



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS C 9219 : 2005
(JEMA)

Electric storage tank water heaters

ICS 91.140.65

Reference number : JIS C 9219 : 2005 (E)

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS C 9219 : 1993** is replaced with this Standard.

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Date of Establishment: 1981-01-15

Date of Revision: 2005-01-20

Date of Public Notice in Official Gazette: 2005-01-20

Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Electricity
Technology

JIS C 9219:2005, First English edition published in 2005-05

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Contents

	Page
1 Scope	1
2 Normative references	1
3 Definitions	2
4 Classification	2
5 Rated voltage and rated frequency	3
6 Performance	3
6.1 Voltage fluctuation characteristic.....	3
6.2 Power consumption	3
6.3 Insulation resistance	3
6.4 Dielectric withstand voltage	3
6.5 Leakage current	3
6.6 Wet insulation performance.....	3
6.7 Normal temperature.....	3
6.8 Abnormal temperature	4
6.9 Automatic temperature control	4
6.10 Temperature limiter.....	4
6.11 Thermal fuse	5
6.12 Heating performance.....	5
6.13 Heat insulating performance	5
6.14 Service performance	5
6.15 Hydrostatic pressure resistance of tank	5
6.16 Corrosion resistance of tank.....	5
6.17 Corrosion resistance of heating element	5
6.18 Overload of heating element	6
6.19 Flame retardance of thermal insulating material	6
6.20 Tank capacity	6
6.21 Low temperature resistance	6
6.22 Water hammer protection	6
6.23 Back current protection	6

6.24	Resistance to destruction by vacuum pressure	6
6.25	Effect to water quality	6
7	Construction	8
7.1	Construction in general	8
7.2	Live parts	11
7.3	Wiring	15
7.4	Grounding terminal and grounding lead wire	16
7.5	Power supply cable	16
7.6	Switch	17
7.7	Heating element	17
7.8	Automatic temperature control	17
7.9	Temperature limiting control	17
8	Materials	18
9	Tests	19
9.1	Standard conditions for testing	19
9.2	Test methods	19
10	Inspections	26
10.1	Type inspection	26
10.2	Product inspection	27
11	Designation of product	27
12	Marking	27
13	Precaution for installation and use	28
13.1	Requirement at installation of water heater	28
13.2	Precaution for use of water heater	29
Annex 1 (normative)	Transitional provisions for JIS C 9219	32

Electric storage tank water heaters

1 Scope This Japanese Industrial Standard specifies household electric storage tank water heaters of push-up type used at the maximum working pressure not exceeding 0.1 MPa with the rated power consumption not exceeding 10 kW (hereafter referred to as “water heaters”).

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

- JIS B 8410 *Pressure reducing valves for water works*
- JIS B 8414 *Relief valves for hot water appliances*
- JIS C 0445 *Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system*
- JIS C 0446 *Identification of conductors by colours or numerals*
- JIS C 2520 *Wires and rolled wires for electrical heating*
- JIS C 3301 *Rubber insulated flexible cords*
- JIS C 3306 *Polyvinyl chloride insulated flexible cords*
- JIS C 3312 *600 V Grade polyvinyl chloride insulated and sheathed portable power cables*
- JIS C 3327 *600 V Rubber insulated flexible cables*
- JIS C 8303 *Plugs and receptacles for domestic and similar general use*
- JIS C 8304 *Small switches for indoor use*
- JIS C 8371 *Residual current operated circuit breakers*
- JIS G 0571 *Method of oxalic acid etching test for stainless steels*
- JIS G 0576 *Stress corrosion cracking test for stainless steels*
- JIS G 3555 *Woven wire cloth*
- JIS H 6125 *Magnesium galvanic anodes for cathodic protection*
- JIS K 2240 *Liquefied petroleum gases*
- JIS K 5600-5-4 *Testing methods for paints—Part 5 : Mechanical property of film—Section 4 : Scratch hardness (Pencil method)*
- JIS K 7202-2 *Plastics—Determination of hardness—Part 2 : Rockwell hardness*
- JIS S 3200-1 *Equipment for water supply service—Test methods of hydrostatic pressure*
- JIS S 3200-2 *Equipment for water supply service—Test method of low temperature resistant*
- JIS S 3200-3 *Equipment for water supply service—Test method of water hammer*

- JIS S 3200-4 *Equipment for water supply service—Test method of prevention from back current*
- JIS S 3200-5 *Equipment for water supply service—Test methods of destruction by vacuum pressure*
- JIS S 3200-7 *Equipment for water supply service—Test methods of effect to water quality*
- JIS S 6006 *Pencils, coloured pencils and leads for them*
- JIS Z 2371 *Methods of salt spray testing*

3 Definitions For the purpose of this Standard the following principal definitions apply:

- a) **storage tank system** a type of water heater which has a thermally insulated tank capable of storing hot water
- b) **push-up system** a system of water heater in which the water is fed from the bottom and the hot water flows out from the upper part of the tank pushed up by the fed water at the same rate. There are inlet stop valve type and outlet stop valve type.
 - 1) **inlet stop valve type** such a type that hot water flows out by controlling the valve located on inlet side of water heater
 - 2) **outlet stop valve type** such a type that hot water flows out by controlling the valve located on outlet side of water heater
- c) **pressure reducing valve for water works** a valve which is installed in a pipe line with a mechanism to reduce the pressure of inlet water to the prescribed pressure for delivery and with the function of a non-return valve (see **JIS B 8410**)
- d) **relief valve** a valve which automatically discharges hot water or cold water for safety when abnormal hydraulic pressure appears in the tank and pipe line, or which discharges the water whose volume has been expanded due to heating by electrical current to keep the pressure head inside the tank always not more than 0.1 MPa (see **JIS B 8414**)
- e) **tank capacity** the volume of the tank to store water

4 Classification Water heaters are classified as given in table 1 according to their construction. Water heaters which serve indoors and also outdoors are considered as outdoor water heaters.

Table 1 Classification

Classification	Construction
Indoor water heater	Water heater which is installed in an indoor place or a place where it is not exposed to rain or wind, according to its construction.
Outdoor water heater	Water heater which can be installed in an outdoor place, according to its construction.

5 Rated voltage and rated frequency The rated voltage shall be 300 V or less for single or three phase a.c. The rated frequency shall be 50/60 Hz compatible.

For the appliance with the rated power consumption of over 2 kW up to and including 10 kW, the rated voltage shall be 200 V or more.

6 Performance

6.1 Voltage fluctuation characteristic When the test is carried out by the method of 9.2.2 (hereafter in the test of 9.2.2) the voltage fluctuation characteristic shall be such that the water heater can be used without any practical trouble.

6.2 Power consumption In the test of 9.2.3, the deviation of the measured power consumption from the rated power consumption shall be within the tolerances specified in table 2.

Table 2 Tolerance on power consumption

Rated power consumption kW	Tolerance %
1 or under	±10
Over 1 up to and incl. 10	+ 5 -10

6.3 Insulation resistance In the test of 9.2.4, the measured insulation resistance shall be not less than 1 MΩ.

6.4 Dielectric withstand voltage In the test of 9.2.5, the specimen shall withstand the test voltage.

6.5 Leakage current In the test of 9.2.6, the measured leakage current shall not exceed 1 mA.

6.6 Wet insulation performance For outdoor heaters, in the test of 9.2.7, the wet insulation performance shall be such that the insulation resistance is not less than 1 MΩ, and the specimen shall withstand the specified dielectric withstand voltage.

6.7 Normal temperature In the normal temperature test of 9.2.8, the temperatures at the points of measurement shall not exceed the values specified in table 3, the leakage current shall not exceed 1 mA, the insulation resistance shall be not less than 1 MΩ, and the specimen shall withstand the specified dielectric withstand voltage.

Table 3 Temperatures of each part

Unit: °C

Point of measurement		Temperature
Rectifier	of selenium	75
	of germanium	60
	of silicon	135
Winding	of class A insulation	100
	of class E insulation	115
	of class B insulation	125 (120)
	of class F insulation	150 (140)
	of class H insulation	170 (165)
Handle operated by a man during service	of metal, ceramics or glass	55
	of others	70
Knob of switch and push button	of metal, ceramics or glass	60
	of others	75
Enclosure		85
Surface of wooden base on which specimen is placed		90

Remarks 1 The reference ambient temperature shall be 30 °C.

2 Values in parentheses apply to windings of motors.

3 Built-in types shall be measured in the built-in state.

6.8 Abnormal temperature In the abnormal temperature test of **9.2.9**, the temperature of the enclosure shall not exceed 150 °C, the specimen and the wooden base shall not burn and the insulation resistance shall be not less than 0.1 MΩ. Further, in case of the abnormal temperature test with the tank filled up with water, the water temperature shall not exceed 100 °C.

6.9 Automatic temperature control In the test of **9.2.10**, the automatic temperature control shall show no abnormalities at any part and shall comply with each of the following requirements:

- The average of the measured values before the test shall be within ± 5 °C from the set temperature.
- The average of the measured values after the test shall be within ± 5 °C from the average value before the test.

6.10 Temperature limiter When the temperature limiter is tested by the method of **9.2.11 a)**, the average value of the temperatures at open circuit shall fall within ± 15 °C from the set temperature, and when tested by method of **9.2.11 b)**, the apparatus shall show no abnormalities in any part and the average value of the temperatures at open circuit shall fall within ± 5 °C from the average value before the test.

6.11 Thermal fuse When the thermal fuse is tested by the method of **9.2.12**, the difference between the rated operating temperature and the measured temperature shall be within $\pm 7^{\circ}\text{C}$.

6.12 Heating performance In the test of **9.2.13**, the temperature of heated-up water and the energy efficiency shall be as given in table 4.

6.13 Heat insulating performance In the test of **9.2.14**, the temperature of hot water allowed to stand for 13 h shall be as given in table 4.

6.14 Service performance In the test of **9.2.15**, the temperature of hot water taken at the 12th sampling shall be as given in table 4.

Table 4 Performance

Item		Tank capacity		
		100 L or less	Over 100 L up to and incl. 350 L	Over 350 L
Heating performance	Temperature of heated-up water (T_2)		Marked value $\pm 5^{\circ}\text{C}$	
	Energy efficiency	80 % min.	85 % min.	90 % min.
Heat insulating performance	Temperature of hot water allowed to stand for 13 h	$(T_2 - 25^{\circ}\text{C})$ min.	$(T_2 - 20^{\circ}\text{C})$ min.	$(T_2 - 13^{\circ}\text{C})$ min.
Service performance	Temperature of hot water taken at the 12th sampling	$(T_2 - 45^{\circ}\text{C})$ min.	$(T_2 - 35^{\circ}\text{C})$ min.	$(T_2 - 30^{\circ}\text{C})$ min.

6.15 Hydrostatic pressure resistance of tank In the test of **9.2.16**, the tank including the water paths shall show neither leakage of water nor other abnormalities at any part.

6.16 Corrosion resistance of tank The corrosion resistance of tank shall comply with the following requirements:

- For tanks of stainless steel, interdendritic ditch structures shall not be caused when subjected to the test of **9.2.17 a)** and cracks shall not be caused when subjected to the test of **9.2.17 b)**.
- For tanks of materials other than stainless steel, noticeable corrosion shall not be caused when subjected to the test of **9.2.17 c)**.

6.17 Corrosion resistance of heating element The corrosion resistance of heating element shall comply with the following requirements:

- For heating element of stainless steel, interdendritic ditch structures shall not be caused when subjected to the test of **9.2.18 a)**, and cracks shall not be caused when subjected to the test of **9.2.18 b)**.
- For heating elements of materials other than stainless steel, noticeable corrosion shall not be caused when subjected to the test of **9.2.18 c)**.

6.18 Overload of heating element In the test of **9.2.19**, the electric heating wire (ribbon) shall not break.

6.19 Flame retardance of thermal insulating material When the thermal insulating material stuffed into a place within 50 mm from the electric equipment in the appliance body is subjected to the test of **9.2.20**, the test piece shall not burn completely, and the duration of flaming shall be within 10 s.

The test piece shall not burn completely during the test.

6.20 Tank capacity In the test of **9.2.21**, the tank capacity shall be within $\pm 3\%$ from the marked value of tank capacity for a tank not exceeding 100 L, and within $\pm 2\%$ for a tank exceeding 100 L.

6.21 Low temperature resistance Appliances specified for cold districts shall be tested for low temperature resistance in accordance with **9.2.22** and shall be capable of passing water when water is re-supplied. Further, they shall be free of damage and deformation caused by freeze and shall satisfy **6.15**.

6.22 Water hammer protection Appliances specified as water hammer protective shall be tested for water hammer protection in accordance with **9.2.23** and the upper pressure caused by the water hammer shall not exceed 0.15 MPa.

6.23 Back current protection Appliances with a built-in back current protector shall be tested for back current protection in accordance with **9.2.24** and there shall be no water leakage to the inlet side, and no deformation or other abnormalities.

6.24 Resistance to destruction by vacuum pressure Appliances with a built-in vacuum pressure protector or with a built-in spout room shall be tested for resistance to destruction by vacuum pressure in accordance with **9.2.25** and shall satisfy the following criteria:

- For the appliance with a built-in vacuum pressure protector, rise of the water level shall not exceed one half of the vertical distance from the air-intake sheet surface of the protector to the water level.
- For the appliance with a built-in spout room, no water shall be drawn in from the spout into the inlet side.

6.25 Effect to water quality Appliances shall be tested in accordance with the method specified in **JIS S 3200-7** and the effect to water quality shall satisfy the criteria specified in table 5 (limited only to the appliance used for drinking water).

Table 5 Test items and criteria of the effect to water quality

No.	Test item	Appliance installed at the end of the piping system	Appliance installed in midstream of the piping system
1	Taste	Shall show no abnormality	Shall show no abnormality
2	Smell	Shall show no abnormality	Shall show no abnormality
3	Chroma	0.5 degree max.	5 degrees max.
4	Turbidity	0.2 degree max.	2 degrees max.
5	Cadmium	0.001 mg/L max.	0.01 mg/L max.
6	Mercury	0.000 05 mg/L max.	0.000 5 mg/L max.
7	Selenium	0.001 mg/L max.	0.01 mg/L max.
8	Lead	0.001 mg/L max.	0.01 mg/L max.
9	Arsenic	0.001 mg/L max.	0.01 mg/L max.
10	Hexavalent chromium	0.005 mg/L max.	0.05 mg/L max.
11	Cyanogen	0.001 mg/L max.	0.01 mg/L max.
12	Nitrate-nitrogen and nitrite-nitrogen	1.0 mg/L max.	10 mg/L max.
13	Fluorine	0.08 mg/L max.	0.8 mg/L max.
14	Boron	0.1 mg/L max.	1.0 mg/L max.
15	Carbon tetrachloride	0.000 2 mg/L max.	0.002 mg/L max.
16	1,4-Dioxythane	0.005 mg/L max.	0.05 mg/L max.
17	1,2-Dichloroethane	0.000 4 mg/L max.	0.004 mg/L max.
18	1,1-Dichloroethylene	0.002 mg/L max.	0.02 mg/L max.
19	Dichloromethane	0.002 mg/L max.	0.02 mg/L max.
20	Cis-1,2-dichloroethylene	0.004 mg/L max.	0.04 mg/L max.
21	Tetrachloroethylene	0.001 mg/L max.	0.01 mg/L max.
22	1,1,2-Trichloroethane	0.000 6 mg/L max.	0.006 mg/L max.
23	Trichloroethylene	0.003 mg/L max.	0.03 mg/L max.
24	Benzene	0.001 mg/L max.	0.01 mg/L max.
25	Zinc	0.1 mg/L max.	1.0 mg/L max.
26	Aluminium	0.02 mg/L max.	0.2 mg/L max.
27	Iron	0.03 mg/L max.	0.3 mg/L max.
28	Copper	0.1 mg/L max.	1.0 mg/L max.
29	Sodium	20 mg/L max.	200 mg/L max.
30	Manganese	0.005 mg/L max.	0.05 mg/L max.
31	Chlorine ion	20 mg/L max.	200 mg/L max.
32	Residue on evaporation	50 mg/L max.	500 mg/L max.

Table 5 (concluded)

No.	Test item	Appliance installed at the end of the piping system	Appliance installed in midstream of the piping system
33	Anionic surfactant	0.02 mg/L max.	0.2 mg/L max.
34	Nonionic surfactant	0.005 mg/L max.	0.02 mg/L max.
35	Phenols	0.000 5 mg/L max.	0.005 mg/L max.
36	Organic materials (Total Organic Carbon: TOC)	0.5 mg/L max.	5 mg/L max.
37	Epichlorohydrin	0.01 mg/L max.	0.01 mg/L max.
38	Amines	0.01 mg/L max.	0.01 mg/L max.
39	2,4-Toluene-diamine	0.002 mg/L max.	0.002 mg/L max.
40	2,6-Toluene-diamine	0.001 mg/L max.	0.001 mg/L max.
41	Formaldehyde	0.008 mg/L max.	0.08 mg/L max.
42	Vinyl acetate	0.01 mg/L max.	0.01 mg/L max.
43	Styrene	0.002 mg/L max.	0.002 mg/L max.
44	1,2-Butadiene	0.001 mg/L max.	0.001 mg/L max.
45	1,3-Butadiene	0.001 mg/L max.	0.001 mg/L max.

Remarks 1 Depending on the material in contact with the water of the heater, test items shall be selected in accordance with clause 4 of **JIS S 3200-7**.

2 Transitional provisions for this table 5 are in accordance with annex 1.

7 Construction

7.1 Construction in general The construction of water heater shall comply with the following requirements:

- There shall be no risk of danger during normal service states; the shape shall be correct; the assembling and finishing work of every part shall be good; and the operation shall be smooth.
- The principal parts shall be made of metal or other appropriate materials and shall have good endurance. Neither mechanical nor electrical failure shall take place due to loosening and so on during service.
- The parts of metal cover and box of a switch to which the arc may reach at on-off of the switch shall be lined with arc resistant insulating materials.
- A part of appliance body which is attached or detached shall be so constructed that such operations can be done easily and safely.
- Outdoor water heaters shall be so constructed that the live parts will not be splashed with water under normal service conditions.
- Moisture proof treatment shall be carried out on the portion which may cause any risk due to moisture absorption.