

JIS

JAPANESE INDUSTRIAL STANDARD

Solar Storage Tanks

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In the event of any doubt arising,
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Solar Storage Tanks

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1. Scope

This Japanese Industrial Standard specifies solar storage tanks of direct storage type, indirect storage type, etc. for solar system to store heat energy as sensible heat by using a liquid not exceeding boiling point in atmospheric pressure at not more than 10 m in head pressure as the heat storage medium, hereinafter referred to as the "storage tanks". Therefore, this Standard does not apply to storage tanks using heat storage medium to utilize latent heat. The storage tanks herein mean storage tanks not more than 1000 l in capacity including those for hot-water supply and for heat storage and also include those assembled integrally with auxiliary heat source apparatus.

Further, performances and the like concerning auxiliary heat source apparatus shall be in accordance with the relating reference.

Remark: In this Standard the units and numerical values shown in () are in accordance with the conventional unit and are Standard values.

2. Definitions

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

- (1) heat storage medium Mediums such as water, non-freezing solution, etc. to be stored in storage tank and to store heat energy by temperature difference (sensible heat).
- (2) heat collecting medium Mediums such as water, non-freezing solution, etc. to transfer heat energy from solar storage tank to storage tank. In direct storage type, it is the same medium as the heat storage medium, and in indirect storage type, it is medium other than the heat storage medium.
- (3) storage-tank capacity The volume of heat storage medium to be stored in storage tank and is in accordance with Table 1. However, in the storage tank assembled integrally with auxiliary heat source apparatus, it is the volume of whole tank including the part to be heated by auxiliary heat source apparatus.

Applicable Standards: See pages 29 and 30.

Table 1. Storage Tank Capacities

Type	Storage tank capacity
Open type	Supply to storage tank the water at $20 \pm 5^{\circ}\text{C}$ under the supply water static pressure of 0.34 MPa (3.5 kgf/cm^2) in gauge pressure until the supply water control device such as ball tap, liquid surface switch, etc. closes, thereafter stop the supply water plug and define the water capacity (l) when water is exhausted from water exhausting opening as the storage tank capacity.
Tightly closed type	Supply to storage tank the water at $20 \pm 5^{\circ}\text{C}$ under the supply water pressure of 0.06 MPa (0.6 kgf/cm^2) in gauge pressure until full water state, thereafter stop the supply water plug and define the water capacity (l) when water is exhausted from water exhausting opening as the storage tank capacity.

- (4) auxiliary heat source apparatus The heat source apparatus such as boiler and the like to supplement the shortage when the heat collection from solar heat is not sufficient.
- (5) heat exchanger The heat transfer apparatus to exchange in directly the heat energy of heat collecting medium to heat storage medium in indirect storage type storage tank.

3. Types of Storage Tanks and Name of Each Part

Types of storage tanks and name of each part shall be in accordance with Tables 2, 3, 4, 5 and 6 and Figs. 1 and 2.

Table 2. Types by Storage System

Type	Content
Direct storage type	The storage tank in which the heat exchanger is not assembled in the tank.
Indirect storage type	The storage tank in which the heat exchanger is assembled, includes heat pump type (the heat exchanger by condenser of heat pump is assembled) and that appended with heat exchanger at the outer part of tank is not included.

Table 3. Types by Structure

Type	Content
Open type	The storage tank of such structure that the liquid surface in the tank is opened to atmosphere
Tightly closed type	The storage tank of such structure that the liquid exceeding atmospheric pressure is stored in the tank

Table 4. Types by Setting Place

Type	Content
Indoor type	The storage tank to be set at indoor or at a place where wind and rain do not contact
Outdoor type	The storage tank to be set at outdoor

Table 5. Styles by Existence of Auxiliary Heat Source

Style	Content
Auxiliary heat source apparatus integral style	The storage tank in which the auxiliary heat source apparatus is held
Auxiliary heat source apparatus separated style	The storage tank in which the auxiliary heat source apparatus is not held

Table 6. Type by Water Supply System

Type	Content
Waterwork direct connection type	The system to supply water at not more than 10 m in head pressure, with connecting with waterwork pipe by using pressure reducing valve for waterworks and relief valve
Cistern type	The system to supply water by falling water once to cistern or the like without connecting directly with waterwork pipe

Fig. 1. An Example of Direct Storage Type (Open Type)

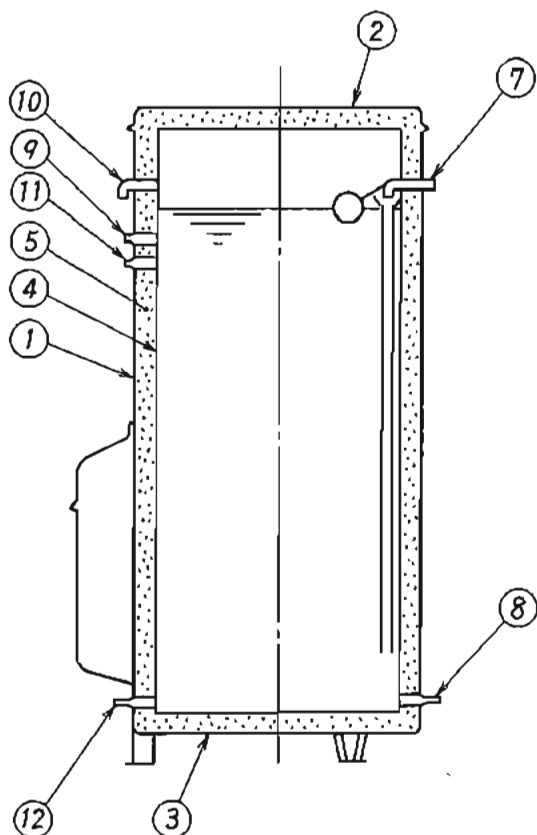
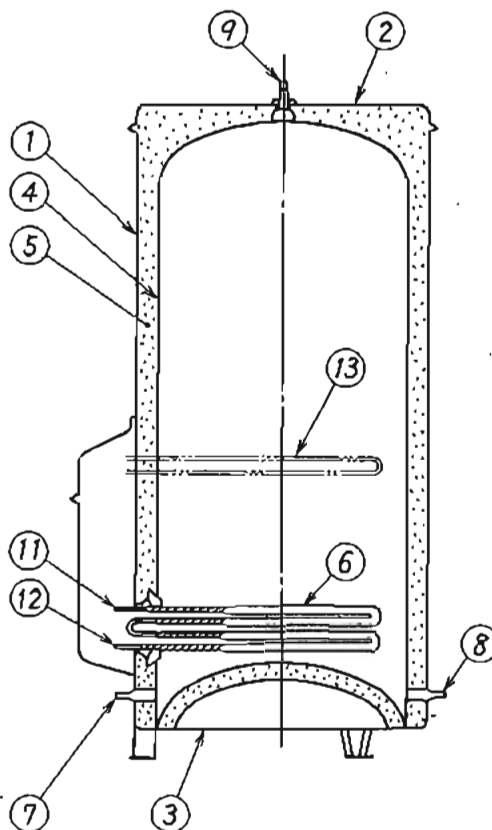


Fig. 2. An Example of Indirect Storage Type (Tightly Closed Type)



- | | | |
|----------------------------|----------------------------|--|
| ① Shell part armour | ⑥ Heat exchanger | ⑪ Return opening for heat collecting medium |
| ② Top part armour | ⑦ Water supply opening | ⑫ Feed opening for heat collecting medium |
| ③ Bottom part armour | ⑧ Water exhaust opening | ⑬ Auxiliary heat source apparatus (example of electric heater) |
| ④ Tank body | ⑨ Hot water supply opening | |
| ⑤ Heat insulation material | ⑩ Weir flow tube | |

4. Performance

The performance of storage tank shall be tested according to the method of 8.2 and, comply with specifications of Table 7.

Table 7. Performance

Item	Performance	Test method
Thermal insulation performance	The heat loss coefficient ($\bar{K}A$) shall satisfy the following described numerical value relative to storage tank capacity (V). $\bar{K}A$ shall be not more than $0.003 V + 5$.	8.2.1
Hot-water output performance	The effective hot water output efficiency (η_T) shall be not less than 80 %.	8.2.2
Heat exchange performance	(1) Water and non-freezing solution type The heat exchange amount diagram shall be marked, and the heat exchange amount (Q), not less than 95 % of the marked value.	8.2.3
	(2) Heat pump type The heat exchange amount (Q) shall be not less than 95 % of marked value.	
Pressure resistance	It shall be free from leakage and remarkable deformation.	8.2.4
Pressure loss of heat exchanger	Diagram of pressure loss shall be marked.	8.2.5
Quality of water	It shall comply with water quality reference (Appendix) based on the Waterworks Law.	8.2.6
Insulation resistance	It shall be not less than 1 M Ω .	8.2.7
Withstand voltage	It shall withstand.	8.2.8

Table 7. Performance (Continued)

Item	Performance		Test method
Water-pouring insulation performance	Insulation resistance	It shall be not less than 1 M Ω .	8.2.9
	Withstand voltage	It shall withstand.	
Surface temperature of operation part	Difference between the measuring temperature and room temperature shall be not more than 25°C for ceramics and not more than 35°C for plastics.		8.2.10
Consumption electric power	For that not more than 100 W in rated consumption power.	The difference relative to marked value shall be within ± 15 %.	8.2.11
	For that exceeding 100 W in rated consumption power.	The difference relative to marked value shall be within ± 10 %.	
Capacity of storage tank	Tightly closed type	The difference relative to marked value shall be within ± 3 %.	8.2.12
	Open type	The difference relative to marked value shall be within ± 5 %.	
Noise	It shall be not more than 60 dB (A).		8.2.13
Painting film performance of armour material	Adhesiveness	The painting film shall not be peeled off.	8.2.14
	Appearance	It shall be free from cracking, swelling, peeling off, and rust.	

5. Structure

5.1 Structure General The structure of storage tank shall be as follows:

- (1) The storage tank has sufficient strength and stability at the time of transportation, installation, operation, etc.
- (2) Each part of storage tank is manufacture by taking into consideration the safety, stability and endurance, and withstands the definite water pressure, is not broken easily nor is deformed.
- (3) The member to contact with heat collecting medium of storage tank and contacting water member have sufficient corrosion resistance, and do not elute hygienically harmful substance. However, except that which does not supply directly hot water.
- (4) The drainage opening capable of draining water easily in storage tank in the set condition. However, the drainage opening, after piping, is not also the water supply opening.
- (5) When the pressure in storage tank has risen, it is able to be connected with a relief valve which actuates at not more than 10 m in head pressure or to be connected with relief tube having sufficient relief effect at the connecting part of hot water-supply outlet.
- (6) Screw threads of piping connecting opening are, as a rule, in accordance with JIS B 0203.
- (7) Attaching of piping connecting opening is horizontal or vertical relative to body axis of storage tank.
- (8) The storage tank, in the case where outer force of $1/2$ of mass of fully filled water actuates at has actuated at the position of centre of gravity in horizontal direction in standard setting condition, has sufficient safety to overturning.

Furthermore, the storage tank fixing part, anchor bolts, etc. withstand the using sufficiently.

- (9) The weir flow tube is of such structure that hygienically harmful substances do not enter. However, except that which does not supply directly the hot water.
- (10) For heat collecting medium, that not harmful hygienically has been used.

5.2 Structure by Division of Water Supply System

- (1) Structure of Waterworks Direct Connecting Type The storage tank which is connected with waterworks pipe directly and supplies water at not more than 10 m in head pressure by using pressure reducing valve and relief valve shall be in accordance with following (a) and (b).

- (a) When the pressure in hot-water supply route of tank has risen, it is able to be connected with a relief valve which actuates at not more than 10 m in head pressure.
- (b) In the case where the pressure-reducing valve and relief valve are built-in or attached, these are those complied with the specifications of JIS B 8410 and JIS B 8414 or those equivalent or superior thereto.

- (2) Structure of Cistern Type The cistern type shall be provided with a relief opening capable of connecting relief pipe having sufficient relief effect. However, the relief opening may be the hot-water supply opening in combination.

5.3 Structure of Outdoor Type The structure of outdoor type shall be as follows:

- (1) Members to be used for outer surfaces of appliances are materials which are difficult to receive influence even though having received irradiation of solar rays for a long time or applied with surface treatment.
- (2) It is of such structure that there is not fear of intrusion of rain water, or there is no interference to securing operation safety of appliances even when rain water has intruded.

5.4 Structure of Open Type The structure of open type shall be as follows:

- (1) Ball Tap The ball tap to be use for open type is that complying with the specification of JIS B 2061 or having quality equivalent or superior thereto.
- (2) Dimensions of Space between Ball Tap Drainage Opening and Weir Flow Pipe In the case where a ball tap is attached with the open type, the height from weir flow pipe to ball tap drainage opening and the dimensions of space between the side wall and the ball tap drainage opening shall be as shown in Table 8 and Fig. 3 or Fig. 4.

Table 8. Dimensions of Space of Ball Tap

Unit: mm

Nominal diameter	Height from weir flow pipe to ball tap drainage opening (A)	Distance between side wall and centre of ball tap drainage opening (B)
13	25 min.	25 min.
20	40 min.	40 min.
25	50 min.	50 min.