

*Indian Standard*  
SPECIFICATION FOR  
DOMESTIC STORAGE TYPE WATER  
HEATERS FOR USE WITH LPG

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**BUREAU OF INDIAN STANDARDS**  
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NEW DELHI 110002

# *Indian Standard*

## SPECIFICATION FOR DOMESTIC STORAGE TYPE WATER HEATERS FOR USE WITH LPG

Domestic and Commercial Gas Burning Appliances  
(Pressure Type) Sectional Committee, CPDC 23

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0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 24 April 1969, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Consumer Products Division Council.

**0.2** IS: 5116-1969\* to which reference has been made in this standard with regard to general requirements as well as methods of tests, is a necessary adjunct to this standard. Should, however, any deviation exist between the requirements of the former and those of this standard, provisions of the latter shall apply.

**0.3** Compliance with this standard does not of itself guarantee that satisfactory service will be attained. Conditions of use vary greatly and it is necessary to relate the standards of performance to the actual use to which the appliance will be subjected during its life.

**0.4** In preparing this standard, assistance has been derived from B.S. 2883:1964 'Specification for domestic instantaneous and storage water heaters for use with liquefied petroleum gases' issued by the British Standards Institution.

**0.5** Attention is invited to **A-1 (c)** which calls for an agreement between the purchaser and the supplier or which permits the purchaser to use his option for selection to suit his requirements.

**0.6** 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†. 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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\*General requirements for domestic and commercial equipment for use with LPG.

†Rules for rounding off numerical values (*revised*).

## 1. SCOPE

**1.1** This standard specifies the constructional and performance requirements of domestic storage type water heaters for use with liquefied petroleum gases at a working pressure of 30 gf/cm<sup>2</sup>, designed to provide a ready supply of hot water at a maximum water temperature of 85°C, having nominal capacities between 6 and 100 litres.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard the following definitions, in addition to the definitions given in 2 of IS : 5116-1969\* shall apply.

**2.1 Storage Type Water Heater** — A self-contained appliance in which a volume of water is heated under thermostatic control and stored for use when required.

## 3. MATERIALS

**3.0** In addition to the relevant material requirements specified in Section 1 of IS : 5116-1969\*, the requirements given in 3.1 to 3.4 shall apply.

**3.1** Apparatus plates and all bosses for screwed connection shall be made of gunmetal or brass of brazing quality. All pipes for water and gas shall be of copper, brass or other suitable material not inferior to copper or brass in resistance to corrosion under normal working conditions.

**3.2** Outer casing of the water heater shall be constructed from corrosion resisting material or shall be adequately protected from corrosion on all surfaces.

**3.3** The material used for lagging the water heater shall be such that it does not corrode the container or other parts in contact with it and does not crumble, sag, or deteriorate in use to such an extent that its efficiency is impaired. It shall be immune to attack by vermin and moisture.

**3.4** The gas cocks and taps shall be made of a material prescribed in 4.6 of IS : 5116-1969\*.

## 4. CONSTRUCTION

**4.0** In addition to the relevant constructional requirements specified in Section 1 of IS : 5116-1969\*, the requirements given in 4.1 to 4.17 shall apply.

**4.1** The material used for the container shall be of adequate thickness to provide sufficient mechanical rigidity and adequate strength to withstand the pressure test as given in Appendix A.

\*General requirements for domestic and commercial equipment for use with LPG.

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**4.2** All seams, joints, bosses for screwed connections and flanges of permanent nature shall be secured by welding or brazing or soldering. If soft solder (tin-lead alloy) is used for jointing, the solder shall not be depended upon for mechanical strength and this shall be assured by spot welding, dovetailing, riveting or other similar methods.

**4.3** The lagging material if provided shall be packed and supported in a manner which precludes the possibility of large air pockets developing within it.

**4.4 Fixing** — There shall be adequate provision for fixing and supporting the water heaters so that no stress is transmitted to water pipes or gas pipes.

**4.4.1** Water heaters may be arranged for floor or wall mounting.

**4.5 Facility of Maintenance** — Similar parts of water heaters of the same make, model and size shall be readily interchangeable. The parts which may require maintenance or replacement shall, as far as practicable, be so located as to assure easy access and replacement.

**4.5.1** Each gas jet or burner complete with jet shall be readily accessible for replacement and shall bear a characteristic jet or burner identification mark.

**4.5.2** It shall be possible to remove the burner without breaking the inlet and outlet water connections or the flue gas connection of the appliance or draining the tank.

**4.5.3** To remove the water and gas sections the use of screw drivers and adjustable spanners only shall be required.

**4.5.4** The component parts and particularly heat exchanger shall be easily accessible and easy to clean. (Vessels whose interiors are inaccessible shall be accepted if fitted with a suitable drain plug easily recognisable and accessible.)

**4.6** Gas inlet connections shall conform to the requirements given in **4.6.1** below and **17** of IS:5116-1969\*.

**4.6.1** The gas inlet connections for different appliance ratings shall be as follows:

<i>Maximum Rating of Appliance</i>	<i>Minimum Bore</i> mm
Up to and including 10 080 kcal/h	6
Over 10 080 kcal/h and including 25 200 kcal/h	9
Over 25 200 kcal/h	13

\*General requirements for domestic and commercial equipment for use with LPG.

**4.7 Water Connections** — Whenever the water connections to the water heaters including valves, taps, pipes and pipe fittings are threaded, the screw threads shall comply with IS: 554-1964\*. The diameter of water connections for inlet and outlet used on water heaters shall be as follows (see also IS: 404-1962† and IS: 1239-1964‡):

Capacity	Minimum Size
l	mm
6	15
15	
25	
35	
50	20
70	
100	

**4.7.1** It shall be possible to descale all water ways susceptible to the formation of scale.

**4.8 Gas and Water Taps** — The water heaters shall be provided with such gas and water taps as are essential for normal operation of the appliance by the user. This requirement does not include water taps for control at outlets remote from the appliance. If taper-plug type water taps are used as a part of the water heater, they should comply with the requirements of taper plug gas cocks.

**4.8.1 Gas Taps** — These shall conform to 7.1 and 7.12 of IS: 5116-1969§. These taps shall be accessible to the user, to enable the gas supply to the pilot and main burner to be turned on and off. On heaters with an input exceeding 10 080 kcal/h either a pilot gas tap which interlocks with the main gas tap, or a 2-stage gas tap with a 'pilot' position, should be provided.

**4.9 Gas Rate Adjusters** — Where provided, gas rate adjusters shall be set and sealed by the manufacturer and shall not be liable to accidental alteration.

**4.10 Primary Air Regulator** — Any aeration adjuster shall not be capable of closing the air inlet completely and shall not be liable to accidental alteration.

**4.11 Jet Fixing** — It shall not be possible to loosen completely burner jets or injector jets without the use of tools.

\*Dimensions for pipe threads for gas list tubes and pressure tight screwed fittings (revised).

†Specification for lead pipes (revised).

‡Specification for mild steel tubes and tubulars (revised).

§General requirements for domestic and commercial equipment for use with LPG.

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**4.12 Pilot Burners** — A lighting pilot shall be provided if the heat input exceeds 1 500 kcal/h.

**4.12.1** Pilots shall conform to the requirements given in 12 of IS:5116-1969\*.

**4.12.2** Pilot burners must be so fitted that they can be easily removed.

**4.13 Flame Failure Device** — Every appliance shall be incorporated with a flame failure device and shall satisfy the requirements specified in 13 of IS:5116-1969\*.

**4.14 Flue Outlet** — The appliance shall have provision for connection to a flue outlet unless the heat input does not exceed 1 500 kcal/h or the storage capacity does not exceed 25 litres.

**4.14.1** All appliances of capacity over 14 litres of water or gas consumption of over 250 g/h, shall be fitted with a connection to a vent pipe for the combustion gases.

**4.14.2 Draught Diverter** — Every water heater requiring connection to a flue shall incorporate a draught diverter.

**4.15 Gas Pressure Tapping** — A gas pressure tapping shall be fitted after the automatic gas valve. The pressure required at the point shall be durably marked in g/cm<sup>2</sup> near the tapping.

**4.16 Filter** — A suitable filter shall be provided in the gas way before the thermostatic valve and the pilot gas tapping.

**4.17 Water Regulator** — Appliances with water surfaces open to atmosphere must be provided with a device intended for regulating the rate of flow of the water.

## 5. PERFORMANCE REQUIREMENTS

**5.0** In addition to the relevant requirements specified in Section 2 of IS:5116-1969\*, the requirements given in 5.1 to 5.6 shall apply.

**5.1 Combustion** — When sampled as detailed in 5.1.1, the carbon monoxide/ carbon dioxide ratio of the products of combustion shall not exceed 0.02 at any rate between the minimum operational rate and an overload rate of 12.5 percent above the manufacturer's normal rate. Test shall be made at a sufficient number of heat input rates to determine the combustion performance over the whole of the prescribed range.

**5.1.1** All appliances shall be fed with cold water so as to maintain a temperature rise of  $16 \pm 5^{\circ}\text{C}$  at normal heat input, and sampling shall be carried out when thermal equilibrium has been established. Wherever

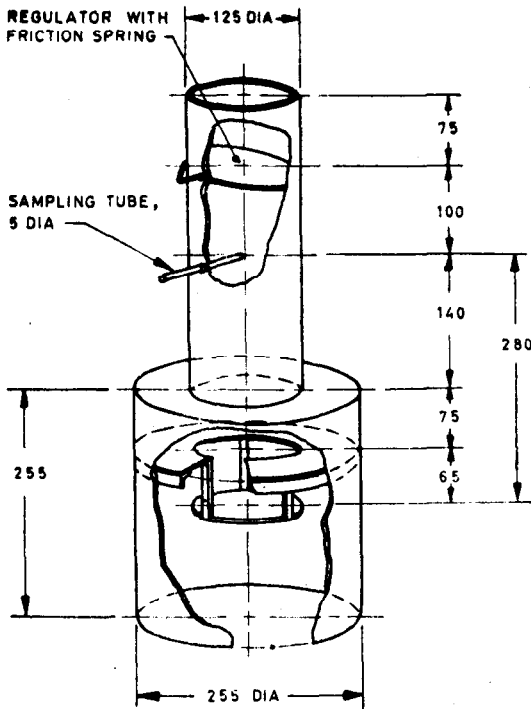
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\*General requirements for domestic and commercial equipment for use with LPG.

practicable a sampling hood shall be used having the following characteristics:

- a) It shall collect all the products from the appliance,
- b) Products shall not spill from the periphery of the hood,
- c) There shall not be undue dilution of products with excess air, and
- d) The hood shall not interfere with the combustion of gas in the water heater.

A hood suitable for most purposes is shown in Fig. 1. Where the hood would interfere with test conditions, the products of combustion shall be collected from a convenient part of the flue duct. This may be done by means of a L shaped probe inserted into the duct and arranged so that the open end can scan the duct cross-section while sample is withdrawn. When the infra-red gas analyzer is used, complete mixing may be ensured by passing the sample to a 1-litre flask; alternatively the products may be drawn from the probe into an aspirator.



All dimensions in millimetres.

FIG. 1 HOOD FOR WATER HEATERS

**5.2 Draw-off Water Temperature**—When tested according to method



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given in Appendix B, draw-off water temperature shall be according to the requirements given in 5.2.1 and 5.2.2.

**5.2.1** The maximum water temperature obtainable at the highest thermostat setting shall be as follows:

- a) It should not exceed 70°C under equilibrium conditions and unless water is required for special purposes; and
- b) It shall not exceed 90°C, if successive small quantities are drawn at frequent intervals.

**5.2.2** The outlet water temperature obtained after drawing-off quantity of water equal to half the total capacity of the water heater shall be within 8°C of the highest temperature obtained.

**5.3 Antidrip Device**— The storage water heaters with open delivery shall be provided with antidrip device. The quantity of water required to cause water to flow through the outlet shall be between 2.5 and 4 percent inclusive of water capacity of the container when tested in accordance with the method described in Appendix C. The device shall be so designed that a continuous flow from the outlet of the heater is obtained with not more than 50 percent of the manufacturer's normal flow rating, and that the flow of water is interrupted cleanly.

**5.4 Loss by Evaporation**— The evaporation loss from an appliance with inlet water control shall not exceed 5 percent of the total contents, when operated for 12 hours at maintenance gas rate.

**5.5 Water Temperature in Feed Cisterns**— The temperature rise of the water in an integral ball-valve-feed cistern after heating the appliance up when cold and operating it at maintenance gas rate for 4 hours shall not exceed 15°C at an initial water temperature and ambient air temperature of  $27 \pm 2^\circ\text{C}$ .

**5.6 Thermal Efficiency**— The thermal efficiency when tested as described in Appendix D shall be not less than 70 percent.

## 6. INSTRUCTIONS

**6.0** In addition to the requirements specified in 23 of IS: 5116-1969\*, the requirements specified in 6.1 to 6.4 below shall apply.

**6.1** Water heater shall be supplied with clear instructions supplemented, if necessary, with diagrams or illustrations indicating the method of installation and connection and precautions necessary to provide for the expansion of water during heating and relief of partial vacuum, if likely to occur. Attention may also be drawn to the requirements of statutory authorities,

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\*General requirements for domestic and commercial equipment for use with LPG.

if any, such as water and gas supply rules applicable to water heaters. Attention should be drawn for the need for periodical descaling of the inner container of the water heater depending upon the hardness of water being used.

**6.2** Instructions sheet shall contain the warning against installing appliances in confined space, for example shower cubicles.

**6.3** Total weight of appliance when full and warning against mounting on walls or floors of insufficient strength.

**6.4** Warning against connecting the appliance directly to the mains if it is not designed to withstand an inlet water test pressure of 15 kgf/cm<sup>2</sup>.

## 7. MARKING

**7.1** In addition to the marking requirements specified in **24** of IS:5116-1969\*, the water heaters shall also be marked with the following:

- a) Permissible maximum working head of water (for controlled outlet water heaters);
- b) Water capacity in litres;
- c) Total heat input in kcal/h with commercial butane;
- d) Recovery time for water to reach 65°C (average) from 15°C with ambient temperature of 15°C; and
- e) Hot and cold water connections shall be clearly and permanently identified.

## 8. PACKING

**8.1** The requirements given in **25** of IS:5116-1969\* shall apply.

# APPENDIX A

( Clause 4.1 )

## PRESSURE TEST FOR WATER HEATER CONTAINERS

**A-1.** The container of every water heater shall be subjected for a period of 5 minutes to a hydraulic or pneumatic test pressure as follows, and shall not show any leakage or appreciable permanent distortion.

- a) Heaters intended to withstand only the head of water they contain (for example, those with a broken feed) shall be sound when completely filled with water at maximum water temperature.

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- b) Other heaters intended for connection to a cistern supply shall not leak or show any sign of distortion at a water pressure 50 percent greater than the recommended maximum head.
- c) Other heaters with inlet water controls shall not leak or show any sign of distortion at a pressure to be agreed to between the manufacturer and the testing authority.
- d) Heaters intended to withstand mains water pressure shall not leak or show any sign of damage or distortion at a static water pressure of 20 kgf/cm<sup>2</sup>.

NOTE — Heaters designed to expose the water surface open to atmosphere are exempted from the above test.

## **A P P E N D I X B**

*( Clause 5.2 )*

### **METHOD FOR DETERMINATION OF DRAW-OFF TEMPERATURE**

#### **B-1. PROCEDURE**

**B-1.1** Light the gas and continue heating until three consecutive readings of the gas rate indicate that a minimum has been reached in the case of a gradual acting thermostat, or that the main gas supply has been closed in the case of a snap-acting thermostat. Turn out the gas, admit cold water at the manufacturer's rated flow, and plot a curve of outlet water temperature against volume of water delivered, taking temperature readings every few seconds.

## **A P P E N D I X C**

*( Clause 5.3 )*

### **METHOD OF TEST FOR ANTIDRIP DEVICE**

#### **C-1. PROCEDURE**

**C-1.1** Fit a suitable water flow meter in the inlet water supply and note the minimum inlet water flow rate required to give a continuous delivery whilst the device is operating.

Turn off the water control tap, and when flow through the outlet has ceased add water ( for example, via funnel connected to a 2-way cock in the inlet supply ) until water flows from the outlet. Determine the minimum quantity required to cause water to flow.

**APPENDIX D***(Clause 5.6)***METHOD FOR DETERMINATION OF  
THERMAL EFFICIENCY**

**D-0.** This test is to determine the proportion of the heat input to the burner that is recovered in the water when a known weight of water is heated, through an observed temperature range using Test Gas A or Test Gas B.

**D-1. PROCEDURE**

**D-1.1** The appliance shall be filled with cold water at  $20 \pm 5^\circ\text{C}$  to its normal capacity less 1 litre for each 20 litres and fraction thereof. Weight of the water shall be noted. The lid of the appliance shall be fitted with an aluminium stirrer and a mercury-in-glass thermometer calibrated to  $0.5^\circ\text{C}$  least count.

**D-1.2** To commence the test, initial temperature of water shall be recorded and the burner lighted; simultaneously the stop watch shall be started and meter reading noted. Thermometer shall be observed periodically and stirring commenced when the temperature reaches  $80^\circ\text{C}$ . When the temperature reaches  $85^\circ\text{C}$ , the gas shall be turned off and watch stopped. Stirring is continued until the maximum temperature is reached on the thermometer.

**D-1.3** Cold water at a measured temperature and at a steady flow shall be admitted at the top. The displaced water shall be drawn off through the shortest possible length of pipe at the bottom into weighed bin (or sequence of bins), the temperature being measured at the point of draw-off every few seconds and observations shall be continued until the temperature of water being drawn off is within  $1^\circ\text{C}$  of the inlet water temperature. A smooth curve of temperature against time shall be plotted; the area  $A$  below the curve shall be computed, and from this area and the rate of flow of water, the total heat content of water shall be calculated.

**D-2. CALCULATIONS**

**D-2.1** The thermal efficiency of the appliance shall be calculated as follows:

$$\text{Thermal efficiency, percent} = \frac{R \times A \times 100}{W \times Q}$$

where

- $R$  = rate of flow of water in kg/min,
- $A$  = area under time-temperature curve in  $\text{min } ^\circ\text{C}$ ,
- $W$  = weight of the gas used in g, and
- $Q$  = net calorific value of the gas used in kcal/g.

**NOTE**—In the above calculations, water equivalent of the appliance is not taken into account.

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