



TANZANIA DRAFT STANDARD

**MEDC12 (5716) P3 - Domestic gas stoves for use with liquefied petroleum gases -
Specification.**

O Foreword

The usage of Liquefied Petroleum gas (LPG) stove in Tanzania is growing very fast especially in the Urban areas where the biomass sources of fuel are insufficient. Most of these stoves are imported from different countries while others manufactured locally. These stoves abound to have different qualities, properties and specification.

Basing on this fact for issues of protecting the users against inferior products and assuring in importing quality products, this Tanzania Standard is established. This was done for the purpose of ensuring the availability of quality LPG cooking stoves to the users.

The standard takes into consideration, the thermal efficiency, safety and the associated environmental effects.

During the preparation of this Tanzania Standard, assistance was derived from the following standards:

IS 4246:2002 – Domestic gas stoves for use with liquefied petroleum gases – Specifications

IS 5116:1996 - Domestic gas stoves for use with liquefied petroleum gases – general requirements.

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 2452 - 3432 kN/m² gas inlet pressure.

3 TERMINOLOGY

For the purpose of this standard, the following terminology shall apply

3.1 Burner

A device for the final conveyance of the gas or a mixture of gas and air to produce a suitable flame which is maintained on or in it.

3.2. Burner Body

A main casting or pressing of a burner.

3.3. Liquefied Petroleum Gas (LP Gas or LPG)

A mixture of certain light hydrocarbons of the type of commercial butane, commercial propote and commercial butane-propane mixture which are derived from petroleum and are gaseous at normal ambient temperatures and atmospheric pressure but may be condensed to liquid state at normal ambient temperature and moderate pressure.

3.4. Tap

A type of valve on an appliance that controls fluid flow and will be liable to be kept in off position when appliance is not in operation.

3.5. Injector Jet

A jet, forming part of an injector, that may be removable and/or adjustable.

3.6. Primary Air

Air introduced into a gas stream before it leaves the burner port.

3.7. Calorific Value (Heat of Combustion)

The number of heat units liberated by the complete combustion of unit volume or mass of gas under specific conditions.

3.7.1 Gross Caloric Value

The sum of the number of heat units liberated by the complete combustion of the unit volume or mass of gas and heat released by condensation of water vapour produced from the condition.

3.7.2. Net Calorific Value

The gross calorific value minus the heat released by the condensation of water vapour produced from the combustion

4. GENERAL

4.1 The construction of all the parts of the equipment shall be sound and of high standard of workmanship and appropriate finish. The construction shall ensure durability and shall comply with the safety requirements.

4.2 Rivets, fastening screws, plugs, etc, shall not lead into gas passages, except where adequate provision has been made to ensure permanent gas-tight joints.

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

5 MATERIALS

5.1 The appliance shall be free from swarf, grit, and other foreign matters. Wherever practicable, rigid metal tubing shall be used for internal gas supplies integral with the appliance. If flexible tubing is used, it shall not be fitted on the outlet side of any control which is capable of cutting off the gas completely, except where screwed metal connections are fitted. The use of low pressure rubber or plastic tubing fitted or pushed on nozzle is not recommended.

5.2 Plastic components which are liable to heating (for example, tap handles, push buttons, etc) shall be free of fissures, distortion, blemishes and discolouration and shall not show signs of ageing when tested as given in Annex D.

5.3 The material used in the construction of the appliance or parts of the appliance shall be resistant to wear, corrosion and deterioration occurring in the normal use. The burner parts shall not melt or distort when the stove burner is operated with flames flashed back for half an hour in the mixing tube.

5.4 Non-metallic materials normally in contact with the gas shall not change in weight or volume by more than 15 percent after being immersed in pentane or LPG for 72h at room temperature, when tested according to Annex F.

5.5 The main body of the burner (including mixer head, mixing tube and burner head) shall be of substantial and durable construction. Metals having a melting point below 510°C shall not be considered acceptable for top burners while metals having a melting point below 800°C shall not be considered for oven, griller or auxiliary burners or any other combination thereof.

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 centers 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 universal 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 The 'ON', 'OFF' and any fixed position of tap handles shall be clearly and durably indicated or shall be obvious by design or position. Where it is not obvious which tap operates which burner, some indication shall be given. All taps shall close in the same direction. The direction of rotation of a tap knob (handle) from off-on-simmer shall be anti-clockwise. Taps shall be designed so that when placed in any position and viewed from a distance of 3 m, will definitely indicate whether the valve is open or closed or in intermediate position.

8.2 Where taps are fitted with adjustable stops, there shall be means for locking the stops in position. If screws are used for this purpose, they shall not lead into gas passages.

8.3 The external finished surfaces shall be easily cleanable.

8.4 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

9.1 The relevant requirements given in 8.1 and 8.2 and the following shall apply

9.2 The appliance shall have at least one tap for each burner

9.3 Preferably all taps (excluding pilot taps) should lock in the 'OFF' position but in all cases it shall be impossible for any handle or tap to move accidentally, for example, by the weight of plugs or handles or when caught by clothing. If this requirement is satisfied by means of an automatic locking device, the tap shall be easy to operate with one hand.

9.4 Taps shall be so made that in normal use and with reasonable application of lubricant, the gas passages do not become blocked

10 INJECTOR JETS

10.1. Injector Jet shall be made of metal, with or without ceramic tip. The melting point of the metal shall not be less than 650°C.

11 BURNERS

11.1 The construction of the burners and the assembly shall allow their dismantling from the supports easily with or without the use of tools.

11.2 The burner supports shall be rigid and shall be fixed in their place. Their construction shall ensure the stability of the burners and shall prevent their undue movement in a horizontal plane.

11.3 The lightness of the joints in the burner assembly shall not depend upon adhesives or any kind of packing.

11.4 If primary air regulators are used, they shall be so designed that they are not easily maladjusted by the user and the construction shall be such that primary air adjustment can be made with the burner in place.

11.5 If the burner is made and assembled in two or more parts they shall be so designed to provide proper self-locating arrangement so that they are always re-assembled to its original design preventing any maladjustment in their assembly. This shall also be applicable for primary air regulators

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

11.7 The appliance comprising two or more burners shall include one burner having a rating of at least 1490 kcal/h, based on net calorific value of the gas (when using commercial LPG).

12 BURNER POT SUPPORTS

12.1 The design of the pot supports shall be such that it is practicable to support a pot 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 pots.

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

13 GAS LEAK PROOFNESS

13.1 All gas carrying parts of the appliance shall be sound and these parts when connected, to form a complete assembly shall also be leak proof against any gas leakage. The complete assembly shall be checked at 14.71 kN/m^2 . The details of test are given in Annex G

14 GAS INLET CONNECTIONS

14.1 Gas inlet pipe/tube shall be made from brass or mild steel.

14.2 Where pipes/tubes for flexible tubing are fitted, they shall be so positioned as to facilitate fitting of the tubing and also to prevent heating of the tubing to more than 60°C . Shape of pipes/tubes is given in Fig. 1.

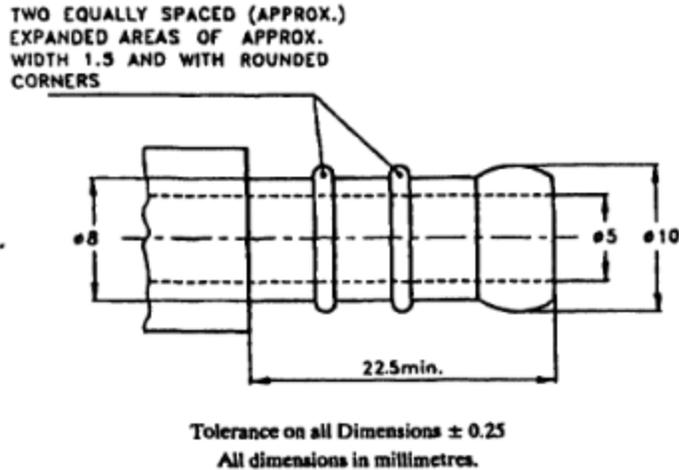


Figure 1 – Pipe/tube for 6.4mm tubing

14.3 The pipe/tube used for main gas manifold shall be of mild steel. The wall thickness of main gas

manifold shall be 1.6 mm + no limit/ - 0.15 mm. The external surface of the gas manifold shall be treated

to resist corrosion. Any other connection made from the main gas manifold shall be only metallic

14.4 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 A, the vertical resultant deflection of the top surface measured at the center of length of the body, shall not exceed 2mm and the distance between the opposite sides (lengthwise and widthwise) shall not change by more than 5mm.

16 GENERAL CONDITIONS OF TEST

16.1 During the tests the initial adjustment of appliance shall not be altered unless specifically required in the test procedure. The appliance shall be adjusted and operated in accordance with the instructions given on or issued with the appliance. Before any tests are made the appliance shall be operated at its full working temperature for a sufficient period to remove any temporary protective coating, which might interfere with observations. The gas connections and system up

to and including the burners shall be examined for leaks before and after test. The performance test results shall not be valid unless the system is sound. The appliance shall be at room temperature at the start of each test unless otherwise stated.

16.2 The room in which tests are conducted shall be adequately ventilated but free from perceptible draughts. The gas/air shall be supplied to the appliance through a control valve, an adjustable pressure regulator and an accurate meter with a pressure gauge on its inlet. A pressure gauge shall be fitted to the inlet of the appliance and additional water manometer to any pressure test points on the appliance. The gas/air pressure shall be measured correct to 2.5 mm water gauge at the inlet to the appliance and controlled so that any variation does not exceed 2.5 mm water gauge.

16.3 Except where otherwise stated, the appliance shall satisfy the performance requirements using LPG. Wherever the combustion characteristics of burners are concerned, each burner shall be tested separately and in all possible combinations with other burners. This procedure shall be used for appliance with up to four burners. For appliance with larger number of burners, the test procedure becomes impossibly long and discretion shall be exercised to eliminate tests on combinations of widely separated and which are fitted in appliance of open construction are unlikely to interfere with the combustion of each other.

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 2942 kN/m² 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 airflow at STP so obtained to be converted to flow of LPG at STP.

NOTE - For this test, 1 litre of LPG = 2.46 g.

17.1.1 When tested for gas consumption, the apparatus shall be setup as given in Annex B.

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 2942 kN/m² 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 60L/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 2942 kN/m² 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 2942 kN/m² 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 or 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 2452 to 3432 kN/m² taps being fully opened and without a pot 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 2452kN/m² to 3432 kN/m² with the

burner tap turned full 'ON' and ignition shall be effected without undue delay after turning on taps.

19 FLAME STABILITY

19.1 It shall be possible to operate the appliance with taps fully open at gas inlet pressure from 2452kN/m² to 3432kN/m² 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 2942kN/m² gas inlet pressure.

19.2 Pilot flames shall be stable, without lifting or soot deposition, at gas inlet pressure from 2452kN/m² to 3432kN/m²

19.3 The fixed minimum pilot rate shall be sufficient to relight the main burner at 2452kN/m² 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 pot 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 pressures ranging from 2452 kN/m² to 3432kN/m²

22 FORMATION OF SOOT

22.1A vessel, 150mm 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 pressures ranging from 2452kN/m² to 3432kNm²

23 RESISTANCES 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 2m/s, as measured with a rotating vane anemometer. The location of the appliance relative to neighboring walls and the direction of the draught shall be varied to correspond to likely conditions of appliance installation. This applies for all pressures from 2452kN/m² to 3432kN/m²

24 COMBUSTION

24.1 When tested according to the method laid down in Annex C, 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 2452kN/m² to 3432kN/m², exceeds 0.02. It shall also be possible to obtain the required carbon monoxide/carbon dioxide ratio with the pot supports reversed or put in any other possible position or with a large skirted vessel placed over any burner. This test needs not to be performed on burners with a gas rate of less than 20L/h at 2942kN/m² 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 With burner lighted at full 'ON' position, the temperature of the flame at any point in a plane at a height of $H \pm 20\text{mm}$ from the top of the pot support shall not exceed 500°C . This test shall be performed on each burner. Thermocouple made from 0.5mm diameter wire and placed in the centre of a stainless steel tube having outside diameter 10mm max., and closed at the end along with temperature indicator shall be used for the measurement of the temperature.

25.2 Surface Temperatures

When operated as described in 25.2 no portion of the surface of the appliance, other than a working surface, likely to be accidentally touched shall exceed 120°C (working surfaces include pot supports, oven flue outlets, grill covers and plate racks).

26 THERMAL EFFICIENCY

When tested as specified in Annex E, the thermal efficiency shall be at least 64% for each burner with the pot support correctly on the pot 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 CLASSIFICATIONS OF TESTS

27.1 Routine Tests

The following shall be carried out as routine 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);
- d) Resistance to draught (see 23);
- e) Combustion test (see 24);
- f) Fire hazard and limiting temperature (see 25); and
- g) Thermal efficiency (see 26).
- h) Gas soundness (see 13);

- i) Ignition and flame travel (see 18);
- j) Flame stability (see 19);
- k) Noise control (see 21)
- l) Flash back (see 21); and
- m) Formation of soot (see 22).

28 INSTRUCTIONS TO APPLIANCE

28.1 The appliance shall be accompanied by an instruction manual 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; The words 'For use with commercial LPG at 2942kN/m² and
- e. Thermal efficiency of 68 percent and above, when declared in accordance with 26 may Use green label.

9 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 2942kN/m²'.
- 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 TBS Certification Marking

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

30 PACKING

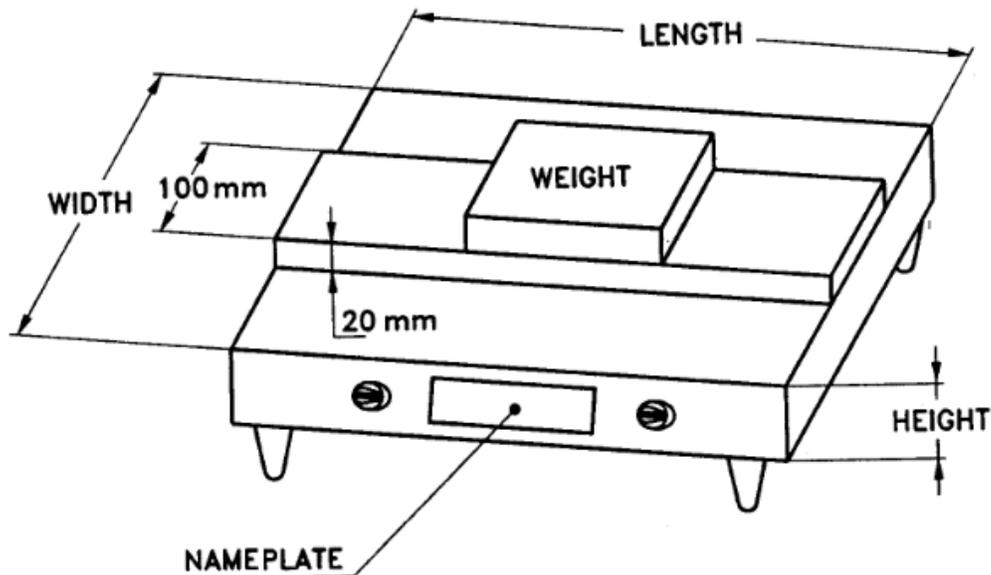
The gas stoves shall be packed as agreed to between the purchaser and the supplier, taking care of safety requirements as such during handling and transit to protect against damages.

For stakeholders comments only

ANNEX A
STRENGTH AND RIGIDITY TEST

A-1 PROCEDURE

A-1. 1 The rubber support (grommet) if any shall be removed and replaced with identical metal supports. The pot 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 250N per burner shall be applied at the top surface subject to a minimum load of 500N for a single burner stove. The load shall be applied without impact to a strip of steel having 20mm thickness, 100mm 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.



IG.

Fig. A1 - Strength test

ANNEX B

GAS CONSUMPTION TEST

B-1PROCEDURE

B.1.1 The test shall be in accordance to 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. B1)

B.1.1.1 Clean and dry air shall be passed at 2942kN/m² inlet pressure through the stove for a few minutes to purge the system of air and 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.

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

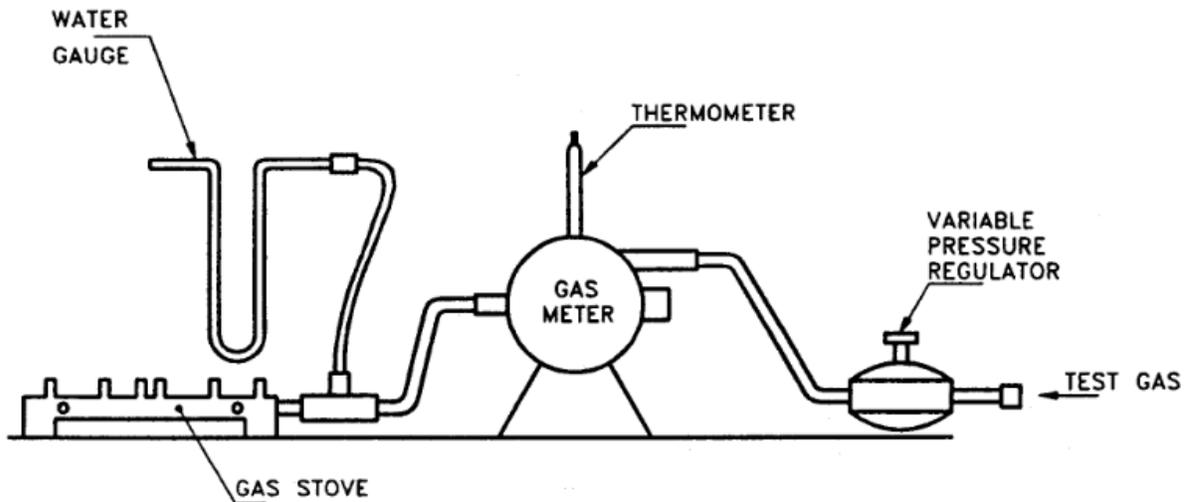


Fig. B1 – Test set up for gas consumption

ANNEX C

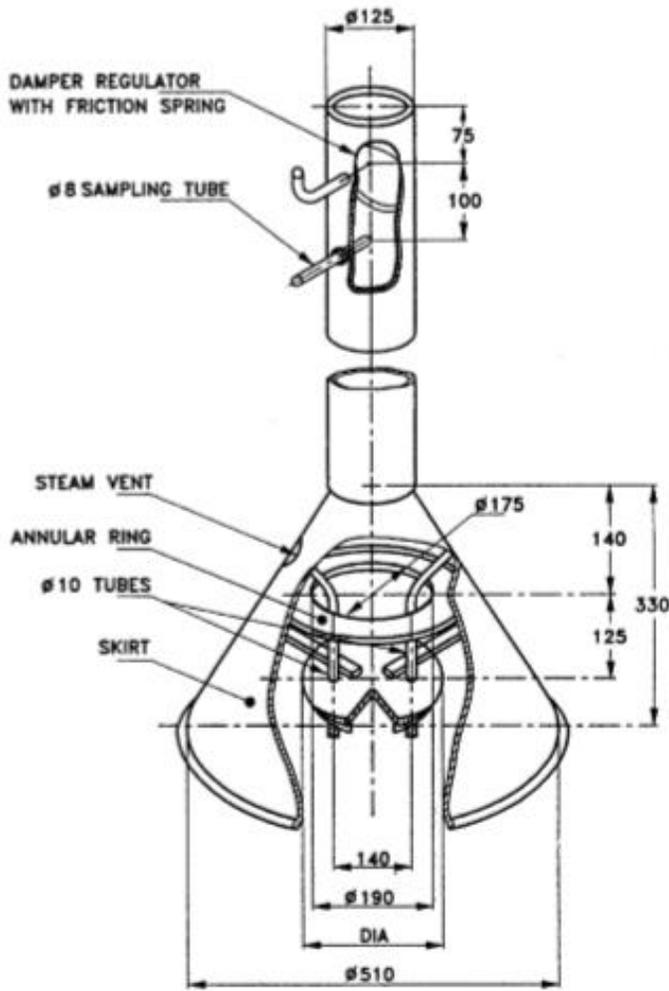
TEST METHOD FOR DETERMINATION OF CARBON MONOXIDE/CARBON DIOXIDE RATIO

C-1 PROCEDURE

C-1.1 The appliance shall be set-up in accordance with clause 16. Before starting the test, a pot of 190mm 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.

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

For stakeholders comments only



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

Fig. C.1 - 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 2452 kN/m² shall be admitted and the burner operated for a few minutes before sampling commenced. The reason for this being that during

the fast 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.

C-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 pent oxide 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.

C-1.3 Each burner shall be examined with gas at 2452kN/m² to 3432kN/m² inlet pressure. It shall also be noted that each burner is tested separately or with all the possible combination of the other burners operating.

For stakeholders comments only

ANNEX D

METHOD OF TEST FOR PLASTICS COMPONENTS

D - METHOD

D - 1.1 The test shall be made in a dry products free heating cabinet. Where the plastics are integral with, pushed on or secured to another component, the stressed condition shall either be simulated or, where practicable, the plastics part shall be assembled to the mating component.

D - 1.2 Visually inspects the component to establish its initial condition. Place the stressed component in the cabinet for a continuous period of 48 h at a temperature of 60°C, after which inspect it again.

D- 1.3 If during the final examination it is observed that the plastics part has sustained any fissures, distortion, blemishes or discolouration it shall be deemed to have failed

For Stakeholders Comments Only

ANNEX E
THERMAL EFFICIENCY TEST

E-1 PROCEDURE

E-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 2kg. 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. E1.

E-1.2 The gas shall be passed at 2942kN/m² 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 pot 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 obtained.

Next, the valves on the bottle and the gas line shall be closed and the bottle shall be disconnected and reweighed. 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 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.

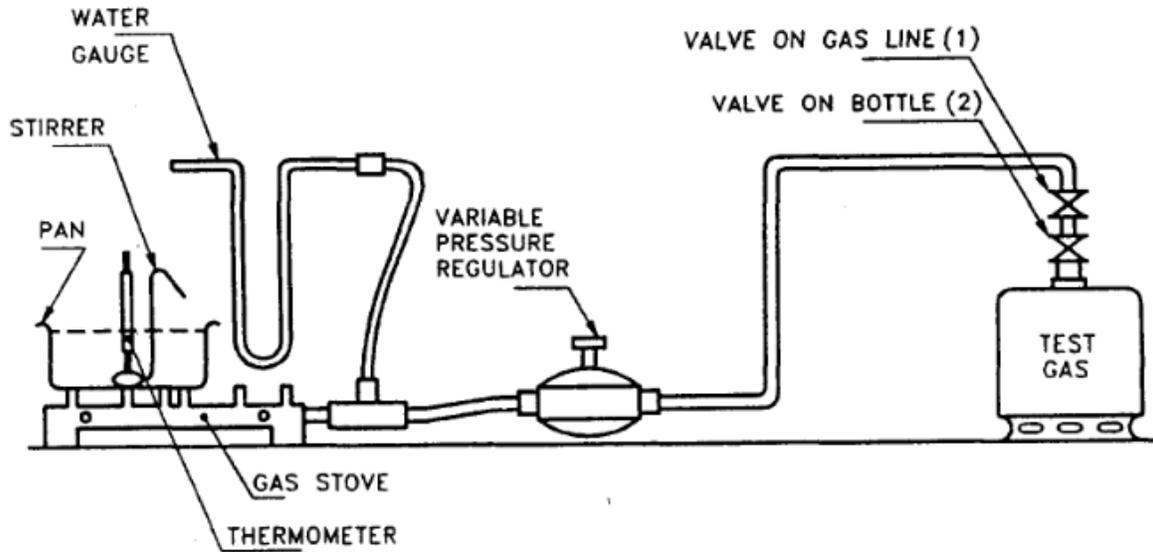


Fig. E1 Test set-ups for thermal efficiency by weight

For stakeholders

Table 1 - Aluminium Pots for Thermal Efficiency Test

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 shall be used for test.
2. The pot shall be cylindrical with flat bottom.
3. The finish of the pot bottom from inside shall always be bright.
4. Above 107 I/h, pots shall be specially constructed to conform, as far as possible, with the principles used in formulating this table.

E-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.
- d) The water temperature shall be within $\pm 2^{\circ}\text{C}$ of the actual room temperature.
- e) The net calorific value of gas is used. [f this is not determined experimentally, the value may be taken as 10900 kcal/kg for calculation.
- f) At the start of the test, the burner shall be at room temperature.

- g) 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.
- h) 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.
- i) This test need not be performed on burners with a gas rate of less than 20W at 2942 kN/m² inlet pressure.
- j) Accuracy of weighing balance used shall be of 0.1 g for consumption measurement and 1g for the other weights.
- k) Specific heat of aluminium is 0.214.
- l) 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.

For stakeholders comments only

ANNEX F

METHOD FOR DETERMINATION OF SWELLING OF MATERIALS

F-1 PROCEDURE

F-1.1 Weigh a piece of material under examination in air and then in water; and calculate the volume. Thereafter, immerse in pentane for 72 h at room temperature. In case liquid pentane is not available, immerse the piece in LPG in a sealed container capable of withstanding the vapour pressure of LPG to be expected. After 72 h. withdraw the sample and allow to weather in air for 5 min and reweigh in air and water for estimation of volume. In case of loss of weight, care shall be taken not to confuse it with the removal of small bits of grease, which may have been present in the sample under test. If this is suspected, perform the test on two samples, wash one of them for a few minutes in liquid pentane before commencing the test. If deterioration in the properties of the compound are suspected as a result of loss of weight, then obtain the whole of the component, such as diaphragm or O-ring and subject to the test as described above reassembled in the appliance and tested for operation in the usual way.

For Stakeholders Comments Only

ANNEX G
METHOD FOR TEST FOR GAS SOUNDNESS

G-1 PROCEDURE

G- 1.1 The appliance shall be tested for gas soundness by the following method:

Subject the appliance to be tested to an air supply at a pressure of 150 gf/cm^2 with the bubble leak indicator (see Fig. G1) in the air supply line. Apply this pressure with all the taps of the appliance closed and examine the bubble indicator for the appearance of bubbles. The interval between successive bubbles passing through it shall not be less than 10 s. Repeat the test with all the jets of the appliance sealed and all the taps open. Repeat the two tests after the taps have been turned 'ON' and 'OFF' ten times.

G- 1.2 The method given below shall be used to locate the point of leakage:

Immerse the appliance to be tested or the part through which the gas flows assembled in working condition, in a water-bath at room temperature. Then connect it to an air supply at a pressure of 150 gf/cm^2 for a minimum period of 10 s with all the taps of the appliance closed and the appliance or the tested parts shall be examined for leakage of air.

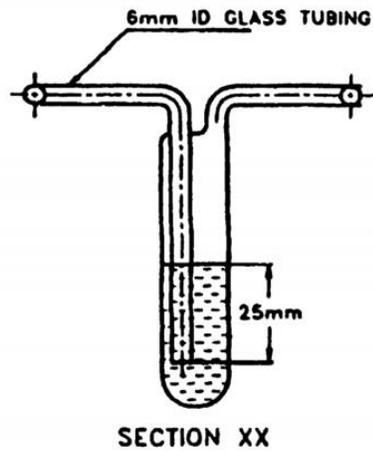
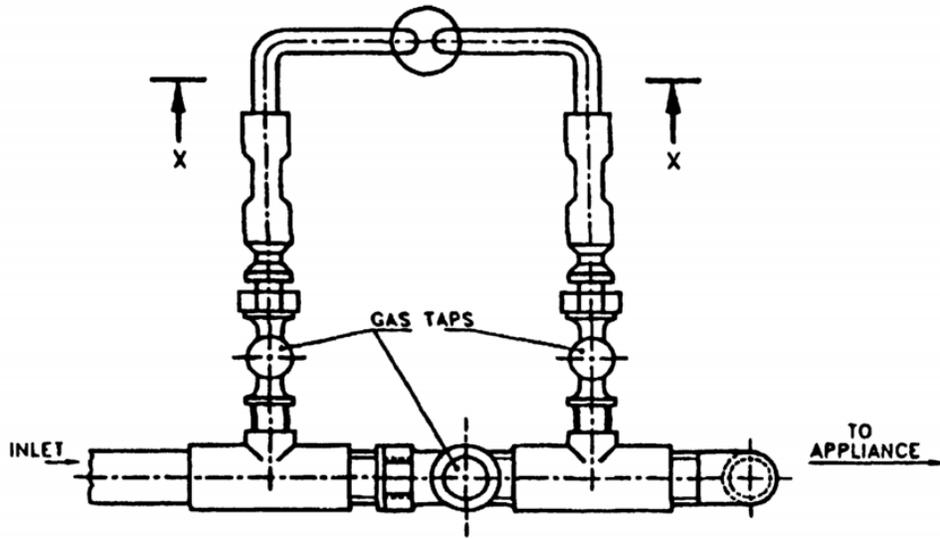


Figure G1- Bubble leak indicator