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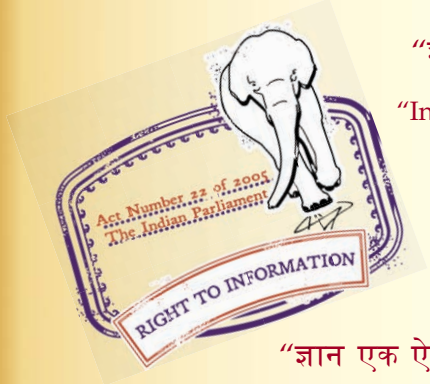
IS 4786 (1968): Variable High Pressure Regulators for Use with Liquefied Petroleum Gases [MED 16: Mechanical Engineering]



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IS : 4786 - 1968
(Reaffirmed 2010)

Indian Standard
SPECIFICATION FOR VARIABLE HIGH PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GASES

(Third Reprint MAY 1997)

UDC 621 640 4 621 642 036

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
New Delhi 110 002

Gr 3 *December* 1968

AMENDMENT NO. 2 FEBRUARY 1979

Alteration

[*Page* 5, *clause* 3.2.5(a), *line* 1] - Substitute '-10°C' *for* '40°C'.

(EDC 16)

AMENDMENT NO. 1 MARCH 1977
TO
IS : 4786-1968 SPECIFICATION FOR VARIABLE HIGH PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GASES

Alterations

(*Page* 6, *clause* **4.4**) — Substitute the following for the existing clause:

'**4.4 Connections** — Inlet unions shall conform to the appropriate outlet connection specified in IS: 3224-1971§.'

[*Page* 6, *foot-note with section* (§) *mark*] — Substitute the following for the existing foot-note:

' §Specification for valve fittings for compressed gas cylinders (*first revision*).'

(*Page* 6, *clause* **4.5**) — Substitute the following for the existing clause:

'**4.5 Body** — After machining and before finishing treatment (for example, painting), the body shall be non-porous. If pressure testing is used, the minimum gat or air pressure applied shall be 10 kgf/cm^2.'

Addendum

(*Page* 10, *Appendix A*) — Add the following at the end:

'Alternatively, commercial liquefied petroleum gas (LPG) may be used as the test gas.'

Indian Standard

SPECIFICATION FOR VARIABLE HIGH PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GASES

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Indian Standard

SPECIFICATION FOR VARIABLE HIGH PRESSURE REGULATORS FOR USE WITH LIQUEFIED PETROLEUM GASES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 18 September 1968, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Division Council

0.2 With the establishment of petroleum refineries in India liquefied petroleum gases are available in largo quantities and are being increasingly used in domestic installations

0.3 In the preparation of this standard considerable assistance has been derived from B.S. 3016 Part 3 1960 'Specification for pressure regulators for use with butane/propane gases, Part 3 Variable high pressure regulators' issued by the British Standards Institution

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, obseived or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS.2-1960* The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard specifies materials, construction, performance and testing requirements for variable high pressure regulators for liquefied petroleum gases (butane, propane and their mixtures) in the vapour phase above 50 gf/cm^2 outlet pressure.

NOTE — Generally LPG appliances are being designed to operate at a pressure of 1 kgf/cm^2, but specialized equipment may call for use of higher pressures

*Rules for rounding off numerical values (*reused*)

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Liquefied Petroleum Gases (LPG) — shall mean and include any material which comprises predominantly of any of the following hydrocarbons or mixtures of them.

propane, propylene, butanes (*n*-butane and *iso*-butane) and butylenes.

2.2 Butane Gas — A mixture consisting predominantly of C_4 hydrocarbons with some C_3 hydrocarbons and a small amount of C_3 hydrocarbons.

2.3 Propane Gas — A mixture consisting predominantly of C_3 hydrocarbons with some C_2 hydrocarbons and a small amount of C_4 hydrocarbons.

2.4 Variable High Pressure Regulator — A high pressure regulator fitted with means of adjustment intended to be operated by the user.

3. MATERIALS

3.1 All component parts shall be manufactured from, or be treated with, materials unaffected by chemical or thermal influences that may be encountered in normal use. For guidance some appropriate materials are specified in the following Indian Standards, but other types of materials may be used provided that the standards of performances, durability and safety of the regulators are not thereby lowered

*IS : 319-1962 Specification for fiee-cutting brass rods and sections (*revised*)

IS : 3465-1966 Specification for jointing compounds lor use in liquefied petroleum gas appliances and installations

IS : 3488-1966 Specification for brass bars, rods and sections suitable for forging

Brass parts shall not be susceptible to season cracking. The susceptibility to season cracking shall be determined by the method given in IS : 2305-1962†

3.2 Diaphragm Material Diaphragm material shall be of synthetic rubber or other material equally suitable for the application and shall satisfy the following requirements.

3.2.1 The material shall be impermeable to the test gas (*see* Appendix A) at a pressure of 2.5 tunes the maximum outlet pressure obtainable from the regulator when subjected to a suitable permeability and porosity test.

3.2.2 The material shall be such that when the assembled regulator is subjected to the test specified in Appendix B, the diaphragm shall not pull out, or burst, at a pressure less than 10 kgf/cm^2.

*Since revised.

†Method for mercurous nitrate test for copper and copper alloys.

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

3.2.4 The material shall not after immersion in pentane for 72 hours and in the liquid test gas (*see* Appendix A) for a similarlar time show a weight or volume change greater than 15 percent. After this test the material shall be still capable of meeting the flexibility requirements of **3.2.5**.

NOTE – The foregoing tests are works batch tests On initial selection of a diaphragm material, it shall also be tested m the test gas in the vapour phase for 72 hours, and shall not show a weight or volume change greater than 15 percent.

3.2.5 The material shall be such that the flexibility of the diaphragm shall not be impaired by either of the following tests (*see* Appendix C).

a) Reduction to 40°C and returning to the lowest temperature at which it will be required to function, and

b) Raising to 65°C.

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

3.2.7 The material shall not show appreciable evidence of deterioration when subjected to the accelerated ageing test described in **4.3** of IS : 3400 (Part IV)-1965*.

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

3.3.1 The material shall not after immersion in pentane for 72 hours and liquid test gas (*see* Appendix A) for a similar length of time, show any volumetric change greater than 10 percent. The loss of plasticizers or other ingredient due to extraction shall not exceed 5 percent by weight.

NOTE – The foregoing tests are works batch tests On initial selection of valve pad material, it shall also be tested in the test gas in the vapom phase for 72 hours, and shall not show any volumetric shrinkage or volumetric increase greater than 10 percent, The loss of plasticizers or other ingredient due to extraction shall not exceed 5 percent by weight.

3.3.2 The material shall not show appreciable evidence of deterioration when subjected to the accelerated ageing test described in **4.3** of IS : 3400 (Part IV)-1965*.

3.3.3 The pad shall be so retained that it cannot become loose or work out of position under service conditions.

*Methods of test for vulcanized rubbers: Part IV Accelerated ageing.

3.3.4 The valve pad fitted in its housing shall be immersed in pentane or the test gas (*see* Appendix A) 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.

3.3.5 The hardness of the material shall not vary over a temperature range between the lowest temperature at which it will be required to function and 65°C to the extent that the performance of the regulator fails to satisfy the requirements of **5.1**.

3.3.6 The material shall have a low compression set cold flow and creep characteristics and be free from porosity, pits and foreign particles and shall have a smooth non-tacky surface with minimum talc or bloom.

4. CONSTRUCTION

4.0 A typical variable higher pressure regulator is illustrated in Fig. 1.

4.1 The regulator, including all the component parts, shall be of sound construction and of a high degree of workmanship and finish.

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

4.3 Screw Threads — Unless otherwise specified, the threads on the inlet and outlet of the bodies of regulators fitted with screwed ends shall comply with the requirements of IS : 554-1964* or IS:2643-1964† or IS : 1362-1962‡ and shall have sufficient length of threads to provide clearance and prevent bottoming.

4.4 Connections — Inlet unions shall conform to the outlet **9** of IS : 3224-1966§.

4.5 Body — After machining and before finishing treatment, the body shall be non-porous when pressure tested at a gas or air pressure of not less than 10 kgf/cm^2.

4.6 Vent — The air vent hole shall be so located that:

a) the accidental entry of foreign matter is minimized,
b) it does not easily become blocked, and
c) it would be difficult for an instrument inserted through the air vent hole to reach the diaphragm.

NOTE — The purchaser may specify the provision of an insect screen over the vent hole.

*Dimensions for pipe threads for gas list tubes and pressure tight screwed fittings (*revised*).
†Dimensions for pipe threads for fastenmg purposes.
‡Dimensions for screw threads for general purposes (diameter range 1.6 to 39 mm) (*revised*) (Since withdrawn).
§Specification for valve fittings for compressed gas cylinders.

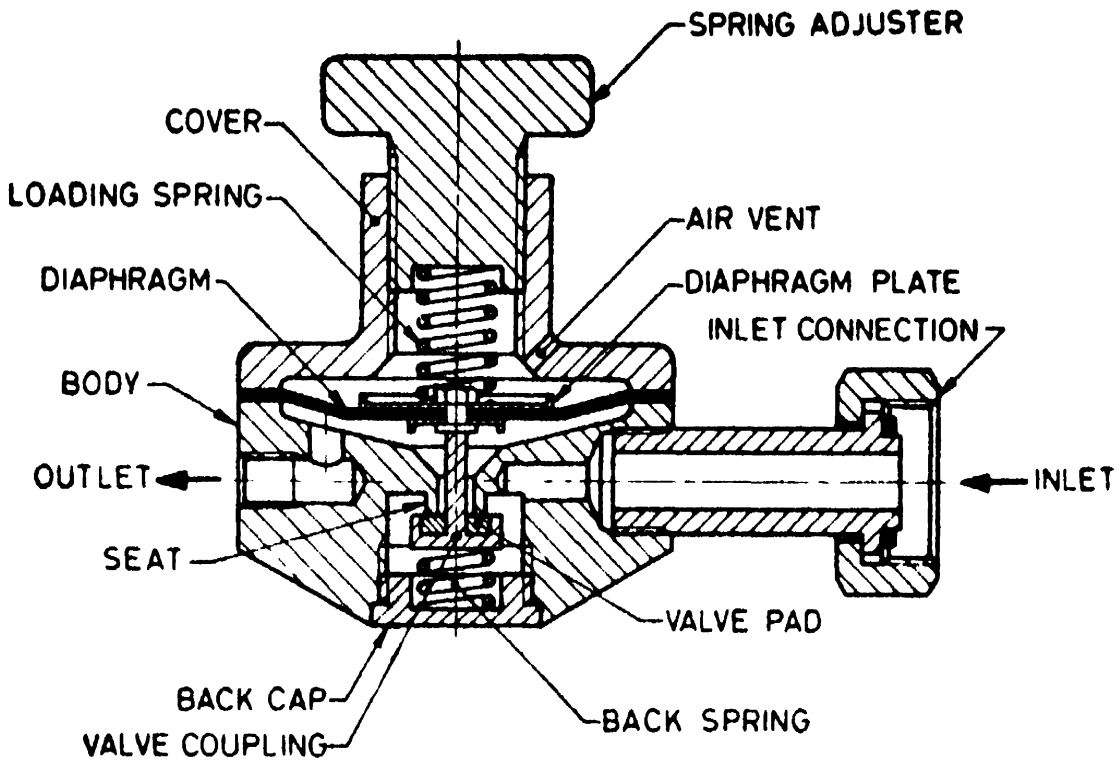

FIG. 1 DIAGRAMMATIC SECTIONAL ILLUSTRATION OF A VARIABLE HIGH PRFSSURE REGULATOR FOR LIQUEFIED PETROLEUM GASES

4.7 Range of Pressure Adjustment — The range of pressure adjustments and the maximum outlet pressure shall be by mutual agreement between the purchaser and the manufacturer.

In the case of regulators fitted with direct-reading calibrated means of adjustment, the calibrations shall be clear and legible. They shall comply with the requirements of **5.1** at each calibration mark.

4.8 Relief Valves — The inclusion of relief valves in regulator construction is not recommended.

4.9 Excess Flow Check Valve — If an excess flow check valve is included in the construction of the regulator, its performance shall be specified by the manufacturer.

4.10 Pressure Gauges — Where an outlet pressure gauge is fitted as an integral part of the regulator the maximum pressure (plus over pressure) which the gauge will withstand shall be higher than the maximum outlet pressure setting that can be provided by the regulator (*see* IS : 3624-1966*).

*Specification for bourdon tube pressure and vacuum gauges.

5. PERFORMANCE

5.1 The regulator shall be capable of being operated in all positions, but the test shall be carried out with the regulator horizontal and with the cover uppermost. The pipe between the outlet of the regulator and the outlet pressure gauge shall be of the same nominal diameter of outlet regulator and not less than 8 diameters long but not so long as to cause a significant pressure drop.

5.1.1 With an initial setting and an inlet pressure as specified by the manufacturer the outlet pressure shall not deviate by more than 10 percent from the setting, at flows measured whilst rising from 10 to 100 percent of the specified test capacity. The static pressure shall not exceed the outlet pressure setting by more than 20 percent.

5.1.1.1 *Propane regulators* — After setting as in **5.1.1** and with inlet pressure of 3.5 kgf/cm^3 and 11 kgf/cm^2, the outlet or delivery pressure shall not deviate from the setting by more than 20 percent with flows measured whilst rising from 10 percent to 100 percent of the specified test capacity. The static pressure shall not exceed the outlet pressure setting by more than been percent. These requirements shall also be met after the regulator has been exposed and has recovered from ambient temperature between 20°C and 45°C.

5.1.1.2 *Butane regulators* — After setting as in **5.1.1** and with inlet pressure of 0.8 kgf/cm^2 and 3.2 kgf/cm^2 the outlet or delivery pressure shall not deviate from the setting by more than 20 percent with flows measured whilst rising from 10 percent to 100 percent of the specified test capacity. The static pressure shall not exceed outlet pressure setting by more than 30 percent. These requirement shall also be met after the regulator has been exposed to and has recovered from ambient temperature between 20°C and 45°C.

NOTE — The foregoing test are intended as comparative tests, with the ' specified test capacity ' laid down by the manufacturers. The maximum capacity will depend on operating circumstances and the permissible pressure drop

6. TESTS

6.1 Regulator — The completed regulator shall not leak when tested at 2.5 times the maximum outlet pressure obtainable from the regulator applied through the outlet connection and held for a period of not less than 30 seconds.

6.2 Inlet Connection — Those parts of the regulator normally subjected to cylinder pressure shall be capable of withstanding a pressure of 25 kgf/cm^2 held for two minutes, without leakage.

6.3 Diaphragm — The diaphragm of regulator shall not pull out from their fixings when the assembled regulator is subjected to test generally similar to that prescribed in Appendix B.

7. SEALING

7.1 After tests, the body and cover of each regulator shall be sealed to discourage interference with the internal mechanism. The manner of sealing shall be agreed to between the purchaser and the manufacturer.

8. MARKING

8.1 Each regulator shall be legibly and indelibly marked with the following

a) Manufacturer's name, initials or identifications,

b) The month and years of manufacturers,

Example

4/67 for April l967,

c) The number of this standard, followed by the letter B indicating butane or the letter P indicating propane, and

d) Any other marking agreed to between the purchaser and the manufacturer

8.2 BIS Certification Marking

The product may also be marked with Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of the 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.

9. PACKING

9.1 The regulators shall be so packed as to avoid damage in transit The openings shall be sealed off to prevent the entry of foreign matter

APPENDIX A

(*Clauses* 3.2.1, 3.2.4, 3.3.1 *and* 3.3.4)

TEST GAS COMPOSITION

The test gas is nominally 50 percent propane, 50 percent propene, In practice this gas will conform to the following specification:

A hydrocarbon mixture consisting predominantly of C_3 hydrocarbons approximating to 50/50 propane/propene. It shall have the following composition:

a) The total content of propene 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 1 mol percent.

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

APPENDIX B

(*Clauses* 3.2.2 *and* 6.3)

BURSTING AND PULL OUT TEST OF DIAPHRAGM IN AN ASSEMBLED CONDITION

B-1. GENERAL

B-1.1 The test is designed to give a practical result on an assembled regulator, and is intended as a 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 to 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

B-3.1 The pressure is applied at approximately 0 8 kgf/cm^2 per second up to the level specified in **3.2.2.**

APPENDIX C

(*Clause* 3.2.5)

LOW TEMPERATURE TEST FOR DIAPHRAGMS

C-1. DETERMINATION OF DIAPHRAGM FLEXIBILITY AT LOW TEMPERATURE

C-1.1 The following test has been found satisfactory for quickly assessing the low temperature behaviour of diaphragm material:

A strip of the material is immersed in a methyl alcohol solution tooled to the required test temperature by small additions of dry ice; after the test piece has been maintained at the test temperature for approximately 10 minutes, the flexibility can be checked, and when compared with the flexibility of a similar test piece at room temperature, should show little or no increased resistance to flexing.

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