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मानक



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Mazdoor Kisan Shakti Sangathan

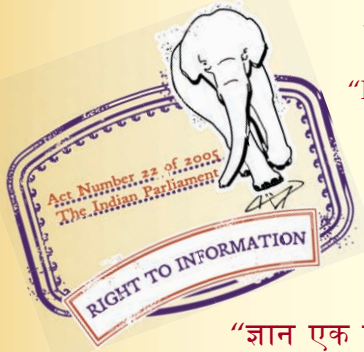
“The Right to Information, The Right to Live”

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“Step Out From the Old to the New”

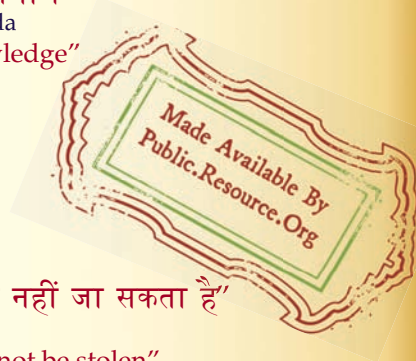
IS 2082 (1993): Stationary storage type electric water heaters [ETD 32: Electrical Appliances]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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REAFFIRMED

2009

IS 2082 : 1993
(Reaffirmed 1994)

भारतीय मानक

REAFFIRMED

NOV 2004

बिजली के पानी गर्म करने के भंडारन किस्म के
स्थिर हीटर — विशिष्ट

(चौथा पुनरीक्षण)

Indian Standard

STATIONARY STORAGE TYPE ELECTRIC
WATER HEATERS — SPECIFICATION

(*Fourth Revision*)

Second Reprint NOVEMBER 2000
(Incorporating Amendment No. 1)

UDC 683.97 : 621.365

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

January 1993

Price Group 4

AMENDMENT NO. 2 NOVEMBER 1999
TO
IS 2082 : 1993 STATIONARY STORAGE TYPE
ELECTRIC WATER HEATERS — SPECIFICATION
(Fourth Revision)

(Page 8, clause 24.1, First sentence) — Substitute the following for the existing:

'The tests specified in Table 2 shall constitute the type tests and shall be carried out on one sample of water heater selected preferably at random from a regular production lot.'

(Page 8, clause 24.1.1, first sentence) — Substitute the words **'The sample'** for **'All samples'**.

(ETD 32)

Printed at Dee Kay Printers, New Delhi

**AMENDMENT NO. 3 APRIL 2001
TO
IS 2082 : 1993 STATIONARY STORAGE TYPE
ELECTRIC WATER HEATERS — SPECIFICATION
(Fourth Revision)**

(Page 5, clause 16.1, para 2, last line) — Substitute '12' for '11'.

(Page 7, clause 17.1, line 2) — Substitute '16' for '15'.

(ETD 32)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 4 MAY 2002
TO
IS 2082 : 1993 STATIONARY STORAGE TYPE
ELECTRIC WATER HEATERS — SPECIFICATION
(Fourth Revision)

(Cover page and pages 1 to 8, Designation) — Substitute 'IS 2082 (Part 1) : 1993' for 'IS 2082 : 1993' wherever it appears.

(Page 3, clause 11.1, para 2, line 3) — Substitute '250 mm' for '700 mm'.

(Page 4, clause 13.1, line 4) — Substitute ' $72 \pm 5^{\circ}\text{C}$ ' for ' $72 \pm 3^{\circ}\text{C}$ '.

(Page 5, clause 15.1) — Insert the following Note at the end of the clause:

'NOTE — Water heaters may be tilted to withdraw the entire quantity of water for verification of rated capacity.'

(Page 6, Table 1) — Substitute the following for the existing:

Table 1 Standing Loss

Rated Capacity in Litres	Loss in Kilowatt Hours per Day for 45° Difference
6	0.792
10	0.990
15	1.138
25	1.386
35	1.584
50	1.832
70	2.079
100	2.376
140	2.673
200	2.970

AMENDMENT NO. 5 JUNE 2003
TO
IS 2082 : 1993 STATIONARY STORAGE TYPE
ELECTRIC WATER HEATERS — SPECIFICATION
(Fourth Revision)

[*First cover page and pages 1 to 8, Designation (see also Amendment No. 4)*] — Substitute 'IS 2082 : 1993' for 'IS 2082 (Part 1) : 1993' wherever it appears.

(ET 32)

Reprography Unit, BIS, New Delhi, India

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the general, safety and performances requirements of Stationary Storage Type Electric Water Heater.

The standard was originally published in 1962. The first revision was made in 1965, second in 1978 and third revision was brought out in 1985.

As per the decision of the third meeting of the Electrotechnical Division Council, separate safety standard on stationary storage type electric water heater has been brought out. In the fourth revision of this composite standard instead of giving details of safety requirements, reference has been made to safety standard IS 302-2-21 (1992). The purpose of this standard is to state and define the principal performances characteristics of stationary storage type electric water heater for household and similar which are of interest to the use and to describe the standard methods for measuring their characteristics, while this standard covers the safety requirements, the details of safety requirements are given in a separate standard IS 302-2-21 (1992) 'Safety requirements for household and similar electrical appliances : Part 2 Particular requirements, Section 21 Stationary storage type electric water heater'.

While preparing this standard assistance has been derived from IEC Pub 379 (1982) 'Methods of measuring the performances of water heaters for house hold purpose' issued by the International Electrotechnical Commission.

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

Indian Standard

STATIONARY STORAGE TYPE ELECTRIC WATER HEATERS — SPECIFICATION

(*Fourth Revision*)

1 SCOPE

1.1 This standard cover general safety and performance requirements of Stationary Storage Type Electric Water Heater for household and similar purpose.

1.2 In addition to the above 1.1 of IS : 302-2-21 (1992) is applicable.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standards:

<i>IS No.</i>	<i>Title</i>
302-1 (1979)	Safety of household and similar electrical appliances: Part 1 General requirements
302-2-21 (1992)	Safety of household and similar electrical appliances: Part 2 Particular requirements, Section 21 Stationary storage type electric water heater

3 TERMINOLOGY AND SYMBOLS

3.1 For the purpose of this standard the following definitions and letter symbol shall apply in addition to those given in 2 of IS 302-2-21 (1992).

3.2 Unvented Water Heater

A water heater designed to work under the pressure of the water supply main. The flow of water being controlled by one or more valves in the outlet system (*see* Fig. 1A).

3.2.1 Classification of other water heaters are shown in Fig. 1B, 1C and 1D.

3.3 Rated Capacity

The water capacity assigned to the water-heater by the manufacturer and marked on it.

3.4 Standard Loss per 24 h

The energy-consumption of a filled water heater, after steady-state conditions have been reached, when connected to the electrical supply, during any 24 h when no water is withdrawn.

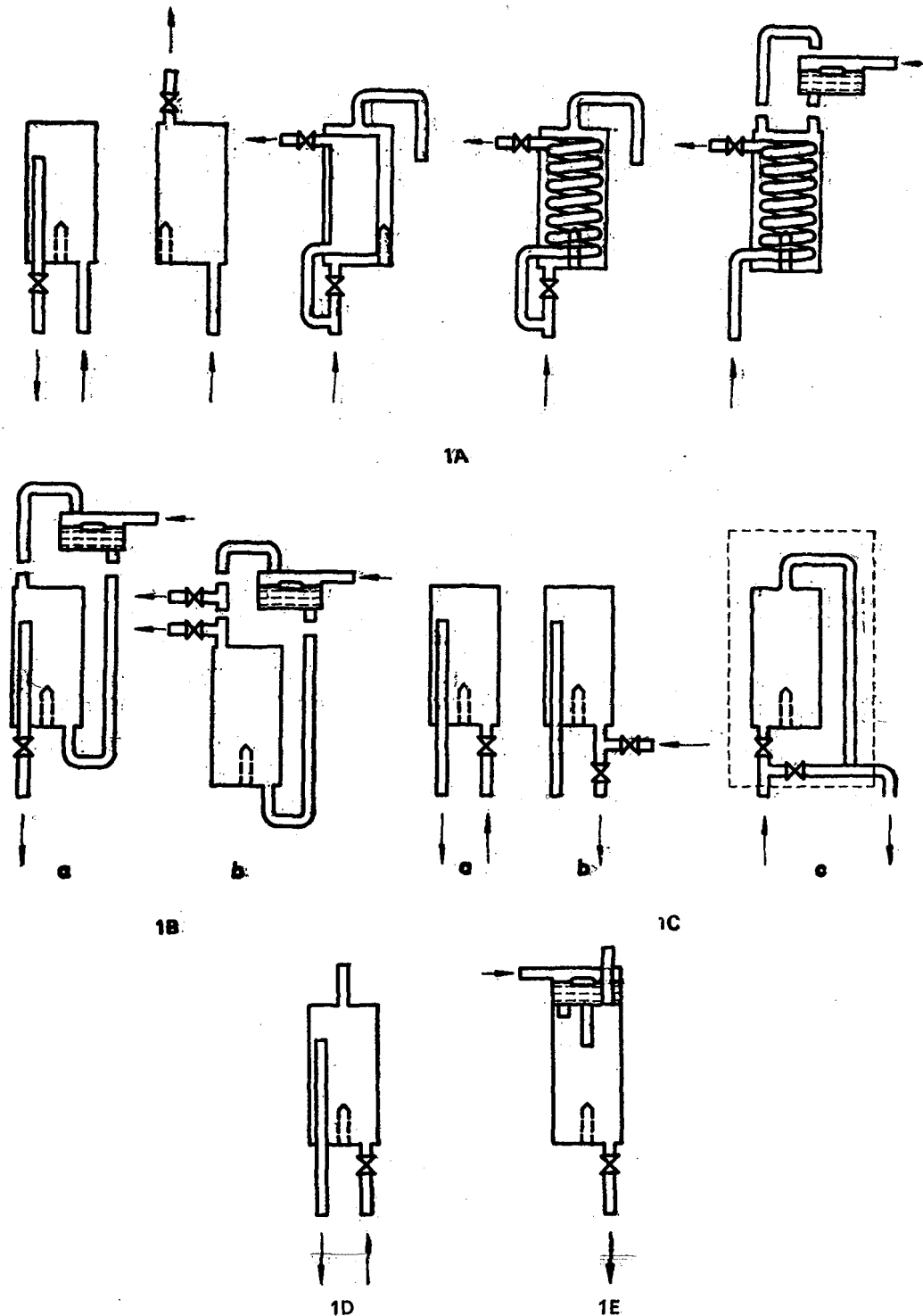
3.5 Rated Voltage

The voltage (for three phase-supply, the voltage between phases) assigned to the appliance by the manufacturer.

3.6 Symbols

For the purpose of this standard the symbols used have the following meanings:

A	= Deviation of dial calibration
E	= Energy consumption per 24 h
F_m	= Mixing factor
Q_{pr}	= Standing loss per 24 h
t_R	= reheating time
$t_{R, 50}$	= reheating-time for a water temperature rise of 50 k.
θ	= temperature indicated on thermostat dial
$\Delta\theta$	= cyclic variation (differential) of thermostatic control
θ_{amb}	= ambient temperature during the tests
θ_c	= temperature of cold water
θ_{A1}	= Water temperature after a thermostat cut-out
θ_A	= mean water temperature after a thermostat cut-out
θ_{B1}	= Water temperature after a thermostat cut-in
θ_B	= mean water temperature after thermostat cut-in
θ_M	= mean water temperature without withdrawal
θ'_p	= mean water temperature for the determination of θ_p



- 1A = UNVENTED WATER-HEATERS [Sub-Clause 2.102 of IS 302-2-21 (1992)]
- 1B = CISTERN-FED WATER-HEATERS [Sub-Clause 2.103 of IS 302-2-21 (1992)]
- 1C = OPEN OUTLET WATER-HEATERS [Sub-Clause 2.105 of IS 302-2-21 (1992)]
- 1D = VENTED WATER-HEATER [Sub-Clause 2.106 of IS 302-2-21 (1992)]
- 1E = CISTERN-TYPE WATER-HEATER [Sub-Clause 2.104 of IS 302-2-21 (1992)]

FIG. 1 SCHEMATIC REPRESENTATION OF STORAGE WATER HEATERS

- θ_p = mean water temperature when determining the hot water output
 θ_R = water temperature after reheating
 θ_w = mean water temperature after withdrawal without replenishment

4 GENERAL REQUIREMENTS

4.1 Clause 3 of IS 302-2-21 (1992) shall apply.

5 GENERAL NOTES ON TESTS

5.1 Clause 4 of IS 302-2-21 (1992) shall apply.

6 RATINGS

6.1 Clause 5 of IS 302-2-21 (1992) shall apply.

7 CLASSIFICATIONS

7.1 Clause 6 of IS 302-2-21 (1992) shall apply.

8 MARKING

8.1 Clause 7 of IS 302-2-21 (1992) shall apply.

8.1.1 The stationary storage type electric water heater may also be marked with the Standard Mark.

9 SAFETY REQUIREMENTS

9.1 The water heater shall comply with the requirement given in 8 to 31 of IS 302-2-21 (1992).

10 GENERAL CONDITIONS FOR MEASUREMENTS

10.1 Unless otherwise specified, measurements are carried out on the water heater, operating:

- in a substantially draught-free room; and
- at an ambient temperature-amb of $27 \pm 2^\circ\text{C}$.

The ambient temperature is calculated from measurements at a number of points half-way between the water-heater and the walls of the room or 1 m distant from the water heater, whichever is less, and at half the height of the water-heater:

- at a relative air-humidity not exceeding 85%.

The values for temperature and relative humidity are only valid at steady-state conditions and not at the moment when hot water is withdrawn from the water-heater at rated input. Measurement should not be carried out if, in warm conditions. The voltage needed to provided the rated input deviates more than 5 percent from the rated voltage.

- at rated frequency, if applicable;

- mounted as described in 11, supplied with water at a temperature θ_c of $22 \pm 2^\circ\text{C}$ and provided from a source having a substantially steady pressure and installed according to the manufacturer's instructions;

- at a thermostat-setting as described in 13.

10.2 A diagram of measurements is given in Fig. 4.

11 MOUNTING OF THE WATER HEATER

11.1 Wall-mounted water-heaters are mounted on a panel situated at least 150 mm from any structural wall.

They are positioned so that there is a clear space of at least 250 mm above and below the heater and at least 700 mm at the sides and front.

Floor-mounted water heaters are placed on the floor or any stand supplied with them. A false floor may be used to facilitate measurements.

Water-heaters for building-in are built in according to the manufacturer's instructions.

12 MEASUREMENT OF STORED WATER TEMPERATURE

12.1 Measurements of water temperature without withdrawal of water are made with a thermocouple placed inside the upper section of the container. However, for metal containers the thermocouple may be placed on the outer surface of the container (see Fig. 3).

The mean water temperature after a thermostat cut-out θ_A is the average value of n temperatures θ_{A1} recorded after each cut-out of the thermostat and is given by:

$$\theta_A = \frac{\sum_{i=1}^n \theta_{A1}}{n}$$

The mean water temperature after a thermostat cut-in θ_B is the average value of n temperatures θ_{B1} recorded after each cut-in of the thermostat and is given by:

$$\theta_B = \frac{\sum_{i=1}^n \theta_{B1}}{n}$$

12.2 Measurement of temperature of withdrawn water are made in the outflow which is to be continuous. The temperature is measured to an accuracy of $\pm 0.5 \text{ K}$ and, if a thermometer is used, it is to be a type that records quickly and accurately in any position.

Temperature readings are preferably taken continuously. Alternatively, they may be taken at equal intervals evenly spread over the discharge, for example ten readings at 5%, 15%, etc, of the rated capacity. If there is a sharp drop in temperature, additional readings may be necessary in order to correctly calculate the average value θ'_P .

NOTE — An apparatus suitable for this measurement is given as an example in Fig. 2.

13 THERMOSTAT SETTING

13.1 The thermostat of water-heaters where adjustment is provided is set so that the mean water temperature θ_M , as measured in 16 is $72 \pm 3^\circ\text{C}$.

The thermostat-setting is to remain unchanged throughout the measurements. If the thermostat has a dial to indicate the temperature, the equivalent dial-reading θ is to be recorded.

For water heaters where regulation of the water-heater thermostat is not provided for the user, no adjustment to the thermostat setting is made.

14 MEASUREMENT OF ENERGY CONSERVATION

14.1 The electrical energy consumed is measured by means of a watt-hour meter and recorded in kilowatt-hours to the nearest 0.01 kwh.

15 VERIFICATION OF THE RATED CAPACITY

15.1 The water-heater is filled in the normal way and then the water supply is cut off. It is then emptied through the water inlet or if it is not possible, through the drain plug opening.

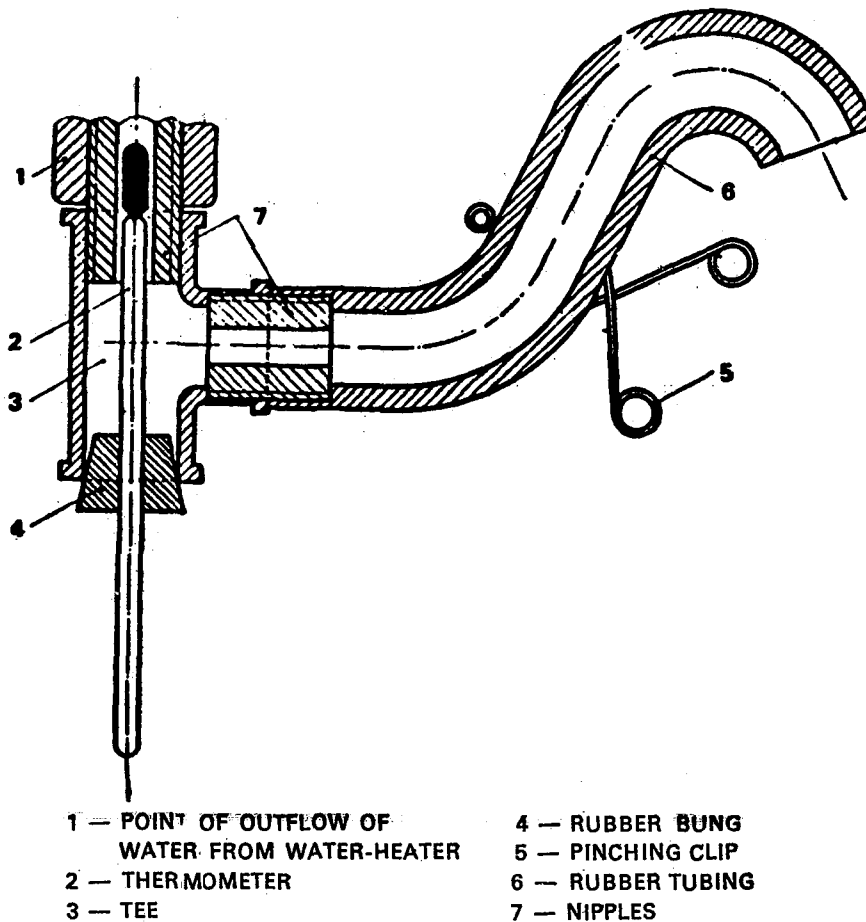


FIG. 2 MEASUREMENT OF WATER TEMPERATURES (see 12.2)

Water in the feed cistern of a cistern-fed water-heater is excluded from the quantity withdrawn.

The water withdrawn is measured and the result stated in litres, to the nearest one-tenth litre.

15.1.1 The actual capacity shall not be less than 95 percent of the rated capacity.

16 STANDING LOSS PER 24 HOURS

16.1 The water heater is filled with cold water.

The electrical supply is then switched on for a few cycles of operation of the thermostat until steady conditions have been reached.

Starting and ending at a cutout of the thermostat, the energy E_1 consumed during time t_1 (hours) is measured over a period of not less than 48 h. The water temperature θ_{B1} at each thermostat cut-in and θ_{A1} at each thermostat cut-out are measured by means of a thermocouple positioned as in 11.

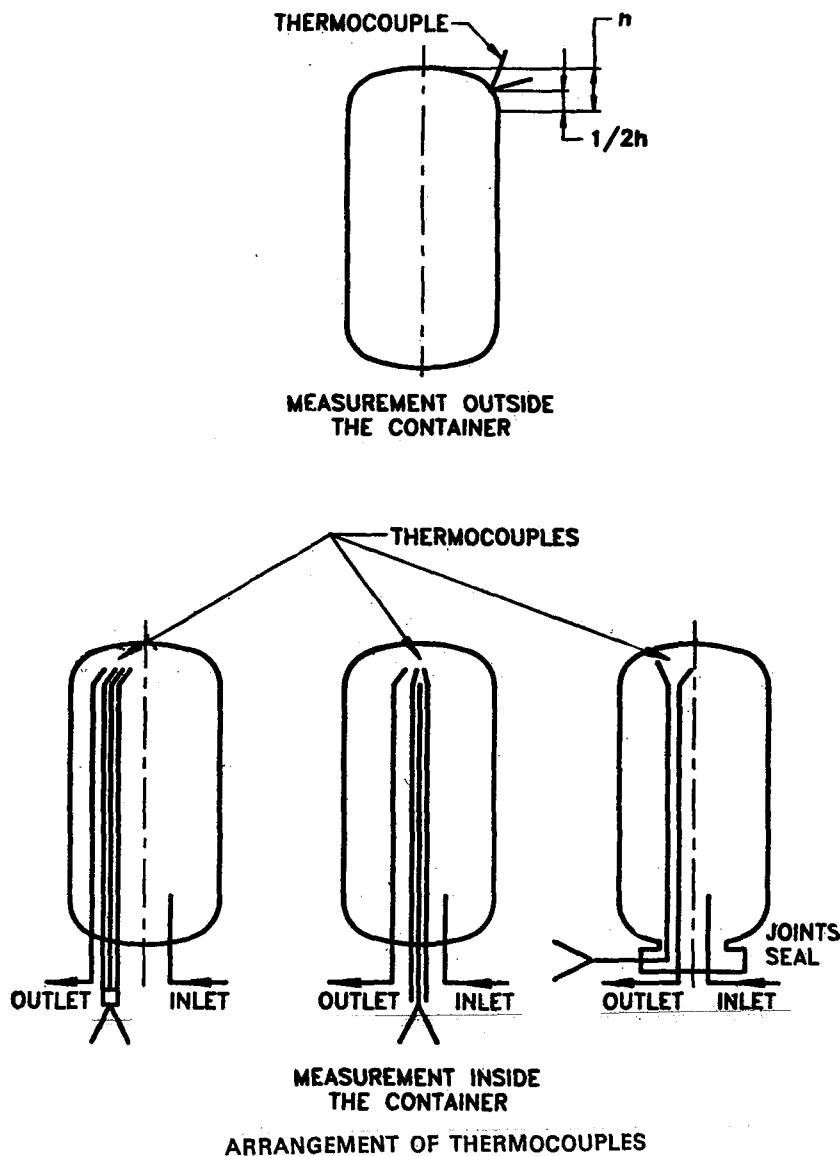


FIG. 3 MEASUREMENT OF WATER TEMPERATURE USING A THERMOCOUPLE

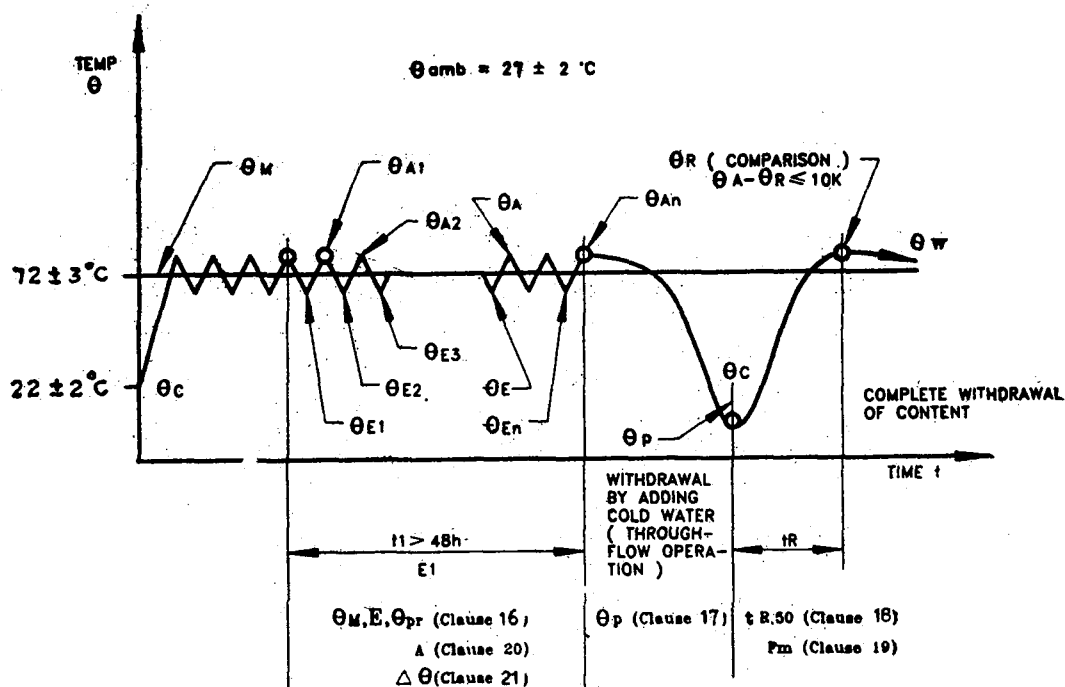


FIG. 4 MEASUREMENT FOR THERMAL STORAGE WATER HEATERS

The energy consumption E per 24 h is calculated according to the following formula:

$$E = \frac{E_1 \times 24}{t_1}$$

The mean water temperature θ_M is calculated by the formula:

$$\theta_M = \frac{\theta_A + \theta_E}{2}$$

θ_A and θ_E being calculated as indicated in 12.

Standing loss per 24 h Q_{pr} is calculated according to the formula:

$$Q_{pr} = \frac{45}{\theta_M - \theta_{amb}} \times E$$

Q_{pr} is expressed in kilowatt-hours per 24 h related to a temperature rise of 45 k and expressed to the nearest 0.1 kwh.

16.2 The standing loss per 24 hours shall not be more than the value given in Table 1.

16.2.1 In the case of cistern type water heater, a relaxation of up to 30 percent of the specified values in the case of cylindrical type over

50 percent in case of other shape may be allowed.

NOTE — The word 'shape' refer to shape of the inner container.

16.2.2 In case the standing loss marked on the water heater is less than that specified in Table 1, a tolerance of + 10 percent shall be allowed on this value subject to the provision that the actual standing loss shall in no case exceed the values specified in Table 1.

Table 1 Standing Loss

Rate Capacity in Litre	Loss in Kilowatt Hours per Day for 45° Difference
6	0.880
10	1.100
15	1.265
25	1.540
35	1.760
50	2.035
70	2.310
100	2.640
140	2.970
200	3.300

17 HOT WATER OUTPUT

17.1 Immediately following measurement according to 15 the water heater is switched off after a cut-out of the thermostat.

Then,

- a quantity of water equal to the rated capacity is withdrawn through the outlet at a constant rate of flow by supply cold water; the flow of water from open outlet water-heaters is controlled by the inlet valve. The flow in any other type of water-heater is kept constant by means of a valve fitted in the outlet.

The rate of flow is adjusted:

- to 2 litre/min for water heaters with a rated capacity less than 10 litre;
- to 3 litre/min for water heaters with a rated capacity of 10 litre up to 50 litre;
- to 10 litre/min for water heaters with a rated capacity of more than 50 litre up to 200 litre;

The temperature is measured in the manner described in 12.2 and the average temperature of withdrawn water θ'_p established. The mean temperature θ_p is calculated from the following formula:

$$\theta_p = 50 \frac{\theta'_p - \theta_c}{\theta_A - \theta_c} + 22.$$

- The hot-water output is recorded as the rated capacity at θ_p (..... litres at ...°C).

18 REHEATING TIME

18.1 Immediately following determination θ_p according to 17.

- the electrical supply is switched on;
- the heating time t_R from switch-on until the first cut-out of the thermostat when the temperature of the water θ_r as measured according to 12.1 is within 10 K of θ_A .

The reheating time required for heating up the water from 22°C to 72°C is calculated from the following formula and expressed in hours and minutes:

$$t_R \cdot 50 = t_R \cdot \frac{50}{\theta_R - \theta_C}$$

then,

- the water-heater is switched off and the water supply turned off;
- the water is withdrawn through the inlet but if this is not possible, the water may be withdrawn through the drain plug;

- the mean water temperature by withdrawal without replenishing with cold water is recorded as θ_w .

18.2 The reheating time shall not exceed the time declared by the manufacturer.

19 MIXING FACTOR

The mixing-factor F_m is determined by comparing the mean water temperature with and without cold water flowing into the water-heater. The mixing factor is expressed as a percentage and given by the formula:

$$F_m = \frac{\theta_{wv} - \theta_p}{\theta_{sw}} \cdot 100$$

19.1 The mixing factor shall be as declared by the manufacturer.

20 DEVIATION FROM DIAL CALIBRATION

20.1 This measurement applies only to thermostat which can be adjusted by the user and with an exposed dial.

The deviation of dial calibration, A , is determined by comparing the dial reading with the mean water temperature and is given by the formula:

$$A = \theta - \theta_M$$

20.2 The dial calibration shall not differ by more than 10°C.

21 CYCLIC TEMPERATURE VARIATION (DIFFERENTIAL)

The cyclic temperature variation of the thermostat $\Delta\theta$ is expressed by the formula:

$$\Delta\theta = \theta_A - \theta_B$$

21.1 The cyclic variation of thermostat control shall not exceed 10°C.

22 FINISH

22.1 The external finish used on metal components shall be of a heat and moisture resisting nature and shall not be adversely affected by variation in temperature occurring under normal operating conditions or after the endurance test.

23 ENDURANCE

23.1 Water heaters shall be so constructed that, in normal use, there will be no electrical or mechanical failure that might impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as a result of heating vibration, etc. Compliance is adequately checked by the test of the other clauses of this standard.

24 TESTS

24.0 Categories of Tests

Tests are classified as type, acceptance and routine tests.

24.1 Type Tests

The tests specified in Table 2 below shall constitute the type tests and shall be carried out on two samples of water heaters of the same type and rating selected preferably at random from a regular production lot. Before commencement of the tests, the water heaters shall be visually examined and inspected for obvious visual defects in respect of components, parts and their assembly, construction, stability markings, provision of suitable terminals for supply connections, earthing and the effectiveness of screws and connections. The external surface finish shall be even and free from finishing defects.

24.1.1 Criteria of Acceptance

All samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If any of the samples fails in any of the type tests, the testing authority, at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test(s) in which failure(s) occurred. No failure should be permitted in the repeat tests(s).

Table 2 Schedule of Type Tests
(Clause 24.1)

Sl No.	Test	Clause Reference
i)	Safety requirement	8 to 31 of IS 302-2-21 (1992)
ii)	Capacity	15
iii)	Standing loss	16
iv)	Hot water output	17
v)	Reheating time	18
vi)	Mixing factor	19
vii)	Deviation of dial calibration	20
viii)	Cyclic temperature variation	21
ix)	Finish	22
x)	Endurance	23

24.2 Acceptance Tests

The following shall constitute the acceptance tests.

Test	Clause Reference
a) Protection against electric shock	8) of IS 302-2-21 (1992)
b) Input	10 do
c) Temperature-rise	11 do
d) Insulation resistance and leakage	13 do
e) Moisture resistance	15 do
f) Insulation resistance and electric strength (After humidity treatment)	16 do
g) Construction	22 do
h) Earthing connection	27
j) Capacity	15
k) Standing loss	16
m) Deviation of dial calibration	20

NOTE – For the purpose of the acceptance tests, the humidity treatment is done for 24 hours while conducting the test for moisture resistance as given in 15 of IS 302-2-21 (1992).

24.2.1 A recommended sampling procedure for acceptance tests is given in Appendix B of IS 302-1 (1979).

24.3 Routine Tests

The following shall constitute the routine tests:

Test	Clause Reference
a) Protection against electric shock	8 of IS : 302-2-21 (1992)
b) High voltage	13.2.2 of IS : 302-1 (1979)
c) Earthing connection	27 of IS : 302-2-21 (1992)
d) Pressure test	22.101 of IS : 302-2 21 (1992)

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Amendments Issued Since Publication

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