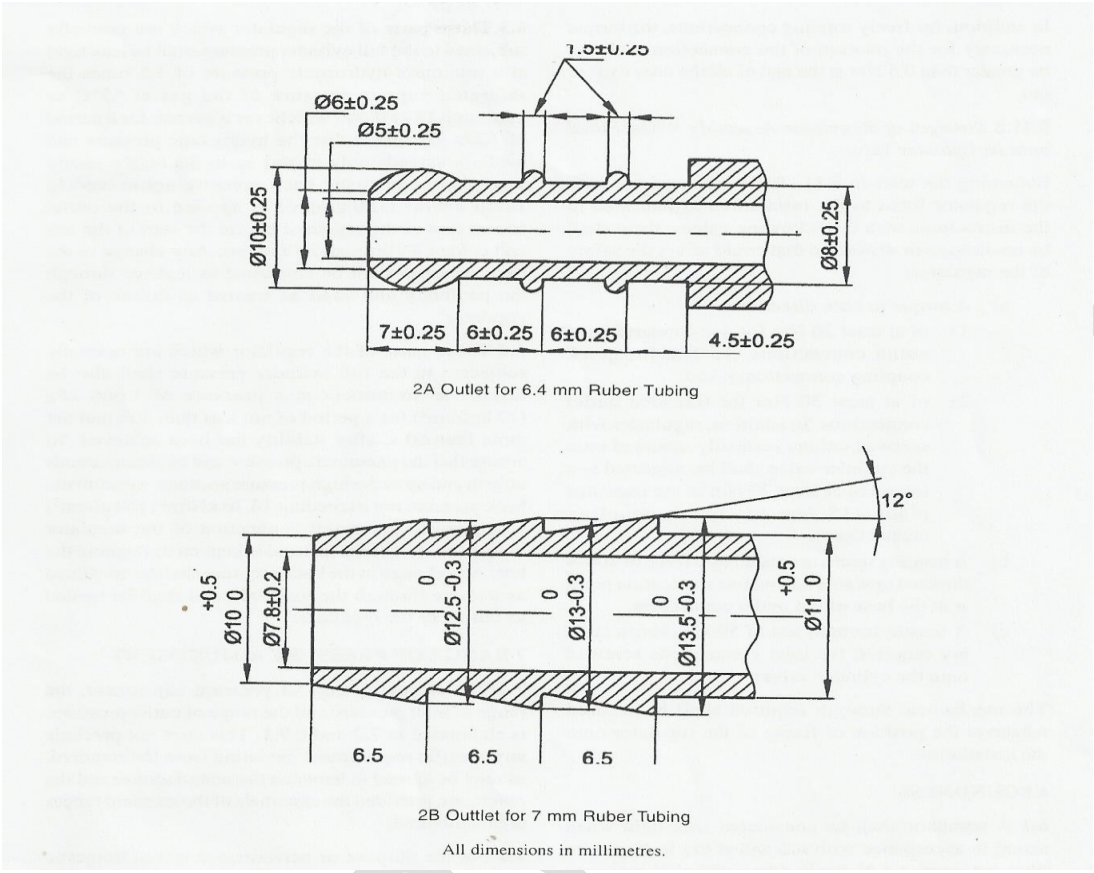


Fig 3 Outlets for Ruber Tubing

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 4 N mm^3/s (the symbol N indicates conversion to normal temperature and pressure conditions, NPT that is 760mmHg and 0 ^0C).

5.2 The regulator shall be leak tight when tested pneumatically at a pressure of 0.490 kN/m^2 (5gf/cm^2 or 0.071 PSI or 0.490 mbar) below twice the nominal pressure when fitted with a relief valve or 14.70 kN/m^2 (150$gf/cm^2$2.13 PSI or 14.70 mbar) 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 60 s 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 hydrostatics pressure of 1.5 times the saturated vapour pressure of the gas at 65^0C or minimum 18 kgf/cm^2 (255.2 PSI or 1800 mbar), 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 14.70 kN/m^2 (150 gf/ cm^2 or 2.13 PSI or 14.70 mbar) is applied to the outlet connection of the regulator before the start of the test and is kept on through 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 1666 kPa (17kgf/cm^2 or 241.5 PSI or 1666 mbar) for a period of not less than 30s and not more than 60s, after stability has been achieved. To ensure pneumatic pressure sections, a pneumatic back pressure (not exceeding 14.70 kN/m^2 (150 gf/cm^2 or 2.13 PSI 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 essentials of the standard ranges are maintained.

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

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 gasses are given below:

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 Butane	1.333 1.414 1.826 1.140	Air 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 serves as a guide also 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 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 be also be used.

7.6 Inlet pressure deviation

During the tests for performance, it may be noted that there is a light 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 49 kPa (0.5 kgf/cm^2 or 7.11 PSI or 49 mbar) to 1666 kPa (17 kgf/cm^2 241.5 PSI or 1666 mbar) on gas flow rate of 10 to 100 percent of rate capacity. The delivery pressure shall not be less than 2206 kN/m^2 (22.5 gf/cm^2 or 319.7 PSI or 2206 mbar or 225m WC or 8858.27 WC) and not more than 3923 kN/m^2 (40 gf/cm^2 or 568.8 PSI or 3923 mbar or 400 mm WC or 15.748 inch WC). Static (look up) pressure shall not exceed 4412 kN/m^2 (45gf/cm^2 568.8 PSI or 3923 mbar or 450 mm WC or 15.748 inch 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 condition 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 excess flow check device, the performance of the excess flow valve shall also be checked as per Appendix 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^{0}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 Appendix 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.

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

7.10.3.2 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; are shown in **Tables 1, 2** and **3**.

7.11.3 For the tests given in Table 3

(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 1 Mechanical Strength Test for Inlet Connections
(*Clauses* 5.11.1 *and* 8.11.2)

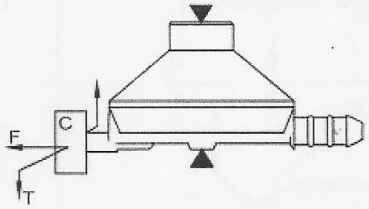
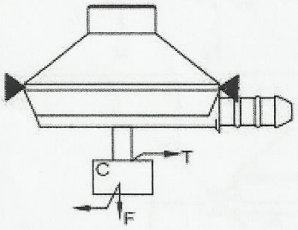
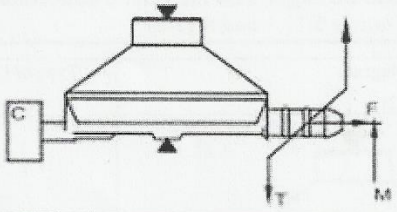
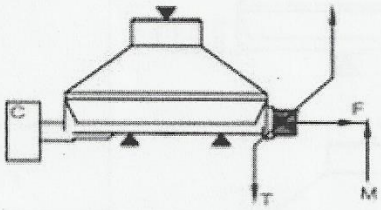
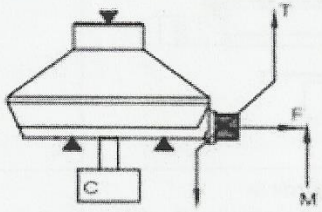
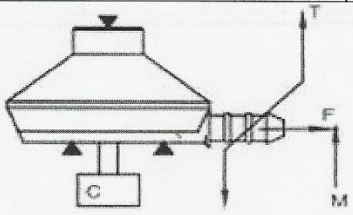
Sl No. (1)	Test Diagram (2)	Type of Load (3)	Value (4)
i)		T F	30 Nm 2 000 N
ii)		T F	30 Nm 2 000 N
key ▼▲▶◀ Regulator holding points T = torque, F = pulling force, C = inlet connection (see 3.7)			

Table 1 Mechanical Strength Test for Inlet Connections

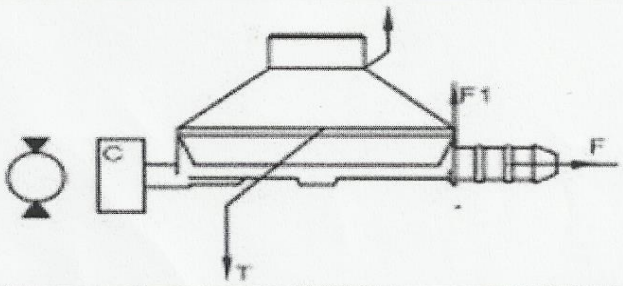
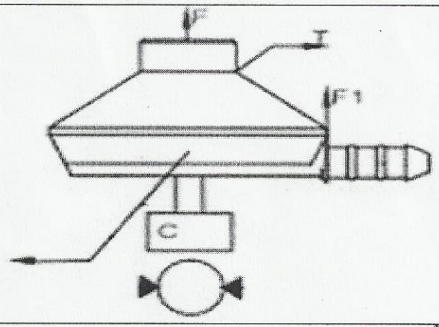
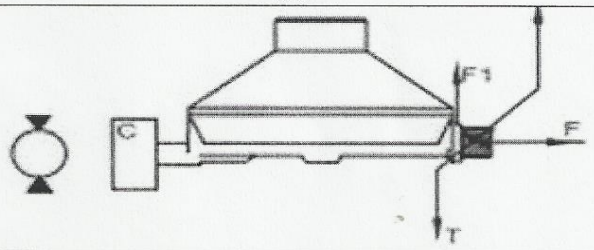
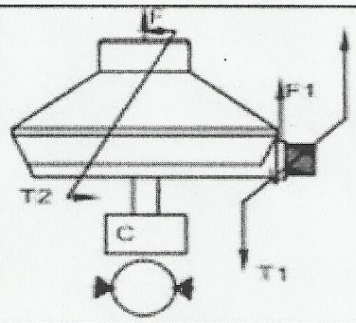
Table 2 Mechanical strength test for outlet connections
(*Clauses* 5.11.2 *and* 8.11.2)

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 2 Mechanical Strength Test for Outlet Connections

Table 3 Mechanical Strength Test for the Device Assembly mounted on the Cylinder Valve
(*Clauses* 5.12.1, 8.11.2 *and* 8.11.3)

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 F1	30 Nm 20 Nm — 400 N	30 Nm 15 Nm 500 N 400 N

key: Regulator fixing points; Valve; F = pulling force; 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)

Table 3 Mechanical Strength Test for Device Assembly mounted on the Cylinder Valve

8 Sealing

8.1 If the regulator is permanently not crimped, the body and the 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 with the following:

(a) Manufacturer's or distributer's name or trade mark;

(b) Month and year of manufacture (for example 12 -10 for December 2010);

(c) Rated capacity, in m^3/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 with 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.

Annex A Method of test for adhesion of paint

A-1 Procedure

A-1.1 Mark a square measuring 12-15 mm 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 1-1.5 mm and inched at approximately 120^0 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 min 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.

Annex B 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

B-3.1 Apply the pressure at approximately 78kPa (0.8kgf/cm^2 or 11.32 PSI or 780 mbar) per second up to the level specified in Clause **3.3.4** and maintained for 120s.

Annex C Immersion test (resistance to hydrocarbons)

C-1 General

C-1.1 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 ± 5 ˚C for 72h.

C-2.3 Remove the sample and expose it to the atmosphere. After 5 min, Weigh the sample W_1. Thereafter, have it remain exposed to the atmosphere for 24h and weigh W_2 and calculate the following:

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

(b) Percentage of matter extracted = $\frac{(W_0 - W_2)}{W_o} \times 100$

C-3 The results of the above test shall be in accordance with values as give 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 clean the component after removal from immersion.

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

D-1 General

D-1.1 The test is designated to differentiate between the original thickness of the test pieces and that after recovery, is expressed as a percentage of the initial applied compression.

D-2 Procedure

D 2.1 Test three mono-block test piece discs of 13±0.5mm diameter and 6.3±0.3mm thickness subjected to the following conditions:

(a) Compression : 25% at (27 ± 2°C)

(b) Duration of test : 168^{+0}_{-2}h for valve pad and seal material and 24 ± 0.5h for diaphragm

(c) Test temperature : 70 ± 1°C

D-3 Calculation

D-3.1 The compression set expressed as a percentage of the initial deflection shall be calculated from the following formula:

$$\text{Compression set percent} = \frac{t_0 - t_1}{t_o - t_8} \times 100$$

where:

t_o = initial thickness of the test piece in mm;
t_1 = thickness of the test piece after recovery in mm; and
t_8 = height of the spacer in mm.

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

Annex E 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 generally 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 down-stream 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 ±10° 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^{0}C) and maximum temperature (+65^{0}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 15cm^3/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 Fig 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 performance.

E-3 Test method- additional tests 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

E-4.1 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;
(c) 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.

For the purpose of routine testing, the regulator when checked, the excess flow check valve shall shut off the gas flow in all the cases of disconnection of the flexible hose fitted down- stream of the regulator.

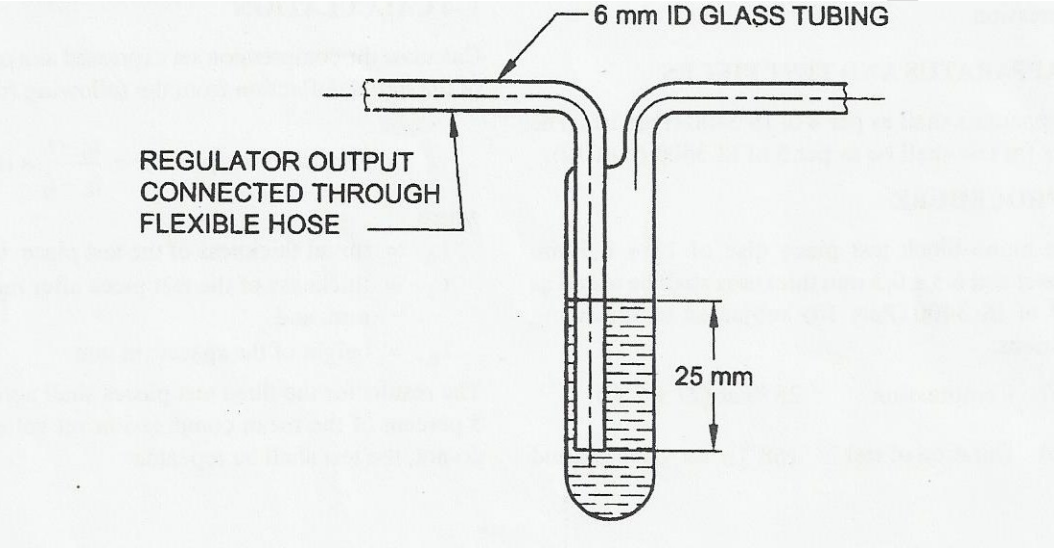


Fig 4 Buddle Indicator

Annex F Cycle test (Endurance test)

F-1 Purpose

F-1.1 The purpose of the test is to evaluate the quality of various flexibles such as valve pad, diaphragm and spring, vis-à-vis retention of critical properties relevant to function, resistance to deformation/degradation and loss of flexibility under conditions of flexing and un-flexing. 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 in 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 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 the environment where there should be no danger of fire. Alternatively, the venting can be done via gas burning devices.

Annex G 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^{0}C, maintained at this temperature by some reliable means (by additions of dry ice).

G-1.3 Keep the container immersed long enough (10 min) for the complete assembly to attain – 20^{0}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 entering the assembly or moisture condensing inside. This may be avoided be 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^{0}C.

G-2.2 Keep the container immersed long enough (10 min) for the complete assembly to attain 65^{0}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 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**.**

END OF DOCUMENT