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भारतीय मानक
Indian Standard

IS 2082 : 2018

स्थिर भंडारण प्रकार बिजली पानी के हीटरों की विशिष्टि

(पांचवा पुनरीक्षण)

Stationary Storage Type Electric Water Heaters — Specification

(Fifth Revision)

ICS 91.140.65; 97.100.10

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Electrical Appliances Sectional Committee, ETD 32

FOREWORD

This Indian Standard (Fifth Revision) would be adopted by the Bureau of Indian Standards, after the draft finalized by the Electrical Appliances Sectional Committee is approved by the Electrotechnical Division Council.

This standard covers the general, safety and performances requirements of stationary storage type electric water heater. The details of safety requirements are given in a separate standard IS 302-2-21 'Safety requirements for household and similar electrical appliances: Part 2 Particular requirements, Section 21 Stationary storage type electric water heater.

The standard was originally published in 1962. The first revision was made in 1965, second in 1978, third revision in 1985 and the fourth revision was brought out in 1993.

This fifth revision has been undertaken to align it with the latest version of IS 302-2-21 published in 2011 and to consolidate the 6 amendments issued to the earlier standard. Apart from the changes brought about due to the revision of IS 302-1 : 1979 to IS 302-1 : 2008 and revision of IS 302-2-21 : 1992 to IS 302-2-21 : 2011, the major changes which have taken place during this revision are as follows:

a) Terminology for 'unvented water heater' changed to 'closed water heater' and covered under 302-2-21.
b) Terminology for 'Rated Voltage' covered under IS 302-1 : 2008.
c) Figure giving schematic representation of storage water heaters now covered under IS 302-2-21 : 2011 as 'Examples of Types of Storage Water Heaters'.
d) Figure for 'Measurement of Water Temperature Using a Thermocouple' now covered under figure 'Examples of Positions of the Thermocouples' under IS 302-2-21 : 2011.
e) Minus sign introduced for tolerance value for ambient temperature (*see* **9.1**)
f) Tolerance on 'Mean water temperature' changed to ±3 °C in line with IEC 60379
g) Requirements for endurance test has been deleted as it is adequately covered in other clauses of this standard.

This standard is to be read in conjunction with IS 302-2-21 : 2011.

While preparing this standard assistance has been derived from IEC 60379 : 1987 'Methods of measuring the performances of water heater for house hold purpose' issued by the International Electrotechnical Commission.

For the purpose of deciding whether a particular requirement of this standard is complied wit, 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.

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Indian Standard

STATIONARY STORAGE TYPE ELECTRIC WATER HEATERS — SPECIFICATION

(Fifth Revision)

1 SCOPE

This standard deals with the general, safety and performance requirements of electric storage water heaters for household and similar purposes and intended for heating water below boiling temperature, their rated voltage being not more than 250 V for single-phase appliances and 415 V for other appliances.

Appliances not intended for normal household use but which nevertheless may be a source of danger to the public, such as appliances intended to be used by laymen in shops, in light industry and on farms, are within the scope of this standard.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account,

a) the use of appliances by young children or infirm persons without supervision; and

b) playing with the appliance by young children.

NOTES

1 Attention is drawn to the fact that,

a) for appliances intended to be used at high altitudes, additional requirements may be necessary; and

b) for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary; and

2 This standard does not apply to:

a) appliances for boiling water (IS 302-2-15);

b) instantaneous water heaters (IS 302-2-35);

c) commercial dispensing appliances and vending machines (No Indian standard exists at present);

d) appliances intended exclusively for industrial purposes; and

e) appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 REFERENCES

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

IS No.	*Title*
302-1 : 2008	Safety of household and similar electrical appliances : Part 1 General requirements
302-2-21 : 2011	Safety of household and similar electrical appliances : Part 2 Particular requirements, Section 21 Stationary storage type electric water heaters

3 TERMINOLOGY

3.1 The following definitions and letter symbols shall apply in addition to those given in **3** of IS 302-2-21.

3.2 Rated Capacity

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

3.3 Standing 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.

3.4 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
Qpr	—	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

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θ_A — mean water temperature after a thermostat cut-out

θ_{E1} — Water temperature after a thermostat cut-in

θ_E — mean water temperature after thermostat cut-in

θ_M — mean water temperature without withdrawal

θ'_P — mean water temperature for the determination of θp

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 REQUIREMENT

Clause **4** of IS 302-2-21 is applicable.

5 GENERAL CONDITIONS FOR THE TESTS.

Clause **5** of IS 302-2-21 is applicable.

6 CLASSIFICATION

Clause **6** of IS 302-2-21 is applicable.

7 MARKING AND INSTRUCTIONS

Clause **7** of IS 302-2-21 is applicable.

8 SAFETY REQUIREMENTS

8.1 The water heater shall comply with the requirements given in **8** to **32** of IS 302-2-21.

9 GENERAL CONDITIONS FOR MEASUREMENTS

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

a) in a substantially draught-free room; and

b) at an ambient temperature-θ_{amb} of 27 ± 2° 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:

a) 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 provide the rated input deviates more than 5 percent from the rated voltage:

a) at rated frequency, if applicable;

b) mounted as described in **10**, supplied with water at a temperature θ_c of 22 ± 2° C and provided from a source having a substantially steady pressure and installed according to the manufacturer's instructions; and

c) at a thermostat-setting as described in **12.**

9.2 A diagram of measurements is given in Fig. 2**.**

10 MOUNTING OF THE WATER HEATER

10.1 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 250 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.

11 MEASUREMENTS OF STORED WATER TEMPERATURE

11.1 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.

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

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

The mean water temperature after a thermostat cut-in θ_E is the average value of n temperatures θ_{E1} recorded after each cut-in of the thermostat and is given by:

$$\theta_E = \frac{\sum_{i=1}^{i=n}}{n} \theta_{E1}$$

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

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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.1.

12 THERMOSTAT SETTING

12.1 The thermostat of water-heaters where adjustment is provided is set so that the mean water temperature θ_M, as measured in **15** is 72 ± 3° 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.

13 MEASUREMENT OF ENERGY CONSUMPTION

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

14 VERIFICATION OF THE RATED CAPACITY

14.1 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.

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.

The measured water discharge from the tank shall not be less than the rated capacity.

15 STANDING LOSS PER 24 HOURS

15.1 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_{E1} at each thermostat cut-in and θ_{A1} at each thermostat cut-out are measured by means of a thermocouple positioned as in **11**.

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 is being calculated as indicated in **11.**

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

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

θ_{PR} is expressed in killowatt-hours per 24 h related to a temperature rise of 45K and expressed to the nearest 0.1 kWh.

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

15.2.1 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' refers to shape of the inner container.

15.2.2 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

(*Clause* 15.2)

Rated Capacity in Litre	Loss in kilowatt Hours per Day for 45K Difference
(1)	(2)
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

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16 HOT WATER OUTPUT

16.1 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 supplying 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:

a) to 2 litre/min for water heaters with a rated capacity less than 10 litre;

b) to 3 litre/min for water heaters with rated capacity of 10 litre up to 50 litre; and

c) 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 **11.2** and the average temperature of withdrawn water θ'_p established. The mean temperature θ_p is calculated from the following formula:

$$\theta_p = 50\frac{\theta'_p - \theta_C}{\theta_A - \theta_C} + 15$$

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

17 REHEATING TIME

17.1 Immediately following determination θ_p according to **16**,

a) the electrical supply is switched on; and

b) 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 **11.1** 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:

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

then,

a) the water-hater is switched off and the water supply turned off;

b) the water is withdrawn through the inlet but if this is not possible, the water may be withdrawn through the drain plug; and

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

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

18 MIXING FACTOR

18.1 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:

$$F_m = \frac{\theta_W - \theta_p}{\theta_W} \cdot 100$$

18.2 The mixing factor shall not be less than that declared by the manufacturer.

19 DEVIATION FROM DIAL CALIBRATION

19.1 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:

$$A = \theta - \theta_M$$

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

20 CYCLIC TEMPERATURE VARIATION (DIFFERENTIAL)

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

$$\Delta\theta = \theta_A - \theta_E$$

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

21 FINISH

21.1 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 type tests.

22 TESTS

22.1 Categories of Tests — Tests are classified as type, acceptance and routine tests.

22.1.1 *Type Tests*

22.1.1.1 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. Before commencement of the tests, the water heaters shall be visually examined and inspected for obvious

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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.

22.1.1.2 *Criteria of acceptance* — The sample 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* 22.1)

Sl No.	Test	Clause Reference
(1)	(2)	(3)
i)	Safety requirement	8 to 32 of IS 302-2-21
ii)	Capacity	14 of IS 2082
iii)	Standing loss	15 do
iv)	Hot water output	16 do
v)	Reheating time	17 do
vi)	Mixing factor	18 do
vii)	Deviation of dial calibration	19 do
viii)	Cyclic temperature variation	20 do
ix)	Finish	21 do

22.1.2 *Acceptance tests*

The following shall constitute the acceptance tests.

Sl No.	Test	Clause Reference
a)	Protection against access to live parts	8 of IS 302-2-21
b)	Power input and current	10 do
c)	Heating	11 do
d)	Leakage current and electric strength at operating temperature	13 do
e)	Moisture resistance	15 do
f)	Leakage current and electric strength	16 do
g)	Construction	22 do
h)	Provisions for Earthing	27 do
j)	Capacity	14 of IS 2082
k)	Standing loss	15 do
m)	Deviation of dial calibration	19 do

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

22.1.3 *Routine tests* — The following shall constitute the routine tests:

	Test	Clause Reference
a)	Protection against access to live parts	8 of IS: 302-2-21
b)	High voltage	13.2.2 of IS: 302-2-21
c)	Earthing connection	27 of IS: 302-2-21
d)	Pressure test	22.101 of IS: 302-2-21

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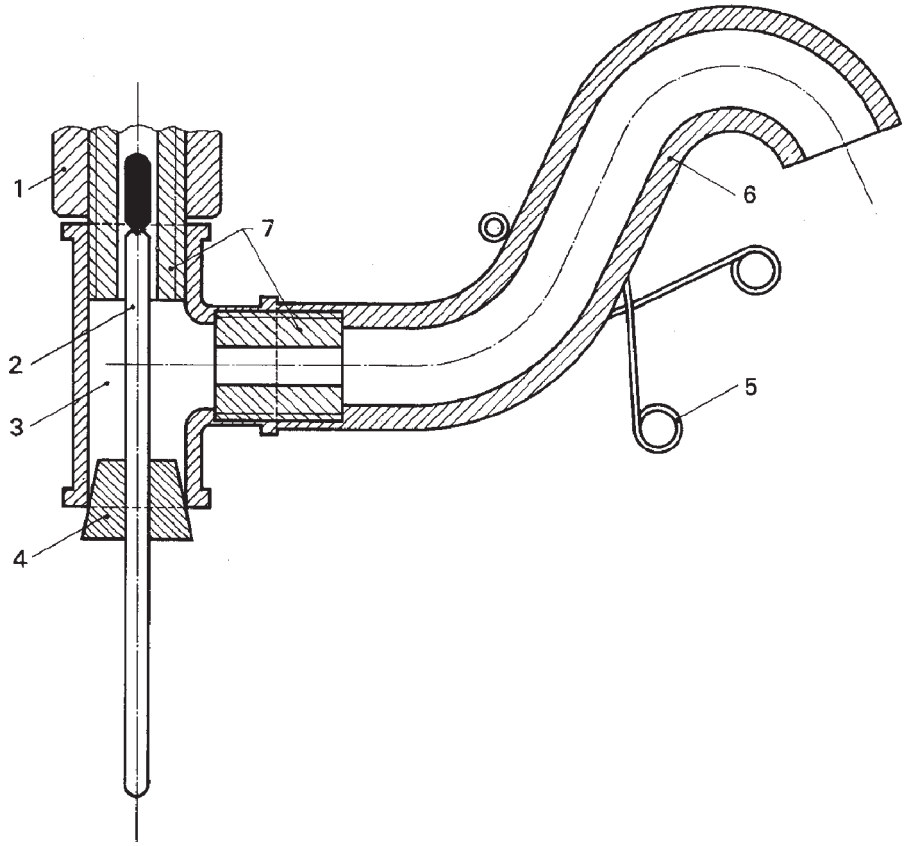

1 = point of outflow from water-heater
2 = thermometer
3 = tee
4 = rubber bung
5 = pinching clip
6 = rubber tubing
7 = nipples

FIG. 1 MEASUREMENT OF WATER TEMPERATURES (*see Clause* **11.2**).

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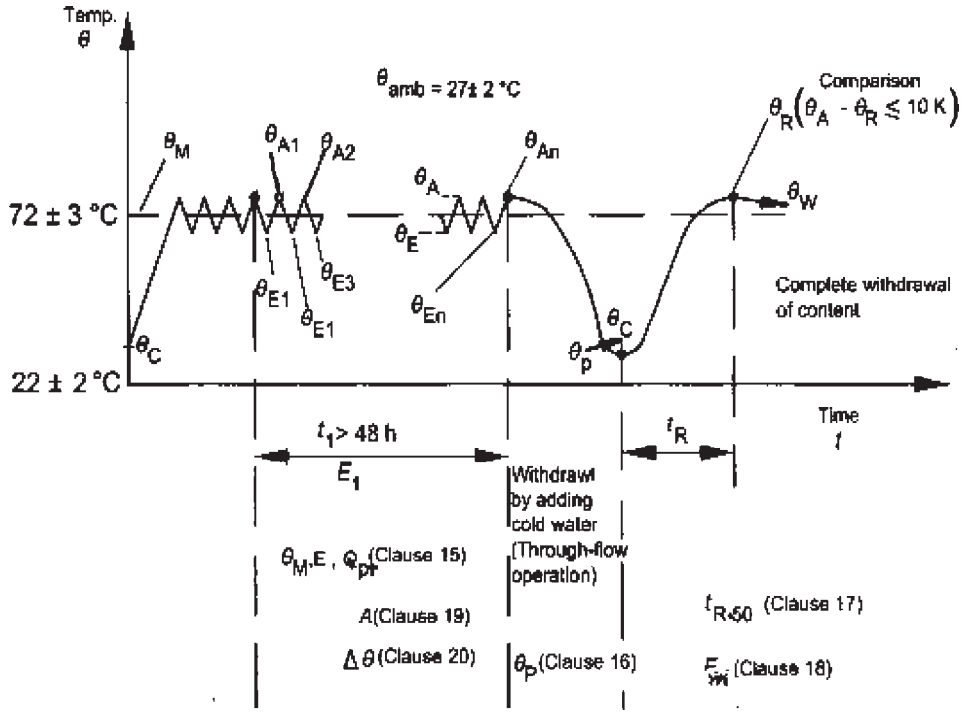

FIG. 2 MEASUREMENT OF THERMAL STORAGE WATER HEATERS

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