GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 27.010

F 01

GB 21519-2008

Minimum Allowable Values of Energy Efficiency and Energy Efficiency Grades for Electrical Storage Water Heaters

储水式电热水器能效限定值及能效等级

Issued on: April 01, 2008 **Implemented on: November 01, 2008**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine;

Standardization Administration of PRC.

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1 Scope

This Standard specifies the minimum allowable value of energy efficiency, evaluating value of energy conservation, grade of energy efficiency, test methods and inspection rules for the domestic and similar electrical storage water heater (hereinafter referred to as electrical water heater).

This Standard is applicable to the electrical storage water heater.

2 Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 20289-2006 Electrical Storage Water Heater

3 Terms and Definitions

For the purposes of this Standard, the terms and definitions given in GB/T 20289-2006 and the following apply.

3.1 Minimum allowable values of energy efficiency for electrical storage water heaters

According to the test conditions specified by the standard, the maximum 24h natural energy consumption coefficient and the minimum hot water output rate allowed by the electrical water heater.

3.2 Evaluating values of energy conservation for electrical storage water heaters

heater to be tested and the tested corner or the position about 1m from the electrical water heater to be tested, whichever is smaller; and locate in half height of the electrical water heater to be tested. The ambient temperature shall be measured under the stable conditions.

c) The relative humidity shall not exceed 85%, and measured under stable conditions. It shall not be taken at the moment when the hot water is discharged from the electrical water heater.

d) It shall be carried out under the rated output power of the electrical water heater to be tested; the deviation shall not exceed ±5%.

e) Influent temperature shall be maintained at 15°C±2°C.

f) Make the electrical water heater in normal installation and use conditions. For the electrical water heater with outlet opened, turn off the water inlet valve of the electrical water heater. For the closed electrical water heater, the water pressure when the water is not drained during the test shall be stable between 0.28MPa and the rated pressure of the electrical water heater; the fluctuation is within the range of ±0.05MPa.

5.1.2 Instrument for test

a) The instrument for electrical measurement shall have an accuracy of no less than ±0.5%;

b) The instrument for temperature measurement shall have an accuracy within 0.5K;

c) The instrument for time measurement shall have an accuracy of ±1s/h;

d) The instrument for humidity measurement shall have any accuracy of ±1%;

e) The instrument for energy consumption measurement shall have an accuracy of 0.01kW•h.

5.1.3 Installation of electrical water heater

The electrical water heater to be tested shall be installed in accordance with the instruments provided by the manufacturer. If the accessory is attached to the machine. When installing, the accessory attached to the machine shall be used and install the accessory.

The wall-mounted electrical water heater shall be installed in the space of the obstacle-free or partition wall or partition plate of the test corner wall. The partition wall or partition plate shall be at least 150mm from the wall; at least 250mm distance from the top and bottom; and at least 700mm space shall be left from the front and two sides.

The electrical water heater used on the ground shall be installed on the floor; or installed on a similar floor or bracket for the benefit of the test; it shall be as close to the two side walls of the test corner wall.

The flush-mounted electrical water heater shall be installed in place according to the manufacturer's instructions.

Installation of the inlet and outlet pipes: connect the necessary accessories (such as safety valves, etc.) according to the manufacturer's instructions. The connecting pipes and valves that are not provided by the manufacturer shall use the non-metal parts; if the metal parts are used, certain insulation measures need to be added (equivalent to non-metallic pipe materials).

5.2 Test method for capacity

The electrical water heater to be tested shall be filled with water in the manner of normal use (for the closed electrical water heater, the specified water pressure shall be applied); The mass of the electrical water heater without water shall be subtracted from the mass of electrical water heater filled with water; and the result shall be divided by the density of water at the measured temperature to obtain the actually-measured capacity, *C*, of the electrical water heater, in L; accurate to 0.1L.

5.3 Test of 24h natural energy consumption

5.3.1 Selection of test points

5.3.1.1 For container with good heat transmissivity

a) Selection of single container test points

Before the test, the appropriate hole is pre-punched at the position of the test point of the container; clean up; so that it shall not affect the temperature measurement effect. The thermocouple is tightly attached to the outer surface of the container; each electrical water heater to be tested is placed with a 5-point thermocouple; as shown in Figures 1 and 2. After the arrangement is completed, use the materials with equivalently original insulation effect to fill and prevent the heat dissipation.

b) Selection of double container test points

The two containers of the double container shall select and arrange the test points as per 5.3.1.1 a) totally place 10 thermocouples.

The electrical water heater to be tested shall be injected with water at a temperature of (15±2) °C according to the normal mode. Unless otherwise specified in the instructions, for the closed electrical water heater, turn off the water outlet valve, turn on the water inlet valve, and operate and energize at the rated power. Adjust the thermostat of the electrical water heater to a certain temperature; so that the electrical water heater is periodically operating under the state of connecting, disconnecting, and connecting till when the stable state is established, the averaged water storage temperature for undraining, θ_M, is within the range of (65±3) °C. If a process can't be satisfied, adjust the thermostat; properly fill with water; start to operate; repeat the test till the temperature, θ_M, meets the requirements.

For the electrical water heater whose thermostat can't be adjusted, then it can externally equip with adjustable thermostat to satisfy the average water storage temperature for undraining, θ_M, is (65±3) °C.

5.3.4 Test method of 24h natural energy consumption

Set the thermostat according to 5.3.3; so that the average water storage temperature for undraining, θ_M, is within the range of (65±3) °C; and in a stable state. The thermostat starts power off from a certain time (after through 48h) to the thermostat is power off for the first time; use the power meter to measure the electric energy loss, E_1, during such period. Meanwhile, use the timer to measure the corresponding measurement time, t_1. During this measurement period, according to the method specified in 5.3.2, measure and calculate the actual average water storage temperature for undraining, θ_M. The schematic diagram of 24h natural energy consumption test method is shown in Figure 4.

24h energy consumption loss, E, shall be calculated as per Formula (5):

$$E = 24 \times \frac{E_1}{t_1} \qquad \text{.....(5)}$$

Where:

24 – 24h, in h;

E – 24h energy loss; in kW • h;

E_1 – energy loss when the thermostat starts power off from a certain time (after through 48h) to the thermostat is power off for the first time; in kW • h; accurate to 0.01 kW • h;

t_1 – measurement time when calculating the energy loss, E_1; in h.

Adjust the ambient temperature or the thermostat setting; so that satisfy the condition of 40°C ≤ (θ_M - θ_{amb}) ≤ 50°C. Under this condition, 24h natural energy loss, Q_{pr}, shall be calculated as per the Formula (6):

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