IS 4246 (2002): Domestic Gas Stoves for use with Liquefied Petroleum Gases [MED 23: Domestic and Commercial Gas Burning Appliances]

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भारतीय मानक

द्रवित पेट्रोलियम गैसों के साथ प्रयुक्त घरेलू गैस चूल्हे — विशिष्टि

(पाँचवां पुनरीक्षण)

Indian Standard

DOMESTIC GAS STOVES FOR USE WITH LIQUEFIED PETROLEUM GASES — SPECIFICATION

(Fifth Revision)

ICS 75.160.30, 97.040.20

BUREAU OF INDIAN STANDARDS
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July 2002

Price Group 6

FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1967 and revised in 1972, 1978, 1984 and in 1992. Since then many suggestions were received for improvement and with the result Amendments 1, 2 and 3 were issued. This standard is being revised again to incorporate the amendments issued and the suggestions received from time to time. In this revised standard gas consumption by volumetric method, test for strength, rigidity, stability and flame failure devices have been modified.

In preparing this standard, assistance has been derived from the following:

S.I. 432:1976 'Specification for domestic hot plates for use with petroleum gases', issued by Standards Institute of Israel.

BS 5386 (Part 3):1980 'Specification for domestic cooking appliances burning gas Part 3: Grillers and toasters', issued by the British Standards Institution.

This standard is one of a series of Indian Standards on various domestic and commercial gas burning appliances (pressure type) used with LPG. General requirements of this equipment are covered in IS 5116 : 1996 'General requirements for domestic and commercial equipment for use with LPG (*third revision*)', which is a necessary adjunct to this standard. Should, however, any deviation exist between the requirements given in IS 5116 and those of this standard, provisions of the latter shall apply. Other standards published so far in this series IS 4473 : 2002 'Domestic gas ovens for use with liquefied gases (*first revision*)', IS 4760 : 2002 'Domestic cooking ranges for use with liquefied gases (*third revision*)', and IS 11480 : 1998 'Domestic grillers for use with liquefied gases (*first revision*)'.

The Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee examined EN 30 : 1979 'Domestic cooking appliance burning gas' published by European Committee for Standardization. The deviations are given in Annex A. It may be noted that gas stove which passes as per IS 4246 will pass all the requirements of categories II_{23}, II_{2HL3}, II_{2H3} and II_{2N3} appliances specified in EN 30 : 1979.

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 same as that of the specified value in this standard.

The composition of the Committee responsible for the preparation of this standard is given in Annex G.

AMENDMENT NO. 2 AUGUST 2009
TO
IS 4246 : 2002 DOMESTIC GAS STOVES FOR USE WITH LIQUEFIED PETROLEUM GASES — SPECIFICATION

(Fifth Revision)

(*Page* 4, *clause* **26**) — Substitute the following for the existing clause:

'**26 Thermal Efficiency**

When tested as specified in Annex F, the thermal efficiency shall be minimum 68 percent for each burner with the pan placed correctly on the pan supports. For this test, the net calorific value of the gas shall be employed. Thermal efficiency may be declared, if it is 72 percent and above.'

[*Page* 4, *clause* **28.1**(f)] — Substitute '72' *for* '68' and delete 'may use green label'.

[*Page* 4, *clause* **29.1**(g)] — Substitute '72' *for* '68' and delete 'may use green label'.

(ME 23)

Reprography Unit, BIS, New Delhi, India

Indian Standard

DOMESTIC GAS STOVES FOR USE WITH LIQUEFIED PETROLEUM GASES — SPECIFICATION

(Fifth Revision)

1 SCOPE

1.1 This standard specifies construction, operation, safety requirements and tests for domestic gas stoves with metallic bodies intended for use with liquefied petroleum gases at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure.

1.1.1 For convenience, this standard has been divided into three sections as follows:

Section 1 Construction
Section 2 Performance
Section 3 General

2 REFERENCES

The standards at Annex B contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All the 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.

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 6480 shall apply.

SECTION 1 CONSTRUCTION

4 GENERAL

4.1 In addition to the relevant requirements given in **4** of IS 5116, the requirement given in **4.1.1** shall apply.

4.1.1 No pressure regulator shall be included as a part of the stove.

5 MATERIALS

The relevant requirements given in **5** of IS 5116 shall apply.

6 DESIGN FOR MAINTENANCE

6.1 The appliance, including all the component parts, shall be easy to clean and maintain in good working order. There shall be easy access to the accessories and controls for maintenance and adjustment.

6.2 The parts of the burner shall not become disconnected during operation of the appliance. The burners should be so spaced that the relative distance between the centres of the adjoining burner shall not be less than 180 mm.

6.3 Burner ports shall be so designed and located that in normal use spillage of food shall not cause internal fouling of mixing tube and/or blockage of injector jet.

6.4 Burners and parts of burners only of same rating model and make, shall be interchangeable or replaceable without effecting performance.

6.5 Parts, which are intended to be removable by the user, shall be easy to replace correctly, and difficult to assemble incorrectly.

6.6 All nuts, bolts and fittings having spanner flats shall be capable of being moved by suitable spanner or be readily accessible to an adjustable spanner.

7 RIGIDITY AND STABILITY

The appliance shall be so designed that it remains stable and shall not be easily overturned.

8 WORKMANSHIP AND FINISH

8.1 In addition to the relevant requirements given in **7** of IS 5116, the requirements given in **8.2** and **8.3** shall apply.

8.2 The external finished surfaces shall be easily cleanable.

8.3 Except for burners, all other parts, namely, springs, screws, bolts and nuts, pipes, pins, etc, which are visible can be removed for maintenance shall be of corrosion resistant material or treated to resist corrosion appropriate to the conditions of use.

9 GAS TAPS

The relevant requirements given in **8** of IS 5116 shall apply.

10 INJECTOR JETS

The relevant requirements given in **9** of IS 5116 shall apply.

11 BURNERS

11.1 In addition to the relevant requirements given

in 10 of IS 5116, the requirements given in **11.2** and **11.3** shall apply.

11.2 For burners having centre flame, provision shall be made to protect the centre flame from pans resting directly on burner top and smothering the centre flame.

11.3 The appliance comprising two or more burners shall include one burner having a rating of at least 1 490 kcal/h, based on net calorific value of the gas (when using commercial LPG).

12 BURNER PAN SUPPORTS

12.1 The design of the pan supports shall be such that it is practicable to support a pan of 100 mm diameter, over at least one top burner without the use of loose rings, and such that 125 mm diameter vessel remains stable over each burner. Prongs of the support shall have suitable taper to accommodate round bottom pans.

12.1.1 Loose pan supports shall be so designed that it is not possible to place them firmly in other than proper position.

13 GAS SOUNDNESS

13.1 The relevant requirements given in **16** of IS 5116 shall apply.

13.2 Gas Leak Detector

13.2.1 The stove may be provided with a gas leak indicator. If gas leak indicator is provided, it shall conform to the requirements of IS 13432 (Part 1) or IS 13432 (Part 2).

14 GAS INLET CONNECTIONS

14.1 In addition to the relevant requirements given in **18** of IS 5116, the requirements given in **14.2** shall apply.

14.2 The position of the gas inlet shall allow connection to a gas supply on either side of the appliance. Inlet connection at the rear is also permitted. It shall be possible to change gas inlet from one side to other side easily by standard tools.

15 STRENGTH AND RIGIDITY

When tested as specified in Annex C, the vertical resultant deflection of the top surface measured at the centre of length of the body, shall not exceed 2 mm and the distance between the opposite sides (lengthwise and widthwise) shall not change by more than 5 mm.

SECTION 2 PERFORMANCE

16 GENERAL CONDITIONS OF TEST

The relevant requirements given in **19** of IS 5116 shall apply.

17 GAS CONSUMPTION

17.1 Each burner assembly under separate 'ON/OFF' control shall give ± 8 percent of the manufacturers' specified gas consumption in l/h or heat input in kcal/h at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure when measured by volumetric method with a wet gas meter using compressed air (27°C and 760 mm mercury). Thereafter using 0.75 as multiplying factor, the value of air flow at STP so obtained to be converted to flow of LPG at STP.

NOTE — For this test, one litre of LPG = 2.46 g.

17.1.1 When tested for gas consumption, the apparatus shall be set up as given in Annex D. The measurement of volume shall be made with a wet gas flow meter and with minimum consumption of 6 litres or volume displacement of two revolutions of the drum whichever is higher.

17.1.2 Multi burner appliances (namely, appliances having more than one burner) shall give within + 5 and –15 percent of the declared total gas consumption in g/h or heat input in kcal/h at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure with commercial LPG and with all the taps turned on.

17.2 It shall be possible to reduce the consumption rate of the burner to the following extent by providing a fixed simmer orifice in the gas tap:

a) For burners up to 60 l/h gas rate, 35 percent of the rated capacity; and

b) For burners above 60 l/h gas rate, 22 l/h or 26 percent of the rated capacity whichever is higher.

17.2.1 Burners with a gas rate of up to 20 l/h at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure and appliances incorporating piezo-electric ignition shall, however, be exempted from **17.2**.

17.2.2 When the gas consumption of a burner is reduced to simmer as described in **17.2**, the flame shall not extinguish, blow off, strike back or form soot when tested with commercial LPG at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure.

18 IGNITION AND FLAME TRAVEL

18.1 There shall be easy and safe access for lighting and relighting each burner by a match stick and it shall be easy to see that the burner is lighted. Where

the burner or burners are lighted by automatic ignition (battery of flint-operated) or by a pilot flame, it shall not be possible for gas to be admitted to the main burner without being smoothly ignited by the pilot flame. Each burner should be at room temperature at the beginning of the test and should be tested in turn.

18.2 If a flame is applied to any of the outer row of the burner ports when the gas is flowing, flame travel shall be complete. This applies for the all pressures from 2 452 to 3 432 kN/m^2 (25 to 35 gf/cm^2), taps being fully opened and without a pan over the burner.

18.3 When the burner is ignited from a pilot flame and / or by an electric/electronic method, the ignition and flame travel shall be smooth at pressure from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2) with the burner tap turned full 'ON' and ignition shall be effected without undue delay after turning on taps.

18.4 When flame failure devices are used, it shall conform to **14** of IS 5116.

19 FLAME STABILITY

19.1 It shall be possible to operate the appliance with taps fully open at gas inlet pressure from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2) without the flame extinguishing, blowing off or striking back and without the formation of soot.

19.1.1 When the gas consumption of a burner is reduced to simmer after operating for half an hour at full 'ON', the flame shall not extinguish, blow off, strike back or form soot when tested with commercial LPG at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure.

19.2 Pilot flames shall be stable, without lifting or soot deposition, at gas inlet pressure from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2).

19.3 The fixed minimum pilot rate shall be sufficient to relight the main burner at 2 452 kN/m^2 (25 gf/cm^2) gas inlet pressure.

20 NOISE CONTROL

The ignition of the burner flames, their operation and turning 'OFF' shall not give rise to undue or excessive noise during all the operations.

21 FLASH BACK

21.1 A vessel having diameter suitable to cover the pan supports duly filled with water, shall be placed on the burner under test. The tap of the burner shall be turned 'ON' and gas shall be allowed to flow through the burner at full rate, with taps fully opened and gas lighted. After half an hour, the flame shall be immediately reduced to simmer and then brought back to full size. The operation shall be repeated five times. No flash back shall occur during the test. This applies for all pressures from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2).

22 FORMATION OF SOOT

22.1 A vessel, 150 mm diameter, full of water, shall be placed on the burner and the burner lighted at 'ON' position of the tap for one hour. After the test, no soot (unburned carbon) shall be deposited on the burner and on the bottom of the vessel. This applies for all pressures from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2).

23 RESISTANCE TO DRAUGHT

23.1 There shall be no extinction of the flames on any of the burners operating at *maximum* consumption when the appliance is placed in a general (not localized) current of air with a velocity of 2 m/s, as measured with a rotating vane anemometer. The location of the appliance relative to neighbouring walls and the direction of the draught shall be varied to correspond to likely conditions of appliance installation. This applies for all pressures from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2).

24 COMBUSTION

24.1 When tested according to the method laid down in Annex E, on no account the carbon monoxide/ carbon dioxide ratio of the exhaust gases of any burner, operating at any consumption at which the burner is stable at gas inlet pressure from 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2), exceed 0.02. It shall also be possible to obtain the required carbon monoxide/carbon dioxide ratio with the pan supports reversed or put in any other possible position or with a large skirted vessel placed over any burner. This test need not be performed on burners with a gas rate of less than 20 l/h at 2 942 kN/m^2 (30 gf/cm^2) gas inlet pressure.

24.2 The carbon dioxide and carbon monoxide content of the products of combustion shall be determined by the methods capable of giving accuracy of 0.5 percent and 0.001 percent, respectively, of the volume of the sample.

25 FIRE HAZARD AND LIMITING TEMPERATURES

25.1 In addition to the relevant requirements given in **23** of IS 5116, requirements given in **25.2** shall apply.

25.2 With burner lighted at full 'ON' position, the temperature of the flame at any point in a plane at a height of $H \pm 20$ mm from the top of the pan support shall not exceed 500°C, H is the height corresponding to the gas rate of the burner as shown in col 3 of Table

1 under Annex F. This test shall be performed on each burner. Thermocouple made from 0.5 mm diameter wire and placed in the centre of a stainless steel tube having outside diameter 10 mm *Max* and closed at the end along with temperature indicator shall be used for the measurement of the temperature.

26 THERMAL EFFICIENCY

When tested as specified in Annex F, the thermal efficiency shall be at least 64 percent for each burner with the pan support correctly on the pan supports. For this test, the net calorific value of the gas shall be employed. Thermal efficiency may be declared, if it is 68 percent and above.

27 CLASSIFICATION OF TESTS

27.1 Type Tests

The following shall constitute type tests:

a) Strength test (*see* **15**);
b) Gas consumption (*see* **17**);
c) Flash back test for materials of burners (*see* **5.2** of IS 5116);
d) Resistance to draught (*see* **23**);
e) Combustion test (*see* **24**);
f) Fire hazard and limiting temperature (*see* **25**);
g) Floor, wall, ceiling and surface temperature (*see* **23.1** and **23.2** of IS 5116); and
h) Thermal efficiency (*see* **26**).

27.2 Routine Tests

The following shall be carried out as routine tests:

a) Gas soundness (*see* **13**);
b) Ignition and flame travel (*see* **18**);
c) Flame stability (*see* **19**);
d) Noise control (*see* **20**);
e) Flash back (*see* **21**); and
f) Formation of soot (*see* **22**).

SECTION 3 GENERAL

28 INSTRUCTIONS

28.1 The appliance shall be accompanied by an instruction card giving the following information:

a) Brief instructions for installation and regulation which include piping and fitting of terminal, if any;
b) Rating of the burners in kcal/h (with commercial LPG);
c) Instructions for the correct operation of the appliance;
d) Country of origin;
e) The words 'For use with commercial LPG at 2 942 kN/m^2 (30 gf/cm^2); and
f) Thermal efficiency of 68 percent and above, when declared in accordance with **26** may use green label.

29 MARKING

29.1 Each appliance shall be legibly and indelibly marked with the following:

a) Manufacturer's name and/or initials or registered trade-mark;
b) Total gas consumption in g/h (with commercial LPG);
c) Rating of the burners in kcal/h (with commercial LPG);
d) Any special instructions for the safe use of the appliance;
e) The words 'For use with commercial LPG at 2 942 kN/m^2 (30 gf/cm^2 approximately)';
f) Country of origin; and
g) Thermal efficiency of 68 percent and above, when declared in accordance with **26** may use green label.

29.2 BIS Certification Marking

29.2.1 The gas stoves may also be marked with the Standard Mark.

29.2.2 The use of 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 a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from Bureau of Indian Standards.

30 PACKING

The gas stoves shall be packed as agreed to between the purchaser and the supplier, taking care of safety requirements as such during handling and transit to protect against damages.

ANNEX A

(Foreword)

IMPORTANT DEVIATIONS BETWEEN EN 30:1979 AND CORRESPONDING INDIAN STANDARDS

The European Standard EN 30 : 1979 covers most of the requirements covered in IS 4246, IS 4473, IS 4760 and IS 11480 read in conjunction with IS 5116.

The following are the deviations:

a) Due to continuous upgradation of the Indian Standard, the thermal efficiency of gas stoves is now specified as 64 percent minimum. Indian Standard also provides declaration of thermal efficiency on the nameplate, if it is 68 percent or above. The corresponding value in EN 30 is 58 percent.

b) The gas consumption is measured using air in Indian Standard for better repeatability and reproducibility compared to gas in European Standard.

c) Keeping in view of the cooking practices in India and the safety of the users, the Indian Standard limits the flame temperature at a particular height from the top of the pan support. Such test is not available in the European Standard.

d) Though both the standards are permitting a slight amount of leakage of gas in the appliance, the Indian Standard test method is through bubble leak indicator and the European Standard is by actual measurement. The rate of leak permitted in the European Standard is higher than the quantity specified in Indian Standard.

e) The European Standard specifies the limit of carbon monoxide in the product of combustion. The product of combustion is measured by carbon monoxide/carbon dioxide ratio in Indian Standard.

f) The Indian market has liquefiable petroleum gas (LPG) as the cooking gas. European countries have three different families of gases for the same purpose. Hence the European standard specifies the appliance which can be used and/or converted to other families of gases. Liquefiable petroleum gas (LPG) is categorized in the third family of gases and the production of appliances in India would be applicable only to this family.

ANNEX B

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*	*IS No.*	*Title*
1070 : 1992	Reagent grade water — Specification (*third revision*)	13432 (Part 1) : 1992	Gas leak detector for use with low pressure liquefied petroleum gas burning appliances — Specification: Part 1 Mechanical type
5116 : 1996	General requirements for domestic and commercial equipment for use with LPG (*third revision*)	13432 (Part 2) : 1998	Gas leak detector for use with low pressure liquefied petroleum gas burning appliances — Specification: Part 2 Electronic type
6480 : 1988	Glossary of terms relating to domestic and commercial gas burning appliances (*first revision*)		

ANNEX C

(*Clause* 15)

STRENGTH AND RIGIDITY TEST

C-1 PROCEDURE

C-1.1 The rubber support (grommet) if any, shall be removed and replaced with identical metal supports. The pan support and burner shall be removed and the distance between the sides of the appliance body being tested shall be measured.

A reference reading at the top surface of the body at the centre of the width shall be taken. A load of 250 N (25 kg) per burner shall be applied at the top surface subject to a minimum load of 500 N (50 kg) for a single burner stove. The load shall be applied without impact to a strip of steel having 20 mm thickness, 100 mm width and as long as the width of the appliance (*see* Fig. 1). This strip shall be placed in the centre of the top surface of the appliance and its length parallel to the front. The load shall be maintained for five minutes after which the measurement for deflection at top surface of body (at the centre of the width just in front of the strip) shall be taken with the load in position.

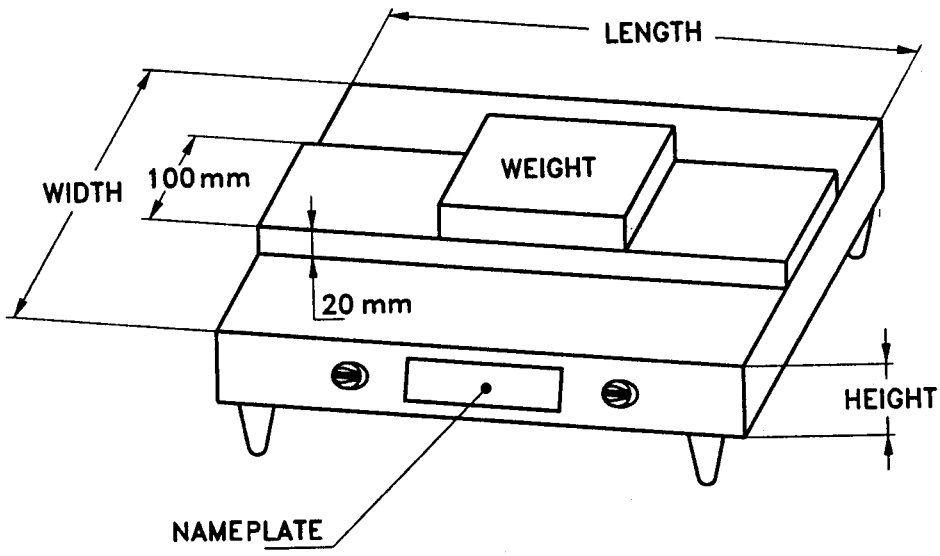


FIG. 1 STRENGTH TEST

ANNEX D

(*Clause* 17.1.1)

GAS CONSUMPTION TEST

D-1 PROCEDURE

D-1.1 The stove shall be set in accordance with **16** with the addition of a suitable device for measuring gas consumption. The wet gas meter, which is an instrument commonly used for this purpose, shall be set up in series with stove under test (*see* Fig. 2).

D-1.1.1 Clean and dry air shall be passed at 2 942 kN/m^2 (30 gf/cm^2) inlet pressure through the stove for a few minutes to purge the system of air and to establish the gas pressure required. Only one burner of the appliance shall be tested at a time and during the test all gas delivered to the stove shall flow through the jet of the burner being tested.

D-1.2 Temperature of the room during the test shall be between 25°C and 30°C.

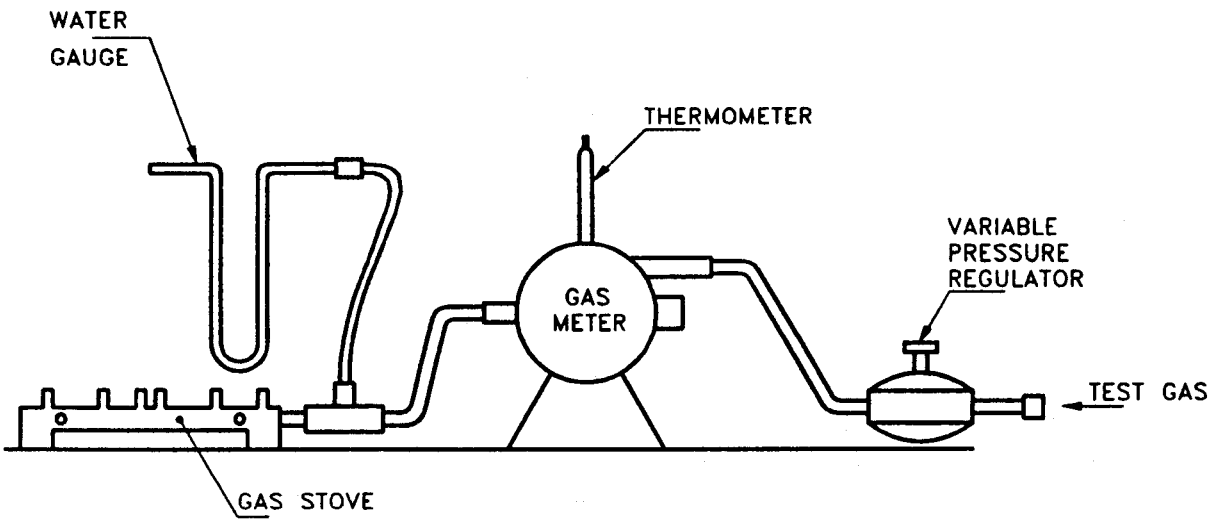


FIG. 2 TEST SET–UP FOR GAS CONSUMPTION

ANNEX E

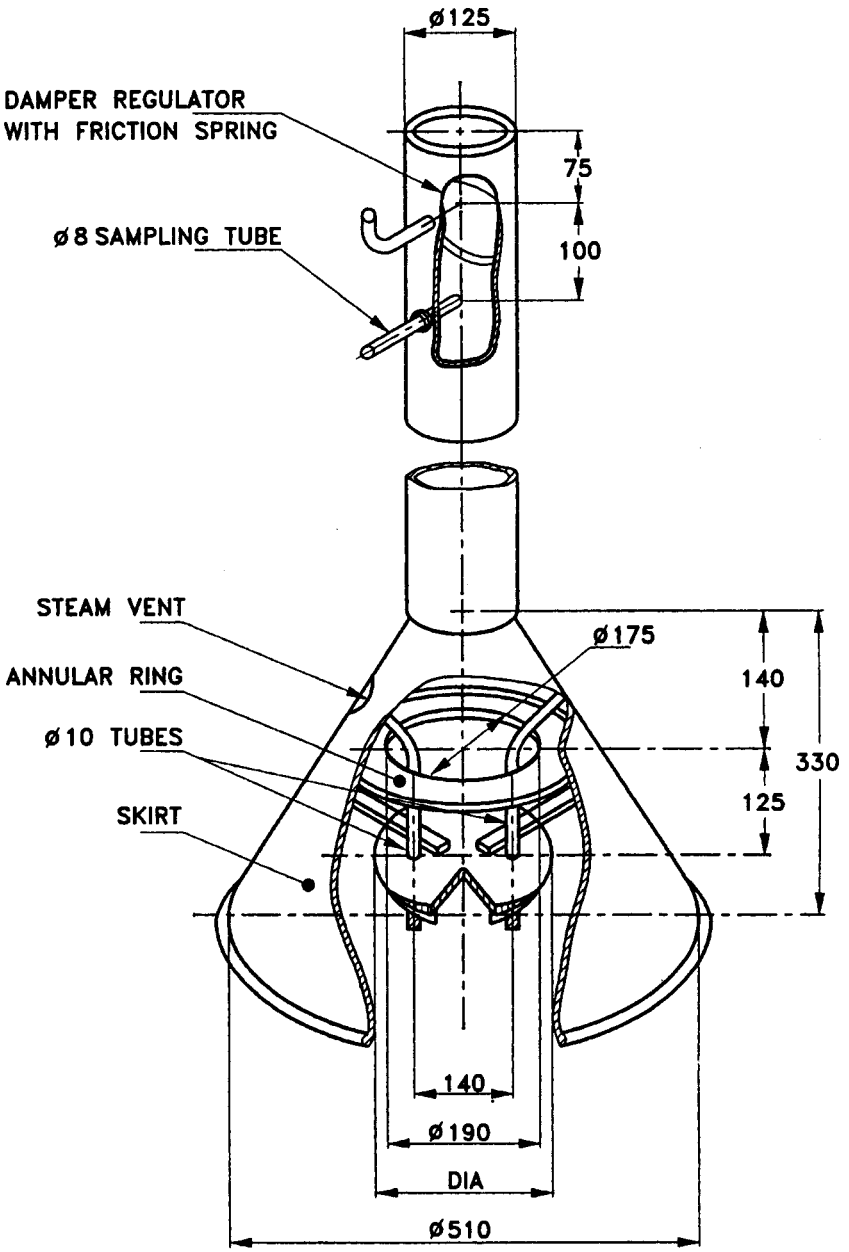
(*Clause* 24.1)

TEST METHOD FOR DETERMINATION OF CARBON MONOXIDE/CARBON DIOXIDE RATIO

E-1 PROCEDURE

E-1.1 The appliance shall be set-up in accordance with **16**. Before starting the test, a pan of 190 mm diameter and of suitable height and containing water sufficient for the test shall be placed over the burner. In addition, a collecting hood (*see* Fig. 3) suitable for the burners under examination shall be obtained.

E-1.1.1 The hood shall be so designed that, while



To correspond with pan dia given in Table 1
(All dimensions in millimetres)

FIG. 3 HOOD FOR BURNER

not interfering in any way with the normal combustion of the burner, it collects a fairly high proportion of the products of combustion. Also, it shall be such that the sample collected represents the whole of the combustion gases and not those from any particular point.

When using this hood, the damper provided shall be set or additional flue pipe added, so that spillage of the flue gases around the skirt is just prevented. With the sample hood in position over the burner under investigation, gas at inlet pressure of 2 452 kN/m^2 (25 gf/cm^2) shall be admitted and the burner operated for a few minutes before sampling commenced. The reason for this being that during the first few minutes the burner is warming up and the proportion of carbon monoxide may be high. However, this is not dangerous provided the burner works satisfactorily after heating up.

E-1.2 Any of the recognized methods having the prescribed accuracy may be used for gas analysis. For carbon monoxide, it is recommended that co-indicator of prescribed accuracy or iodine pentoxide method or catalytic method, for example, Drager method, the Katz method or infra red analysis methods may be used. Carbon dioxide may be tested with an Orsat apparatus, the Haldane apparatus or by infra red analysis.

E-1.3 Each burner shall be examined with gas at 2 452 kN/m^2 to 3 432 kN/m^2 (25 gf/cm^2 to 35 gf/cm^2) inlet pressure. It shall also be noted that each burner is tested separately or with all the possible combination of the other burners operating.

ANNEX F

(Clauses 25.2 *and* 26)

THERMAL EFFICIENCY TEST

F-1 PROCEDURE

F-1.1 The test shall be carried out by weighing the gas used. The gas shall be taken from a small bottle containing LPG weighing 1 kg to 2 kg. The bottle shall be fitted with an 'On/Off' valve and shall be connected to a regulator which, in turn, shall be connected to a pressure gauge and to the appliance. A second 'On/Off' gas valve shall be inserted in the gas ways upstream of the regulator as near as possible to the gas bottle. A typical layout of set-up necessary for this test is shown in Fig. 4.

F-1.2 The gas shall be passed at 2942 kN/m^2 (30 gf/cm^2) inlet pressure through the stove for a few minutes to purge the system of air and to establish the gas pressure required. Only one burner of the appliance shall be tested at a time and during the test all gas delivered to the stove shall flow through the jet of the burner being tested. The pan shall be selected and loaded in accordance with the requirements given in Table 1 and placed centrally over the burner being tested. The temperature of the water t_1 contained shall be noted and recorded as long as it remains constant. The bottle shall be disconnected, weighed, reconnected and valves (1) and (2) opened. The gas control tap shall then be opened and the gas shall be ignited. The water shall be allowed to warm up to about 80 °C when stirring is commenced and continued until the end of the test. The burner shall be put off when the temperature of water reaches 90 °C ± 1 °C. The stirring shall be continued and the maximum temperature t_2 shall be noted.

Next, the valves on the bottle and the gas line shall be closed and the bottle shall be disconnected and re-weighed. It is thus possible to estimate the mass of gas used during the period taken for the water to heat up. Thermal efficiency shall be calculated by the following formula:

$$E = \frac{100\,(G+W)\,(t_2 - t_1)}{MK}$$

where

E = thermal efficiency of the burner in percent,

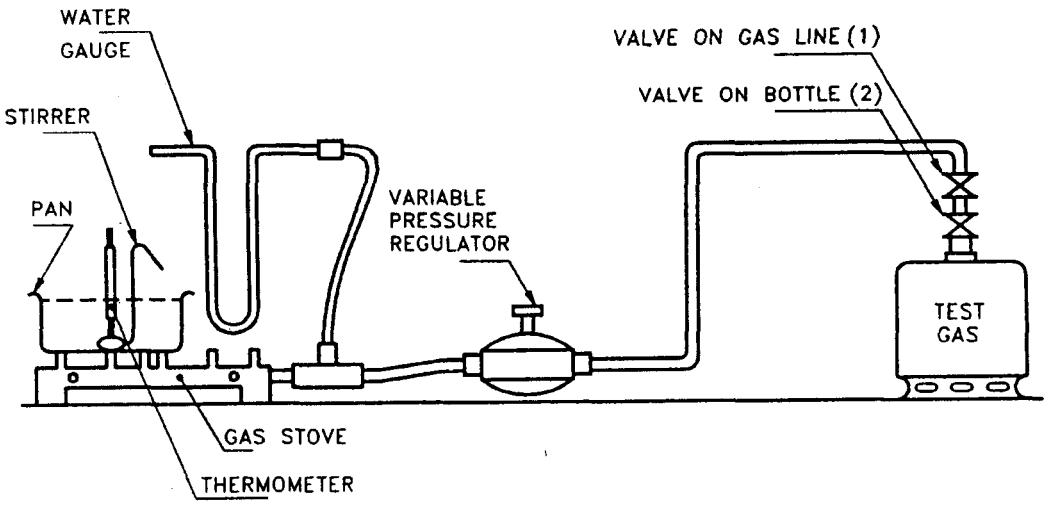


FIG. 4 TEST SET-UP FOR THERMAL EFFICIENCY BY WEIGHT

G = quantity of water in the vessel in kg,

W = water equivalent of the vessel complete with stirrer and lid,

t_2 = final temperature of water in °C,

t_1 = initial temperature of water in °C,

M = gas consumption in kg, and

K = calorific value of the gas in kcal/kg.

Table 1 Aluminium Pans for Thermal Efficiency Test

(Clauses 25.2 and F-1.2)

Gas Rate at STP	Pan Diameter (External)	Pan Height (External)	Total Pan Mass with LID	Mass of Water in Pan
l/h	mm ± 5%	mm	g ± 10%	kg
(1)	(2)	(3)	(4)	(5)
Up to 40	180	100	356	2.0
41-50	205	110	451	2.8
51-60	220	120	519	3.7
61-70	245	130	632	4.8
71-80	260	140	750	6.1
81-95	285	155	853	7.7
96-107	295	165	920	9.4

NOTES

1 Distilled water (*see* IS 1070) shall be used for test.

2 The pan shall be cylindrical with flat bottom.

3 The finish of the pan bottom from inside shall always be bright.

4 Above 107 l/h, pans shall be specially constructed to conform, as far as possible, with the principles used in formulating this table.

F-2 In performing the thermal efficiency test, the following points shall be noted:

a) The set-up shall be carefully checked for leak, before and after the test. If a leak is found after the tests, the results should be cancelled and the test repeated.

b) The room shall be free from draught.

c) The initial temperature of the room shall be between 25 °C and 30 °C. The water temperature shall be within ± 2 °C of the actual room temperature.

d) The net calorific value of gas is used. If this is not determined experimentally, the value may be taken as 10 900 kcal/kg for calculation.

e) At the start of the test, the burner shall be at room temperature.

f) The temperature of the water shall be measured by means of a mercury-in-glass thermometer of accuracy of 0.5 C the bulb of which is immersed to half the depth of the water in vessel.

g) Stirring shall be effected by means of a horizontal loop of 3 mm metal rod attached to an upright, which passes through a 6 mm, hole drilled in lid.

h) This test need not be performed on burners with a gas rate of less than 20 l/h at 2 942 kN/m^2 (30 gf/cm^2) inlet pressure.

j) Accuracy of weighing balance used shall be of 0.1 g for consumption measurement and 1 g for the other weights.

k) Specific heat of aluminium is 0.214.

m) For conducting thermal efficiency test, gas from the commercial cylinder (bottle) of LPG, the first two-thirds of which has been allowed to evaporate (to waste or in vapour withdrawal use), the remaining one-third shall be used for test. The use of last 1 or 2 kg of gas shall be avoided as this may contain heavy ends.

ANNEX G

(Foreword)

COMMITTEE COMPOSITION

Composition of Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee, ME 23

Organization	*Representative(s)*
Petroleum Conservation Research Association, New Delhi	SHRI K. K. DHINGRA (*Chairman*) SHRI PARAMJIT SINGH (*Alternate*)
Bharat Petroleum Corporation Ltd, Mumbai	SHRI GEORGE PAUL SHRI S. K. DEY (*Alternate* I) SHRI SURESH NAIR (*Alternate* II)
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Indian Oil Corporation (R&D), Mumbai	SHRI B. L. BANSAL SHRI A. N. KHAPRE (*Alternate*)
Khadi & Village Industries Commission, Mumbai	SHRI G. L. PATANKAR
LPG Equipment Research Centre, Bangalore	SHRI M. L. ANAND SHRI R. K. VERMA (*Alternate*)
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Welkin India, Faridabad	SHRI M. K. GUPTA SHRI RAHUL GUPTA (*Alternate*)
BIS Directorate General	SHRI M. L. CHOPRA, Director & Head (MED) [Representing Director General (*Ex-officio*)]

Member-Secretary
SHRI S. B. ROY
Director (MED), BIS

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