इंटरनेट मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

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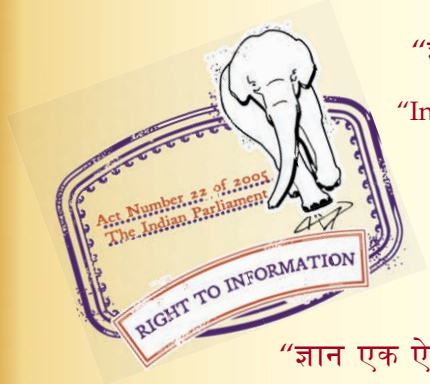
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 9798 (1995): Low Pressure Regulators for Use with Liquefied Petroleum Gas (LPG) Mixtures [MED 16: Gas Cylinders]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 9798 : 1995
(Reaffirmed 2006)

भारतीय मानक

द्रवित पैट्रोलियम गैस (द्र पै गै) मिश्रण के उपयोग के लिए अल्पदाब रेग्यूलेटर – विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

LOW PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GAS (LPG) MIXTURES — SPECIFICATION

(First Revision)

UDC 621·646-4

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 1995

Price Group 5

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

While framing this standard consideration is given to the fact that the production of LPG would be restricted to commercial butane/propane mixture having a ceiling vapour pressure of 1 653 kPa (16·87 kgf/cm^2) at 65°C.

With the introduction of IS 8737 (Part 2) : 1978 'Valve fittings for use with liquefied petroleum gas (LPG) cylinders of more than 5 litre capacity : Part 2 Valve fittings for newly manufactured LPG cylinders', it was felt that a design of pressure regulator for matching these valves is a necessity.

This design would have an inbuilt arrangement wherein the regulator could be clicked-on the valve without use of tools, first locking and sealing the regulator on the valve outlet before the gas flow is initiated. It would not be possible to disconnect the regulator until the cylinder valve is closed.

With the above in view, this Indian Standard was first published in 1981. Since then many suggestions were received for its improvement and with the result Amendments No.1 to 6 were issued. This standard is revised to incorporate the amendments issued and the suggestions received from time to time. This revision includes a new clause for soundness test for high pressure side of the regulator and permits ISO metric threads for the inlet connection. The requirement for the filter has been modified.

Notwithstanding the requirements specified in this standard, any new design, materials and methods of assembly giving at least equivalent results are acceptable. In the preparation of this standard, full recognition has been given to the possibilities of improvement through ingenuity of design.

In the preparation of this standard considerable assistance has been derived from the following publications:

a) IS 4784 : 1968 Low pressure regulators for use with butane gas;

b) IS 4785 : 1968 Low pressure regulators for use with propane gas;

c) BS 3016 : 1983 Pressure regulators and automatic change-over devices for liquefied petroleum gases. British Standards Institution;

d) ANSI Z 22.18-1973 Standard for gas appliances pressure regulators. American National Standard Institute;

e) UL 144 Standard for safety — Pressure regulators for liquefied petroleum gas. Underwriters Laboratories, USA;

f) NF M88-765 March 1975 Fixed adjustment, low pressure, reducing valve for commercial butane for domestic use — Construction, equipment tests. Association Francaise de Normalisation; and

g) Various specifications, original and modified, now in use by several parties in India.

The quantities in this standard have been expressed in technical metric units. However, in view of the introduction of International System (SI) units in the country, the relevant SI units and corresponding conversion factors are given below for guidance:

1 kgf/cm^2 = 98·066 5 kPa (kilopascal) = 10 m of Water column (WC)
= 0·980 665 MPa (megapascal)
= 0·980 665 bar

1 Pa = 1 N/m^2

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Pressures indicated in the various requirements/clauses of this standard are gauge pressure unless otherwise stated.

Indian Standard

LOW PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GAS (LPG) MIXTURES — SPECIFICATION

(First Revision)

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 4·903 kN/m² [50 gf/cm² or 500 mm water column (WC)] outlet pressure.

NOTE — Low pressure is considered to be any pressure below 6·894 kN/m² (70·3 gf/cm²). Domestic and commercial appliances normally operate at a gas pressure of 2·942 kN/m² (30 gf/cm² or 300 mm water column).

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.1 Commercial Butane

A hydrocarbon product composed predominantly of butanes (n and iso), butylenes or their mixtures of maximum vapour pressure of 980 kPa (10 kgf/cm²).

3.2 Commercial Butane/Propane Mixture

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 1 653 kPa (16·87 kgf/cm²).

3.3 Commercial Propane

A hydrocarbon product composed predominantly of propane, propylene or their mixtures of maximum vapour pressure of 2 548 kPa (26 kgf/cm²).

3.4 Lock Up Pressure

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

3.5 Nominal Outlet Pressure

The basic rated 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 2·942 kN/m² (30 gf/cm² or 300 mm WC).

3.6 Rated Capacity

The standard rated capacity for LPG regulators for domestic use is up to 500 l/h of vapour. For purpose other than domestic, higher capacity regulators could 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 regulators whatever the rated capacity.

3.7 Single Stage Regulator

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

3.8 Two Stage Regulators

In this 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 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 may be incorporated in one body.

4 MATERIAL

4.1 All components 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. Materials specified in IS 319 : 1989, IS 410 : 1977, IS 742 : 1981 and 6912 : 1985 are recommanded for the manufacture of the regulators; but other type of materials may be used provided that the standards of performance, durability and safety of the regulator are not lowered.

4.1.1 Brass parts shall not be susceptible to season cracking. The susceptibility to season cracking shall be determined by the method given in IS 2305 : 1988.

4.2 The body for all regulators of rated capacity up to 1 000 l/h shall be manufactured from alloys of zinc and/or aluminum by pressure die-casting.

4.3 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.

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

4.3.2 The material shall not show change of more than 10 IRHD when subjected to ageing of 72 hours at 70°C in accordance with method prescribed in **3** or **4** of IS 3400 (Part 4) : 1987.

4.3.3 The material shall be capable of withstanding a clamping pressure of 490 kPa (5 kgf/cm^2) whereby the material itself or the substance with which the fabric layer has been impregnated shall not be pressed away, flowed away or be bruised or otherwise damaged.

4.3.4 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 275 kPa (2·8 kgf/cm^2).

4.3.5 The material shall, after immersion in pentane or commercial LPG for 72 hours, meet the appropriate requirements tabulated in Annex C. Change in hardness value, before and after the immersion shall not exceed 15 IRHD [*see* IS 3400 (Part 2) : 1980].

NOTE — 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 the vapour phase for 72 hours, and shall not show a weight or volume change greater than 15 percent.

4.3.6 The material shall be such that the flexibility of the diaphragm shall not be impaired after 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 atmosphere to recover completely to ambient temperature of its own (not by induced heating or cooling). After recovery, the setting and performance readings are taken. The readings shall be within the accceptable limits of performance as given in **8.9**.

4.4 Valve Pad Material

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

4.4.1 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 compression set, cold flow and creep characteristics.

4.4.2 The material shall, after immersion in pentane or commercial LPG for 72 hours, meet the appropriate requirements tabulated in Annex C. After this test, change in hardness value from before to after the test shall not exceed 15 IRHD.

NOTE — The tests at **4.4.1** and **4.4.2** are work batch tests. On initial selection of valve pad material, it shall also be tested in commercial LPG in vapour phase for 72 hours 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.

4.4.3 The material shall not show change of more than 10 IRHD when subjected to ageing of 72 hours at 70°C in accordance with the method prescribed under **3** or **4** of IS 3400 (Part 4) : 1987.

4.4.4 The valve pad fitted in its housing shall be immersed in pentane or commercial LPG (*see* Annex D) in the vapour phase for 72 hours after which the pad shall not show evidence of being forced out of position due to swelling or other cause.

5 CONSTRUCTION AND WORKMANSHIP

5.1 A typical regulator to match self closing valve is shown in Fig. 1 for illustration purpose.

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

5.3 The components of a regulator shall be interchangeable with the corresponding components of any other regulator of the same model and size by the same manufacturer.

5.4 Screw Thread

Except for the screwed ends of regulators not fitted with inlet or outlet connectors, screw threads shall comply with the requirements of IS 554 : 1985 or IS 2643 (Part 1) : 1975 or IS 4218 (Parts 1 to 4) : 1976.

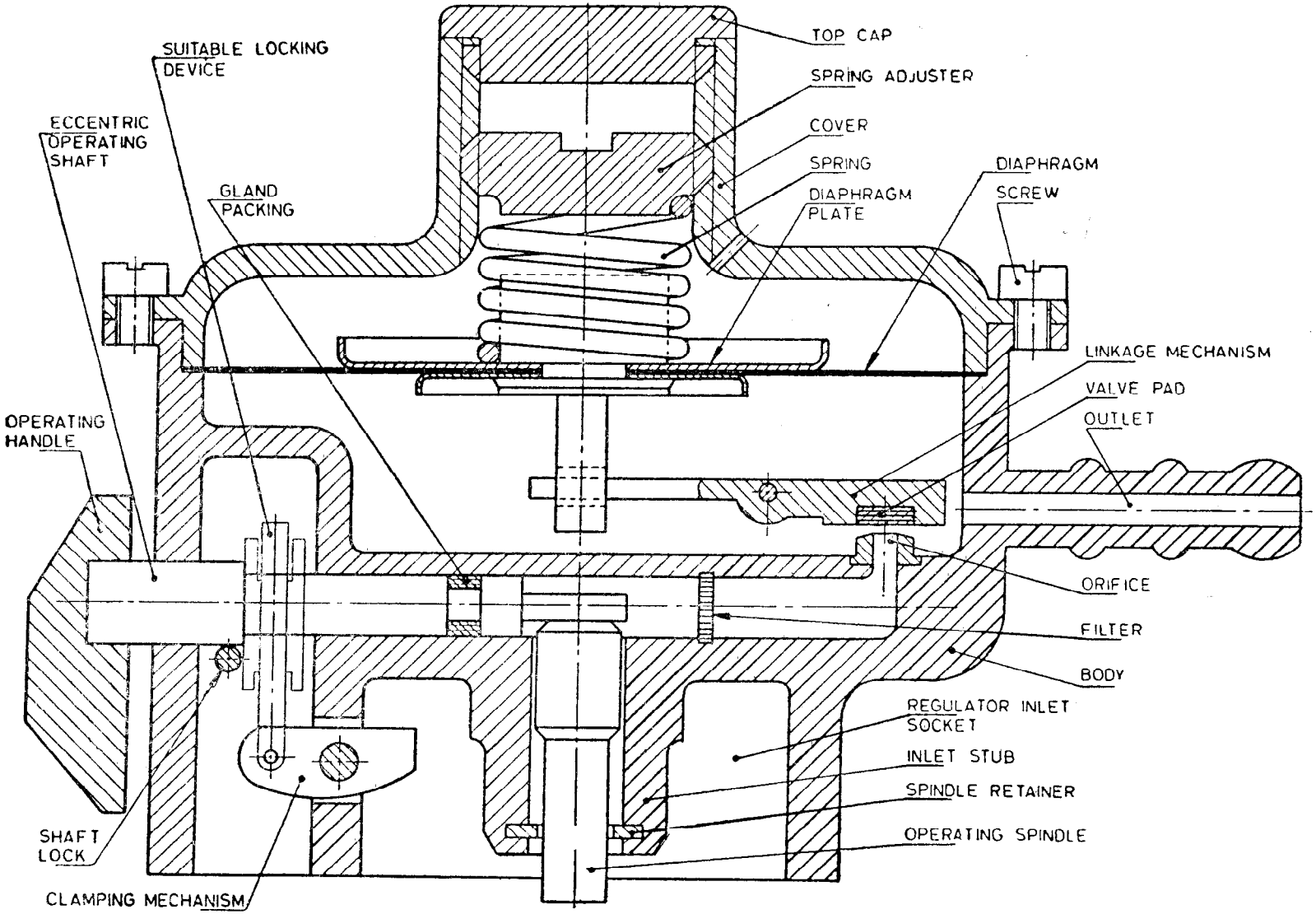


FIG. 1 DIAGRAMMATIC SECTIONAL ILLUSTRATION OF A PRESSURE REGULATOR USED WITH SELF CLOSING SPRING LOADED TYPE VALVE FOR LPG

5.5 Inlet Connection

Where screwed connections are not used, the inlet of the pressure regulator shall be cast integrally as an inseparable part of the body or so fixed which 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 tools or without use of a resilient packing or washer or gasket as a part of the regulator. However, the use of a gasket or packing in the inlet connection of the regulator shall be permitted so long as there is a leak-proof joint with the valve, without the help of gasket or packing as a part of the regulator.

5.5.1 The inlet connection shall be designed to withstand a minimum hydrostatic pressure of 2 490 kPa (25·4 kgf/cm^2) held for 2 minutes.

5.5.2 The inlet connection shall also be capable to withstand a minimum pneumatic pressure of 1 666 kPa (17 kgf/ cm^2) at ambient temperature.

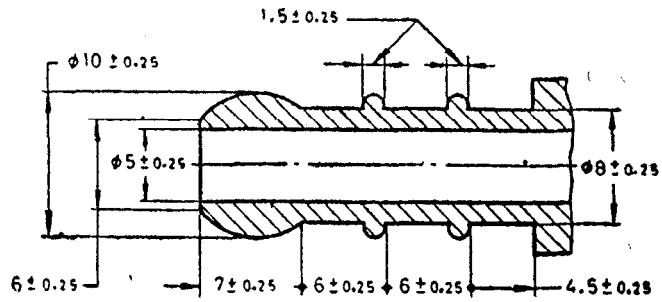
5.5.3 Where screwed connections are used for inlet or outlet of regulator the following shall apply:

a) *SCREWED ENDS* — Where inlet or outlet connections are not fitted, the inlet and outlet of a regulator fitted with screwed ends shall comply with the requirements of IS 2643 (Part 1) : 1975 and IS 2643 (Part 2) : 1975 or IS 4218 (Part 3) : 1976.

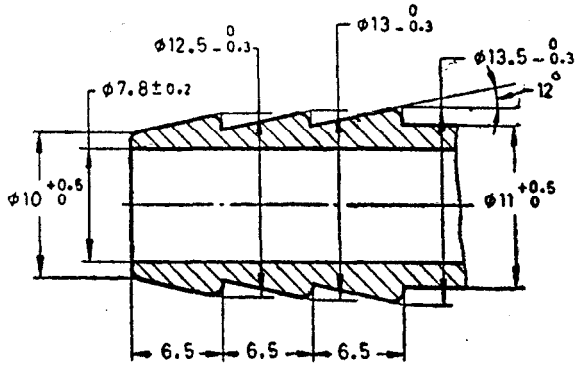
b) *INLET CONNECTORS* — Where used, any washer, connector and nut of a screwed inlet union shall comply with the applicable mating dimensions of IS 8737 : 1995.

5.6 Outlet Connection

For regulators for domestic service the outlet nozzle shall be horizontal cast integrally with the body. The type shall be any of the two mentioned in IS 5116 : 1985, which are reproduced in Fig. 2A and 2B. The choice of type of outlet shall be as per the agreement between the manufacturer and the purchaser. Minor modifications in shape to suit the standard bore or tubing are permissible if agreed to between the manufacturer and the purchaser.



2A Outlet for 6·4 mm Rubber Tubing



28 Outlet for 7 mm Rubber Tubing

All dimensions in millimetres.

FIG. 2 OUTLETS FOR RUBBER TUBING

5.7 Body

5.7.1 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.

5.7.2 After machining and before finishing treatment (for example, painting) the body shall be pressure tested for porosity with gas or air at a pressure of not less than 98 kPa (1·0 kgf/cm^2).

5.8 Vent

The breather hole (air vent above diaphragm space) shall be of such a 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 minimized, and

c) it would be difficult for an instrument inserted through the air vent hole to reach the diaphragm.

5.9 Pressure Relief Valve

Where a pressure relief valve is incorporated in the design, it shall be set to discharge at a pressure not less than twice and not more than three times the outlet pressure setting of the regulator.

NOTE — Provision of a threaded inset screened hole may be provided as per agreement between purchaser and manufacturer, so that any discharge from the relief valve may be led safely away. This is applicable to low pressure regulators used for purposes other than domestic.

5.10 Valve Pad Fitting

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

5.10.2 The inlet orifice and 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 action of contaminating agents in the gas. Any acceptable arrangement meeting this requirement, as agreed between the manufacturer and the purchaser is also permitted.

6 SOUNDNESS

6.1 A regulator shall be considered to be leak tight when tested in accordance with **6.2** and if the leakage rate does not exceed N × 4 mm^3/s. (The symbol 'N' indicates conversion to normal temperature and pressure conditions, NTP that is 760 mm of Hg pressure and 0°C.)

6.2 The regulator shall be leak tight when tested pneumatically at a pressure of 0·490 kN/m^2 (5 gf/cm^2) below twice the nominal outlet pressure when fitted with a relief valve or 14·70 kN/m^2 (150 gf/cm^2) when not fitted with a relief valve, applied through the outlet connection of a fully assembled regulators and held for a period of not less than 30 seconds and not more than 60 seconds, 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.

6.3 Those parts of regulator which are normally subjected to the full cylinder pressure shall be leak tight at a minimum hydrostatic pressure of 2 490 kPa (25·4 kgf/cm^2) for a period of 120 seconds. To ensure that 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) 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 this back pressure shall be ignored for judging the result of the test.

6.4 Those parts of regulator which are normally subjected to the full cylinder pressure shall also be tested for soundness at a pressure of 1 666 kPa (17 kgf/cm^2) for a period of not less than 30 seconds and not more than 60 seconds, after stability has been achieved. To ensure that the 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) is applied to the outlet connection of the regulator before the start of the test and is kept on through out the test. Any change in this back pressure shall be ignored for judging the result of the test.

7 RANGE OF PRESSURE ADJUSTMENT

7.1 The standard range of pressure adjustment, the range of inlet pressure and the range of outlet pressures is elaborated in **7.2** and **8.9.1**. This does not preclude any specific requirement deviating from the standard, as may be agreed to between the manufacturer and the purchaser, provided the essentials of the standard ranges are maintained.

7.2 The standard range of inlet pressure for domestic service regulators for use with LPG

mixtures having vapour pressure up to 1 654 kPa (16·87 kgf/cm^2) at 65°C shall extend for purposes of the performance tests, from 49 kPa (0·5 kgf/cm^2) to 1 666 kPa (17 kgf/cm^2).

8 SETTING AND PERFORMANCE

8.1 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 mixture for the equivalent vapour condition.

The volume conversion factors for certain gases are given below:

Multiply Flow of	*By*	*To Obtain Flow of*
Air	0·707	Butane
	1·290	Natural gas
	0·808	Propane
	0·75	120 RVP Butane/ Propane mixture
120 RVP Butane/ Propane mixture	1·333	Air
Butane	1·414	Air
	1·826	Natural gas
	1·140	Propane
Natural gas	0·775	Air
	0·547	Butane
	0·625	Propane
Propane	1·237	Air
	0·874	Butane
	1·598	Natural gas

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

8.2 Chatter

A regulator using the gas for which it is designed shall not chatter or vibrate while being tested for performance.

NOTE — It is improper to induce chatter by striking the regulator severely or by using an output far in excess of the maximum rated capacity, conditions which may induce vibrations of the internal components and give a false impression of chatter.

8.3 Orientation

A regulator when installed shall be capable of operating in all orientations. The standard performance tests shall be carried out with the regulator in its recommended orientation.

8.4 Outlet Pressure Measurement

For measurement of outlet or delivery pressures of 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 not so long as to create a significant pressure drop.

8.5 Flow measurements shall be carried out using a direct indicating flowmeter (rotameter). Calibrated orifices may also be used.

8.6 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, at varying outlet flows of the regulator under test. The inlet pressure should be readjusted appropriately when such deviation is experienced.

8.7 Lock up shall be achieved within 60 seconds after cessation of flow.

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

8.9 Performance

8.9.1 The regulator shall be set so that, with inlet pressure ranging from 49 kPa (0·5 kgf/cm^2) to 1 666 kPa (17 kgf/cm^2) on gas flow rate of 10 to 100 percent of rated capacity, the delivery pressure shall not be less than 2·206 kN/m^2 (22·5 gf/cm^2 or 225 m of WC) and not more than 3·923 kN/m^2 (40 gf/cm^2 or 400 mm of WC). Static (lock up) pressure shall not exceed 4·41 kN/m^2 (45 gf/cm^2 or 450 mm of WC).

8.9.2 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 when using air or nitrogen or permitted medium, the test shall be repeated using the gas, for which the regulator is designed.

8.10 The requirements of performance as given in **8.9** shall also be satisfied before and after subjecting the regulator to the tests specified in **8.10.1**, **8.10.2** and **8.10.3**. Deviation in the initial setting, after these tests, is acceptable.

8.10.1 *Cycle Test*

When assessing a new design, a type approval test in accordance with Annex E 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 **6.2**, **6.3**, **6.4** and performance as in **8.9**.

8.10.2 *Low Temperature Test*

The regulator is exposed to a temperature of −20°C for a minimum period of 10 minutes for the complete assembled unit to attain this temperature. It is then removed and left exposed to the atmosphere until the assembly returns to ambient conditions, after which it is tested. The method of carrying out the test is elaborated in Annex F.

8.10.2.1 Heating shall not be applied to reach the ambient temperature.

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

8.10.3 *High Temperature Test*

The regulator is exposed to a temperature of 65°C for a minimum period of 10 minutes for the complete assembled unit to attain this temperature. It is then removed and left exposed to the atmosphere until the assembly returns to ambient conditions, after which it is tested. The method of carrying out the test is elaborated in Annex F.

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

8.10.3.2 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 breather hole may be plugged.

9 SEALING

9.1 After testing, the body and cover of each regulator shall be sealed to discourage interference with the internal mechanism as well as the pressure setting.

9.1.1 The manner of sealing shall be as agreed to between the purchaser and the manufacturer.

10 CLASSIFICATION OF TESTS

10.1 Type Tests

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

a) Diaphragm material (**4.3**),

b) Valve pad material (**4.4**),

c) Hydrostatic test (**5.5.1**),

d) Soundness test (**6.4**),

e) Body (**5.7.2**), and

f) Low and high temperature test (**8.10.2** and **8.10.3**).

10.2 Routine Tests

The following shall be carried out as routine tests:

a) Pneumatic test (**5.5.2**),

b) Soundness test (**6.2**),

c) Hydrostatic test (**6.3**),

d) Chatter (**8.2**), and

e) Setting and performance test (**8.9**).

11 MARKING

11.1 A regulator shall be clearly and permanently marked with the following:

a) Manufacturer's name or trade-mark;

b) Month and year of manufacture, for example, 9/93 for September 1993;

c) Rated capacity in m^3/h of LPG;

d) Number of this standard; and

e) Any other markings agreed to between the purchaser and the manufacturer.

11.2 BIS Certification Marking

The regulators may also be marked with Standard Mark.

11.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

11.3 The markings may be distributed over the body, cover and sealing plate/cap as found convenient and as agreed to between the purchaser and the manufacturer.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
319 : 1989	Free cutting brass, rods and sections (*fourth revision*)	3400 (Part 2) : 1980	Methods of test for vulcanized rubbers : Part 2 Hardness (*first revision*)
410 : 1977	Cold rolled brass sheet, strip and foil (*third revision*)	3400 (Part 4) : 1987	Methods of test for vulcanized rubbers : Part 4 Accelerated ageing (*second revision*)
554 : 1985	Dimensions for pipe threads where pressure tight joints are required on the threads (*third revision*)	4218 (Parts 1 to 4) : 1976	ISO Metric screw threads
742 : 1981	Zinc base alloy die castings (*second revision*)	5116 : 1985	General requirements for domestic and commercial equipment for use with LPG (*first revision*)
2305 : 1988	Method for mecurous nitrate test for copper and copper alloys (*first revision*)	6912 : 1985	Copper and copper alloy forging stock and forgings (*first revision*)
2643 (Part 1) : 1975	Dimensions for pipe threads for fastening purposes : Part 1 Basic profile and dimensions (*first revision*)	8737 : 1995	Valve fittings for use with liquefied petroleum gas (LPG) cylinders of more than 5 litre water capacity — Specification (*first revision*)
2643 (Part 2) : 1975	Dimensions for pipe threads for fastening purposes : Part 2 Tolerances (*first revision*)		

ANNEX B

(*Clause* 4.3.4)

BURSTING AND PULL-OUT TEST OF DIAPHRAGM IN AN ASSEMBLED REGULATOR

B-1 GENERAL

B-1.1 The test is designed to give a practical results on an assembled regulator, and is intended as simple check method which may be applied by the regulator manufacturer to diaphragm material which will usually have been previously tested by some other method (for example, Mullin's test) by the supplier.

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

B-2 TEST RIG

B-2.1 The outlet of the assembled regulator is connected to a supply of air or nitrogen.

B-2.2 A gauge is incorporated in the test rig between the air or nitrogen supply and the regulator to indicate the applied pressure.

B-3 TEST METHOD

The pressure is applied at approximately 78 kPa (0·8 kgf/cm^2) per second up to the level specified in **4.3.4** and maintained for 120 seconds.

ANNEX C

(*Clauses* 4.3.5 *and* 4.4.2)

IMMERSION TEST (RESISTANCE TO HYDROCARBONS)

C-1 GENERAL

The test is designed to evaluate the rubber material *vis-a-vis* its resistance to hydrocarbons.

C-2 PROCEDURE

Weigh the sample, W_0 prior to test. Immerse the same in pentane or test gas (as defined in Annex D) maintained at a temperature of 20 ± 5°C for 72 hours. Remove the sample and expose it to atmosphere. After 5 minutes, weigh the sample W_1. Next, let it stay exposed to atmosphere for 24 hours and reweigh W_2 and calculate the following:

a) Percentage of test gas absorbed $= \frac{W_1 - W_2}{W_0} \times 100$, and

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

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

Component	*Extractables, percent*	*Absorbed, percent*
Diaphragm	10	10
Valve pad	5	10
Seal	20	20

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

ANNEX D

(*Clause* 4.4.4)

TEST GAS COMPOSITION

D-1 The test gas is nominally 50 percent propane. In practice, this test gas shall conform to the following specification:

a) The total content of propane shall not be less than 45 mols percent and not greater than 55 mols percent,

b) The total content of C_2 hydrocarbons shall not exceed one mol percent, and

c) The total content of C_4 and higher hydrocarbons shall not exceed 2 mols percent.

D-2 Alternatively commercial liquefied petroleum gas (LPG) may be used as the test gas.

ANNEX E

(*Clause* 8.10.1)

CYCLE TEST (ENDURANCE TEST)

E-1 The purpose of the test is to evaluate the quality of various flexibles, such as valve pad; diaphragm and spring, *vis-a-vis* retention of critical properties relevant to function, resistance to deformation/degradation, 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.

E-2 The regulator is mounted on a valve (whose outlet matches with the inlet of the regulator). The outlet of the regulator is connected to a system which will indicate flow or lack of it (that is, a burner, flowmeter or orifice in parallel with a pressure indicating device such as a manometer column). Air/Gas is introduced into the regulator inlet at an

appropriate pressure in such a manner that the diaphragm gets fully flexed and the valve pad is held on its seat for a minimum of one second, after which the inlet is shut off and the air/gas is vented via the outlet of the regulator to atmosphere.

E-2.1 One example of a set-up to carry out this test is to install quick acting valves upstream and downstream of the regulator, wherein the downstream valve exhausts to 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 5 seconds.

E-2.2 Any other set-up producing equivalent conditions and achieving the same objectives, would be acceptable.

E-3 After completion of the test mentioned above (*see* **E-2**), the regulator shall meet the requirements of soundness test as in **6.2**, hydrostatic test as in **6.3** and performance as in **8.9.1**, however, with the static (lock-up) pressure not exceeding 110 percent of that allowable in relevant lock-up clause.

NOTE — If the tests are carried out using LPG vapour as test medium, sufficient precaution should be ensured to vent the inflammable gas to environments where there should be no danger of fire. Alternatively, the venting could be done via gas burning devices.

ANNEX F

(*Clauses* 8.10.2 *and* 8.10.3)

LOW TEMPERATURE AND HIGH TEMPERATURE TESTS

F-1 LOW TEMPERATURE TEST

F-1.1 A fully assembled regulator, set as in **8.9** is placed in a sealed container and this container is immersed in a bath of any convenient fluid (namely, methanol or any suitable freezing mixture like salt + ice + calcium carbide) cooled to a steady temperature of −20°C and maintained at this temperature by some reliable means (by additions of dry ice). It is kept immersed long enough for the complete assembly to attain −20°C (10 minutes) after which it is removed and exposed to the atmosphere so that the assembly returns to ambient conditions. It is then tested in accordance with **8.9** for performance.

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

F-1.2 A fully assembled regulator set as in **8.9** is placed in a sealed container and this container is placed in a bath of water heated to a steady temperature of 65°C. It is kept immersed long enough for the complete assembly to attain 65°C (10 minutes) after which it is removed and exposed to the atmosphere so that the assembly returns to ambient conditions. It is then tested in accordance with **8.9** for performance.

NOTE — Care should be taken to prevent the bath water from entering the assembly, or of 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.

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AMENDMENT NO. 1 FEBRUARY 1998
TO
IS 9798 : 1995 LOW PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GAS (LPG) MIXTURES — SPECIFICATION

(First Revision)

(*Page* 5, *clause* **6.1**) — Substitute '4 N mm^3/s' *for* 'N × 4 mm^3/s'.

(*Page* 7, *clause* **10.1**) — Substitute the following for the existing:

'The following shall constitute type tests out of the various requirements:

a) Diaphragm material (**4.3**),

b) Valve pad material (**4.4**),

c) Hydrostatic test (**6.3**),

d) Body (**5.7.2**), and

e) Low and high temperature test (**8.10.2** and **8.10.3**).'

(*Page* 7, *clause* **10.2**) — Substitute the following for the existing:

'The following shall be carried out as routine tests:

a) Pneumatic test (**6.2** and **6.4**),

b) Chatter and performance test (**8.9**),'

(*Page* 10, *clause* **F-1.1**) — Insert the following at the end:

'F-2 HIGH TEMPERATURE TEST'

(*Page* 10, *clause* **F-1.2**) — Substitute '**F-2.1**' *for* '**F-1.2**'.

(HMD 16)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 MAY 2002
TO
IS 9798 : 1995 LOW PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GAS (LPG) MIXTURES — SPECIFICATION

(First Revision)

(*Page* 1, *clause* **1**) — Substitute the following (excluding NOTE) for the existing clause:

'1 SCOPE

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

(*Page* 1, *clause* **2**) — Substitute the following for the existing clause:

2 REFERENCES

The Indian Standards listed below are necessary adjuncts to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
319 : 1989	Free cutting brass, rods and sections (*fourth revision*)
410 : 1977	Cold rolled brass sheet, strip and foil (*third revision*)
554 : 1999	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
742 : 1981	Zinc base alloy die castings (*second revision*)
2643 : 1999	Pipe threads where pressure-tight joints are not made on the threads — Dimensions, tolerances and designation (*second revision*)

Gr 2

IS No.	*Title*
3400 (Part 2) : 1995	Methods of test for vulcanized rubbers : Part 2 Hardness (*second revision*)
3400 (Part 4) :	Methods of test for vulcanized rubbers : Part 4 Accelerated ageing (*second revision*)
4218 (Part 1) : 2001	ISO general purpose metric screw threads : Part 1 Basic profiles (*second revision*)
4218 (Part 2) : 2001	ISO general purpose metric screw threads : Part 2 General plan (*second revision*)
4218 (Part 3) : 1999	ISO general purpose metric screw threads : Part 3 Basic dimensions (*second revision*)
4218 (Part 4) : 2001	ISO general purpose metric screw threads : Part 4 Selected sizes for screws, bolts and nuts (*second revision*)
5116 : 1996	Domestic and commercial equipment for use with LPG — General requirements (*third revision*)
6912 :1985	Copper and copper alloy forging stock and forgings (*first revision*)
8737 : 1995	Valve fittings for use with liquefied petroleum gas (LPG) cylinders of more than 5-litre water capacity – Specification (*first revision*)
14962 (Part 1) : 2001	ISO general purpose metric screw threads – Tolerances : Part 1 Principles and basic detail
14962 (Part 2) : 2001	ISO general purpose metric screw threads – Tolerances : Part 2 Limits of sizes for internal and external screw threads – Medium quality
14962 (Part 3) : 2001	ISO general purpose metric screw threads – Tolerances : Part 3 Deviations for constructional screw threads
14962 (Part 4)	ISO general purpose metric screw threads – Tolerances : Part 4 Limits of sizes for hot-dip galvanized external screw threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing

IS No.	*Title*
14962 (Part 5) : 2001	ISO general purpose metric screw threads – Tolerances : Part 5 Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing

NOTE — Delete years specified against Indian Standards in the text.

(*Page* 1, *clause* **3.8**) — Insert the following new clauses after **3.8**:

3.9 Automatic Changeover Device

A device designed to ensure continuity of gas supply where a reserve gas supply is brought into use automatically when the 'service' gas supply is exhausted. This may or may not incorporate a second stage regulation.

NOTE – A typical automatic changeover device is illustrated in Fig. 1A on page 4.

3.9.1 Indicators

An indicator shall be fitted to show when the supply cylinder(s) or vessel(s) is empty and the reserve supply is being used.

3.9.2 Non-return valve shall be fitted to the inlet of automatic changeover devices to prevent possible discharge of gas when changing cylinders. The arrangement shall be such that it cannot readily be disconnected from the device when changing cylinders. When pressure tested against the direction of flow, maximum leakage rates shall not exceed 4 N mm^3/s at standard temperature and pressure. The test shall be carried out at the following pressures:

a) at 0.350 kg/cm^2 minimum pressure, and

b) at 20 kg/cm^2 maximum pressure.

(*Page* 2, *clause* **4.3.2**) – Insert the following Note at the end of the clause:

NOTE — 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

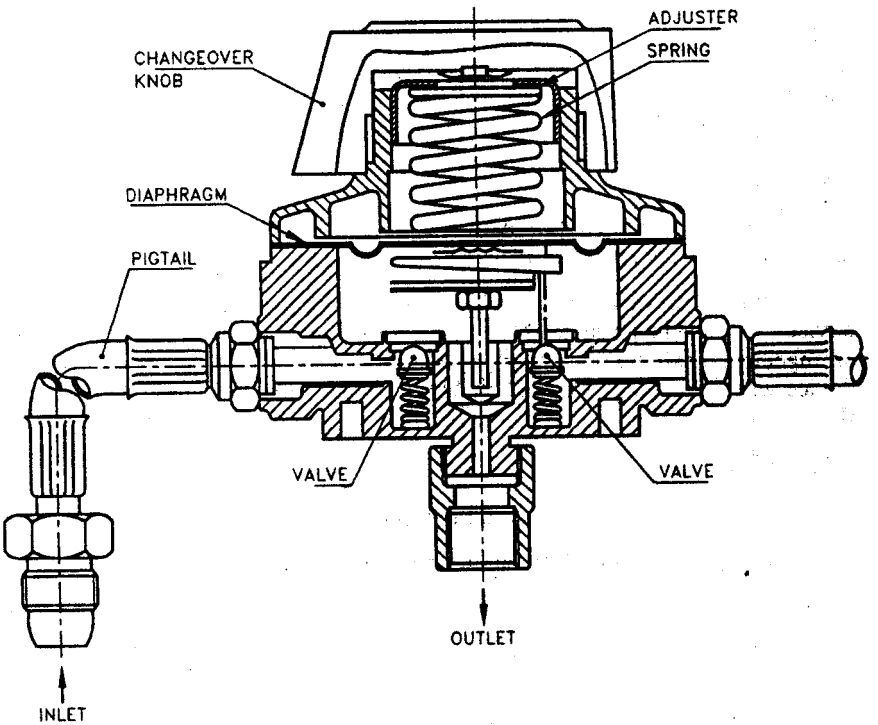

FIG. 1A TYPICAL AUTOMATIC CHANGEOVER DEVICE

(*Page* 2, *clause* **5.4**) — Substitute the following for the existing:

'5.4 Screw Thread

Except for the screw ends of regulators not fitted with inlet or outlet connectors, screw threads shall comply with the requirements of IS 554 or IS 2643 or IS 4218 (Parts 1 to 4) or IS 14962 (Parts 1 to 5).'

(*Page* 4, *clause* **5.5.1**) — Substitute the following for the existing:

5.5.1 The inlet connection shall be designed to withstand a minimum hydrostatic pressure of 1.5 times the saturated vapour pressure of the gas at 65°C subject to a minimum of 18 kgf/cm^2 for 120 s.

(*Page* 4, *clause* **5.5.3**) — Substitute the following for the existing:

'**5.5.3** Where screwed connections are used for inlet or outlet of regulator or cylinder changeover devices, the following shall apply:'

(*Page* 5, *clause* **6.3**, *first sentence*) — Substitute the following for the existing sentence:

Those parts of 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 subject to a minimum of 18 kgf/cm^2 for 120 s.

(*Page* 5, *clause* **7.2**) — Substitute the following for the existing:

7.2 For the performance test of the domestic service regulators the standard range of inlet pressures for use with commercial butane, commercial butane/propane mixture and commercial propane shall be as per Table 1.

Table 1 Performance Test
(*Clauses* 7.2 *and* 8.9.1)

Regulators for Gas	Inlet Pressure kgf/cm^2	Flow in % of Rated Capacity	Range of Outlet Pressure in mm of W.C.
Commercial Butane	0.5-17	100-10	225-400
	17.0	0	450 *Max*
Commercial Butane-Propane Mixture	0.5-17	100-10	225-400
	17.0	0	450 *Max*
Commercial Propane	0.5-20	100 - 10	225-450
	20.0	0	500 *Max*

(*Page* 6, *clause* **8.9.1**) — Substitute the following for the existing:

'**8.9.1** The regulators shall be set as given in Table 1.'

(*Page* 7, *clause* **11.1**) — Substitute the following for the existing:

'**11.1** A regulator shall be clearly and permanently marked with the following:

a) Manufacturer's name or trade-mark;

b) Month and year of manufacture, for example, 12/01 for December 2001;

c) Rated capacity in m^3/h of gas designed for;

d) Number of this standard;

e) Any other markings agreed to between the purchaser and the manufacturer; and

f) Name of gas, designed for.'

(ME 16)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 MAY 2003
TO
IS 9798 : 1995 LOW PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GAS (LPG) MIXTURES — SPECIFICATION

(First Revision)

[*Page* 1, *clause* **2** (*see also Amendment No.* 2)] — Insert the following at appropriate place:

'IS 6009:1970 Method for evaluation of results of accelerated corrosion test

IS 9844:1981 Specification for methods of testing resistance of electroplated and anodized aluminium coatings by neutral salt spray test'

(*Page* 2, *clause* **4.2**) — Insert the following new clause after **4.2**:

4.2.1 *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.

The surface finished components shall be subjected to test for corrosion resistance as per IS 9844. The criteria of acceptance after the test shall be the rating number as given in **6** of IS 6009.

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

(*Page* 2, *clause* **4.4.4**) — Insert the following new clause after **4.4.4**:

'**4.5** Seals, O-rings and rubber components other than diaphragm and valve pad shall withstand the requirement as laid down in **4.4.1** to **4.4.3**.

NOTE — Rubber materials which are coming in contact with LPG shall be tested.'

(*Page* 10, *Annex* F) — Insert the following Annex G after Annex F:

ANNEX G
(*Clause* **4.2.1**)
METHOD OF TEST FOR ADHESION OF PAINT

A square measuring 12 to 15 mm sides shall be marked on plain surface (not having raised or sunk markings) of randomly selected specimen from the lot of painted or powder quoted components. Cross lines at a distance of 1 to 1.5 mm and inched at approximately 120^{0} angle with each other shall be described over the marked portion with a pointed sharp instrument. A cellulose tape shall be applied over this portion and left for 2 min after which it shall be jerked free from the surface. If more than 3 percent of the squares are ripped away from the surface under test and are adhering to this tape, the specimen shall be deemed to have failed the test.

(ME 16)

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