

JIS

JAPANESE INDUSTRIAL STANDARD

Water Chilling Unit

JIS B 8613—1987

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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1. Scope

This Japanese Industrial Standard applies to water-chilling units, hereinafter referred to as the "unit", for cooling or heating water of which refrigerating cycle is composed of displacement type motor compressor, evaporator, condenser, etc., and which have a cooling capacity of 420 kW (360 000 kcal/h) or less measured according to this Standard.

Further, this standard applies to the units for air conditioning, however does not apply to the units for drinking water, and industrial use, nor to the units for cooling and heating by use of brine excluding the water (excepting the brine mixed in the water to prevent freezing due to the lowering of atmospheric temperature).

Remark: In this standard, the units and numerical values in { } are in accordance with the conventional units and are the standard values.

2. Definitions

For the purpose of this Standard, the following definitions apply:

- (1) rated cooling capacity The quantity of heat to be removed from the circulating water when the unit is operated under the conditions of cooling capacity test in 6.2.1. The quantity of heat is expressed in W (kcal/h), and marked on the nameplate or the like.
- (2) rated cooling power consumption The total electric power ⁽¹⁾ to be consumed by motor or the like when the unit is operated under the conditions of cooling power consumption test in 6.2.2, which is marked on the nameplate or the like.

Note ⁽¹⁾ The electric power to be consumed in the unit by motor for compressor, operating circuit, crank case heater, and motor for fan (air-cooled type).

Applicable Standards:

JIS B 7505-Bourdon Tube Pressure Gauges

JIS B 8606-Testing of Refrigerant Compressors

JIS C 1502-Sound Level Meters

JIS Z 8731-Methods of Measurement and Description of A-Weighted Sound Pressure Level

- (3) rated heat pump heating capacity The quantity of heat to be applied to circulating water when the unit is operated under the conditions of heat pump heating capacity test in 6.2.3, in the case where heat pump heating is carried out. The quantity of heat is expressed in W {kcal/h}, and is marked on the nameplate or the like.
- (4) rated heat pump heating power consumption The total electric power ⁽¹⁾ to be consumed by motor or the like when the unit is driven the heat pump heating operation under the conditions of heat pump heating power consumption test in 6.2.4, which is marked on the nameplate or the like.
- (5) heat pump heating Heating by radiating the heat absorbed from the heat source side air or water to the circulating water switching the refrigerant circuit, or heating by radiating the heat absorbed from the heat source side water to the circulating water.
- (6) electric heating apparatus for auxiliary heating The electric heating apparatus to heat in combination with heat pump heating.
The apparatus capable of mounting are contained.
- (7) rated flow rate The flow rate at the time of cooling capacity test in 6.2.1 and flow rate at the time of heat pump heating capacity test in 6.2.3.
- (8) head loss The pressure difference between the inlet side water and the outlet side water of the unit.
- (9) cooling water condenser. The water that passes through the water-cooled type
- (10) chilled water and circulates. The water that is cooled by passing through the evaporator
- (11) hot water The water that is heated by passing through the condenser and circulates when the heat pump is driven.
- (12) energy consumption efficiency The rated cooling capacity divided by rated cooling power consumption.

$$EER = \frac{0.86 \phi_0}{P_r} \left\{ \frac{\phi_0}{P_r} \right\}$$

where EER : energy consumption efficiency 0.86 W/W {kcal/Wh}

ϕ_0 : rated cooling capacity W {kcal/h}

P_r : rated cooling power consumption W {W}

- (13) separate type The compressor, evaporator, condenser, etc. are contained separately in plural units and are used in a combination thereof.

- (14) type inspection The inspection to judge whether the quality of product complies with all quality characteristics shown in the design, or not.
- (15) acceptance inspection The inspection to judge whether the quality characteristics which are considered necessary to be checked are satisfied, or not, at the time of acceptance of the products of the same design and manufacturing as those having passed the type inspection already.
- (16) design pressure The pressure to be used for determining the mechanical strength of component parts or their thickness, in designing the unit.

3. Classification

3.1 Classification by Function The classification by function of units shall be as the following:

- (1) The unit exclusively for cooling.
- (2) The unit for combined use for cooling and heat pump heating (including the units for combined use of heat pump and electric heating apparatus and the units to be used by changing-over the heat pump with electric heating apparatus).
- (3) The unit for combined use for cooling and heating by electric heating apparatus.

3.2 Classification by Heat Exchanging Type on Heat Source Side The classification by heat exchanging type on heat source side of the unit shall be as the following:

- (1) Air-cooled type (air heat source)
- (2) Water-cooled type (water heat source)
- (3) Evaporation-cooled type

3.3 Classification by Construction The classification by the type of construction of unit shall be as the following:

- (1) Integral type
- (2) Separate type

4. Rated Voltage and Rated Frequency

The rated voltage of the unit shall be single phase a.c. 100 V, single phase a.c. 200 V, three phase a.c. 200 V or 220 V (60 Hz), three phase a.c. 400 V or 440 V (60 Hz) and the rated frequency, be 50 or 60 Hz for exclusive use, or 50 Hz and 60 Hz for common use.

5. Performances

5.1 Sealing Property For the sealing property of the unit, there shall be no refrigerant leakage, nor oil leakage on each part of the refrigerant circuit, when tested by the method of Refrigerant-Side Gas Tightness Test specified in 6.2.5.

Further, there shall be no water leakage on each part of the water circuit, when tested by the method of Water-Side Leakage Test specified in 6.2.6.

5.2 Colling Capacity The cooling capacity of the unit shall be tested by the method of Cooling Capacity Test specified in 6.2.1, and its capacity shall be 92 % and over of the rated cooling capacity.

5.3 Cooling Power Consumption The cooling power consumption of the unit shall be the sum of consumed electric powers by the unit when tested by the method of Cooling Power Consumption Test specified in 6.2.2, and it shall be 110 % and under of the rated cooling power consumption.

5.4 Heat Pump Heating Capacity The heat pump heating capacity of the unit shall be tested by the method of Heat Pump Heating Capacity Test specified in 6.2.3 and its capacity shall be 92 % and over of the rated heating capacity.

5.5 Heat Pump Heating Power Consumption The heat pump heating power consumption shall be the sum of consumed electric powers by the unit when tested by the method of Heat Pump Heating Power Consumption Test specified in 6.2.4, and it shall be 110 % and under of the rated heat pump heating power consumption. (for the unit having the electric heating apparatus for auxiliary heating, it does not contain its power consumption.).

5.6 Power Consumption of Electric Heating Apparatus The unit to be heated by heat pump and having electric heating apparatus for auxiliary heating shall be tested by the method of Power Consumption Test of Electric Heating Apparatus for Auxilliary Heating specified in 6.2.7, and the tolerances of power consumption of the electric heating apparatus shall be ± 5 % of the rated power consumption of the electric heating apparatus marked on the nameplate (for the apparatus of not more than 1 kW, ± 10 %).

5.7 Temperature The temperatures at cooling operation and heat pump heating operation shall be tested by Temperature Tests specified in 6.2.8, and the motor winding temperature shall be held not more than the value specified in Table 1, and the temperature of a branch of the source cable, knobs and pushbuttons of a flashing device, the outside frame liable to be touched by the personel and a wooden plate for installing the specimen unit shall meet the requirements specified in Table 2.

Further, there shall occur no abnormal temperature rise in any other places.

Table 1. Allowable Temperature of Motor Winding

Unit: °C

Measuring place		Temperature
Winding	Class A insulated	100 max.
	Class E insulated	115 max.
	Class B insulated	125 (120) max.
	Class F insulated	150 (140) max.
	Class H insulated	170 (165) max.

- Remarks 1. The numerical values in parentheses apply to the winding of rotor.
2. For the motor to be used in refrigerant, the value in the table shall be added by 5°C.

Table 2. Allowable Temperature at Outside Frame Surface

Unit: °C

Measuring place		Temperature
Branching point of source cable and the like		90 max.
Knobs and push-buttons of flasher and the like	Made of metallic materials, ceramics and glass	60 max.
	Others	75 max.
Outside frame liable to be touched by a person		85 max.
Wooden stand surface for the specimen to be placed		80 max.

5.8 Voltage Fluctuation Characteristics The voltage fluctuation characteristics at the time of cooling operation and heat pump heating operation shall comply with the following respectively:

- (1) The voltage fluctuation characteristics at the cooling operation, when the test is carried out by the method of Voltage Fluctuation Characteristic Tests specified in 6.2.9, shall be such that the safety protective apparatus does not actuate and the operation continues without abnormality.

- (2) The voltage fluctuation characteristics at the heat pump heating operation, when the test is carried out by the method of Voltage Fluctuation Characteristics Tests specified in 6.2.9, shall be such that the safety protective apparatus does not actuate, and in the case of unit having the electric heating apparatus for auxiliary heating, the protective apparatus for prevention of superheat does not actuate and the operation continues without abnormality.

5.9 Insulation Resistance The insulation resistance, when tested by the method of Insulation Resistance Test specified in 6.2.10, shall be not less than 1 MΩ.

5.10 Withstand Voltage The withstand voltage, when tested by the method of Withstand Voltage Test specified in 6.2.11, shall comply with the requirement.

5.11 Starting Characteristics The starting characteristics shall comply with the following:

- (1) The starting current shall be tested by the method of Starting Tests specified in 6.2.12, and it shall be 110 % and under of the value marked on the nameplate or the like.
- (2) The starting, when tested by the method of Starting Tests specified in 6.2.12, shall be such that the motor starts independent of the position of the rotor.

5.12 Overload Performance The overload performance shall be such that when tested by the method of Overload Test specified in 6.2.13, the unit shall be able to be operated without abnormalities in motor, electric parts, wiring, etc. (In the heating overload test, the operation of electric heating apparatus may be stopped.).

5.13 Automatic Defrosting Performance (This applies exclusively to the unit to be heated by heat pump with the heat source of air and provided with the automatic defrosting apparatus.) The automatic defrosting performance, when tested by the method of Automatic Defrosting Test specified in 6.2.14, shall satisfy the following conditions:

- (1) The operation does not stop by action of safety protective apparatus.
- (2) The defrosting operation shall be carried out automatically.
- (3) The fused water at defrosting, and the condensed water of heat exchanger of room outside (heat source side) at heating operation can be exhausted or treated without abnormality.
- (4) The total time required for defrosting in continuous operation after completion of the first defrosting shall not exceed 20 % of overall operating time (in the case of the unit having plural independent refrigeration cycles, the total of time required for defrosting at each refrigeration cycle shall not exceed 20 % of overall operating time at each refrigeration cycle.).

5.14 Low Temperature Performance The low temperature performance, when tested by the method of Low Temperature Test specified in 6.2.15, shall be such that the unit is able to be operated without abnormalities in motor or the like.

5.15 Humidity-Resistance Performance The humidity-resistance performance, when tested by the method of Humidity Resistance Test specified in 6.2.16, shall be such that the value of insulation resistance is 1 M Ω , and the withstand voltage complies with Withstand Voltage specified in 5.10.

5.16 Spray Insulation Performance The spray insulation performance, when tested by the method of Spray Insulation Test specified in 6.2.17 with the part to be installed outdoors attached under normal service conditions, shall be such that the value of insulation resistance is not less than 1 M Ω , and the withstand voltage complies with Withstand Voltage specified in 5.10.

5.17 Head Loss Characteristics The head loss characteristics shall be tested by Head Loss Test specified in 6.2.18, and its tolerances shall be within $\pm 10\%$ of the rated head loss value.

5.18 Energy Consumption Efficiency For the energy consumption efficiency, the value of cooling capacity obtained in 5.2 divided by cooling power consumption obtained in 5.3 shall be not less than 85 % relative to the marked value according to the specification of 8.

5.19 Noise The noise level shall be tested in accordance with the method of 6.2.19 Noise Test and the value shall be as agreed upon between the purchaser and the manufacturer.

6. Test

6.1 General The tests of unit shall be carried out by using the instruments specified in (1) and under the conditions specified in (2), unless otherwise specified.

- (1) Accuracy of Instruments The accuracy of instruments to be used for the test shall be as qualified by the public organization according to Table 3 or equivalent thereto.

Table 3. Accuracy of Instrument

Division	Accuracy
Thermometer	Air temperature $\pm 0.1^{\circ}\text{C}$
	Cooled, hot water temperature $\pm 0.1^{\circ}\text{C}$
	Refrigerant temperature $\pm 1.0^{\circ}\text{C}$
Flow meter	$\pm 2 \%$
Refrigerant pressure gauge	$\pm 2 \%$
Electric instrument	$\pm 0.5 \%$

- (2) Test Conditions The test conditions shall be in accordance with the following other than those specified in 6.2:
- (a) The air and the water-temperatures shall be in accordance with the conditions in Table 4.
 - (b) The installation of the machine to be tested shall be carried out by the method specified by the manufacturer, and no modification affecting the capacity shall be carried out.
 - (c) The machine to be tested shall be operated at the rated frequency and the rated voltage (their tolerances shall be within $\pm 2 \%$ of respective ratings).
 - (d) The water of such a quality that it is not corrosive and contains little impurities shall be used.

Table 4. Temperature Conditions

		Service side		Heat source side				Unit: °C
		Cooled, hot water		Water-cooled type		Air-cooled type (Inlet air temperature)		
		Inlet water temperature	Outlet water temperature	Inlet water temperature	Outlet water temperature	Dry-bulb temperature	Wet-bulb temperature	
Cooling tests	Cooling conditions	12 ± 0.5	7 ± 0.5	30 ± 0.5	35 ± 0.5	35 ± 1	24 ± 0.5 (⁵)	
	Overload conditions	- (³)	15 ± 0.5	32 ± 0.5	- (⁴)	43 ± 1	25.5 ± 0.5 (⁵)	
	Low temperature conditions	- (³)	5 ± 0.5	- (⁴)	21 ± 0.5	21 ± 1	15.5 ± 0.5 (⁵)	
Heat-pump tests	Heating conditions	40 ± 0.5	45 ± 0.5	15.5 ± 0.5	7 ± 0.5	7 ± 1	6 ± 0.5	
	Overload conditions	- (⁶)	50 ± 0.5	21 ± 0.5	- (⁷)	21 ± 1	15.5 ± 0.5	
	Defrosting conditions (²)	40 ± 0.5	- (⁶)	-	-	1.5 ± 1	0.5 ± 0.5	

Notes ⁽²⁾ The defrosting conditions indicate the conditions prior to the defrosting operation.

Where defrosting is commenced, the conditions shown in Table 5 are allowed independent of the specifications in Table 4.

⁽³⁾ Service side water flow rate determined by the cooling condition applies.

⁽⁴⁾ Heat source side water flow rate determined by the cooling condition applies.

⁽⁵⁾ This applies to the unit of which wet-bulb temperature affects the heat exchanger on heat source side (the type using the latent heat of water as heat source).

⁽⁶⁾ Service side water flow rate determined by the heat pump conditions applies.

⁽⁷⁾ Heat source side water flow rate determined by the heat pump conditions applies.

Remark: The tolerances in Table 4 are the permissible deviation on the temperature fluctuation during the test.