

JIS

JAPANESE INDUSTRIAL STANDARD

**Glassfiber Reinforced
Plastic Water Tanks**

JIS A 4110—1989

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

JAPANESE INDUSTRIAL STANDARD
Glassfiber Reinforced Plastic Water Tanks

J I S
A 4110-1989

1. Scope

This Japanese Industrial Standard specifies the integrated type water tanks, hereafter referred to as the "water tanks", made of glassfiber reinforced polyester of 50 m³ or under in capacity to be used for water supply facilities which are installed in the interiors and rooftops of 60 m or under in eaves height.

Remark: The units and numerical values given in { } in this Standard are based on the traditional unit system and are currently the criteria in force.

2. Names of Respective Parts

The names of respective parts of the water tanks shall be as given in Fig. 1, Fig. 2 and Fig. 3.

- | | | | |
|--------------------|-----------------------|----------------------------------|--------------------------|
| ① Ceiling | ② Bottom | ③ Peripheral wall | ④ Manhole ⁽¹⁾ |
| ⑤ Inlet opening | ⑥ Outlet opening | ⑦ Overflow opening | |
| ⑧ Drainage opening | ⑨ Ventilation opening | ⑩ Seat for installing electrodes | |
| ⑪ Inside ladder | ⑫ Outside ladder | | |

Note (1) The manhole is the opening part for entrance and exit for persons, and of which cover also is considered to be the one part of the manhole.

Fig. 1. Cylindrical Shape Water Tank (Example Figure)

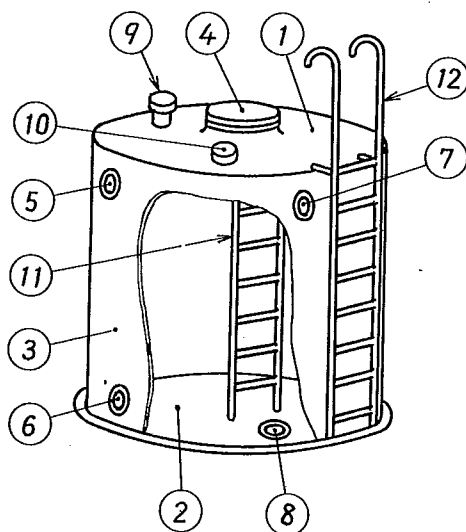
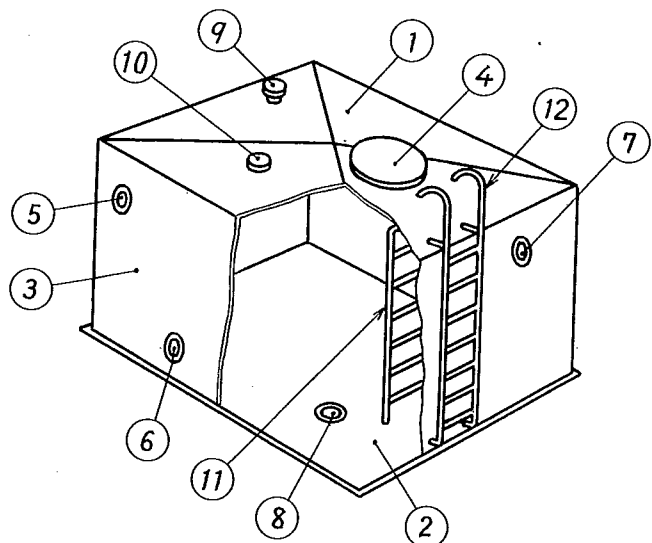
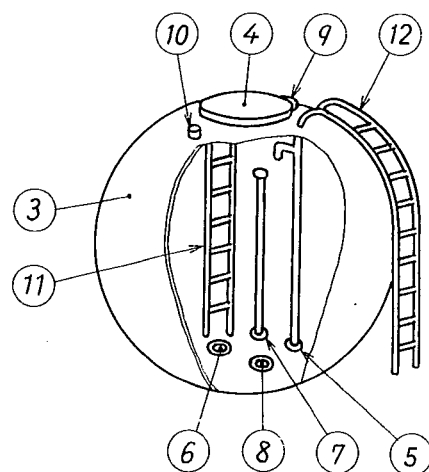


Fig. 2. Cubic Shape Water Tank (Example Figure)



Applicable Standards: See page 11.

Fig. 3. Spherical Shape Water Tank
(Example Figure)

Remarks 1. The inlet opening, outlet opening, overflow opening and drainage opening are generically called as the take-out openings.

2. In Fig. 3, ① and ② shall be included in ③.

3. In the water tanks, there are those which are not equipped with the inside ladder and outside ladder.

4. In the water tanks, there are those which are attached with supporting frame.

3. Types

The types shall be classified as given in Table 1 according to shape thereof and strength.

Table 1. Types

Classification according to shape	Classification according to seismic resistant strength (k_H)
Cylindrical shape	2/3
Cubic shape	1.0
Spherical shape	1.5

4. Qualities

4.1 Appearance The appearance, when tested in accordance with 7., the inside and outside surfaces of the water tank shall be free from flaws, protrusions and remarkable pinholes, traces of repair and bulges which are harmful in use.

4.2 Performances The performances, when tested in accordance with 7., shall comply with the requirements of Table 2.

Table 2. Performances

Item	Performance	Testing method
Tensile strength MPa {kgf/mm ² }	59 {6} min.	7.3.2
Bending strength MPa {kgf/mm ² }	78 {8} min.	7.3.3
Bending modulus of elasticity GPa {kgf/mm ² }	5.9 {600} min.	
Glass fiber content % (mass)	25 min.	7.3.4
Barcol hardness	30 min.	7.3.5
Rate of water absorption %	1.0 max.	7.3.6
Water leakage	No water leakage shall be found.	7.3.7
Deflection when filled with water %	The deflections on peripheral walls of cylindrical shape and spherical shape shall be 0.5 or under of height. For cubic, shall be 1 or under.	7.3.8
	The deflections on bottom of cylindrical shape and cubic shape shall be 2.5 or under of minimum support interval of frame.	
Strength of take-out opening	No water leakage shall be found.	7.3.9
Dissolution resistance	Odor and taste	7.3.10
	Turbidity (degree)	
	Chromaticity (degree)	
	Consumption of potassium permanganate ppm	
	Residue on evaporation ppm	
	Residual chlorine ppm	

Table 2. (Continued)

Item		Performance	Testing method
Dissolution resistance	Hydrogen ion density pH	5.8 or over to 8.6 or under	7.3.10
	Heavy metal ppm	0.1 max. (lead)	
	Phenols ppm	0.005 max.	
Chemical resistance	Consumption of potassium permanganate ppm	10 max.	7.3.11
	Residue on evaporation ppm	30 max.	
Shading performance (Water tank illuminance rate)		0.1 max.	7.3.12

5. Construction

The construction shall be as follows:

- (1) The bottom of the water tank shall be provided with the drainage opening so as to facilitate the drainage of the storage water.
- (2) The manhole shall be so constructed as to be capable of inscribing a circle of 60 cm or over in diameter, and shall have a lockable cover which is easy in opening and closing, and prevents intrusion of rain waters, dusts, etc.
- (3) The ventilating opening shall be so constructed as to have an insect proof net which prevents intrusion of insanitary substances.
- (4) Between the inlet opening and the overflow opening, it shall be so constructed as to have a space capable of preventing reverse flow of water.
- (5) The take-out openings shall be of the flanged type and screwed type. The flange of the flanged type shall be in accordance with the dimensions specified in JIS B 2210, as appropriate.

The screw thread of the screwed type shall be that having the screw threads specified in JIS B 0202 or JIS B 0203.

- (6) The threaded part of the seat for attaching electrodes shall generally be the 50 mm thread seat specified in JIS B 0202.
- (7) The manhole cover, inside ladder, and outside ladder shall be safe against the anticipated loads.

6. Materials

6.1 Materials of Body The materials of the body shall be as follows:

- (1) The unsaturated polyester resin to be used for the manufacture of the body shall be the UP-G specified in JIS K 6919 or that having the qualities equal or superior to this, as well as be superior in waterproofness and weather resistance.
- (2) The glassfiber to be used for the manufacture of the body shall be that of non-alkali specified in JIS R 3411, JIS R 3412, JIS R 3413, JIS R 3415, JIS R 3416 and JIS R 3417, as well as be those which have been processed from these as raw materials.
- (3) In the case where the filler material, colouring material and synthetic fiber are used, the qualities and consumptions thereof shall be those which are not injurious to the qualities of products and the qualities of stored water.
- (4) For the bodies, synthetic resins, plywoods, timbers, metals, etc. may be used as the reinforcing materials. However, that is superior in waterproofness and durability, and which is exposed to the inside of the body shall be that not injurious to the qualities of stored water.

6.2 Materials of Accessories The materials of the accessories shall be as follows.

The materials of the take-out opening, ventilation opening, seat for installing electrodes, manhole cover, inside ladder and outside ladder shall be made of synthetic resin or metal, be superior in waterproofness and durability, and further those which are exposed to the inside of the body shall be that not injurious to the qualities of stored water.

7. Tests

7.1 Test Conditions Unless particularly specified, the temperature and humidity of the test room, in the case where the water is tested, shall be the ordinary temperature and the ordinary humidity of JIS Z 8703.

7.2 Specimens The specimens shall be as follows:

- (1) The specimens shall be of the following 3 types.

No. 1: Water tank as a whole

No. 2: test pieces which have been cut out from the water tank

No. 3: prepare necessary test pieces from a sample which has been manufactured under the same conditions as the manufacture of the water tank.

Further, the cut ends of the test pieces to be used for the dissolution resistance test and chemical resistance test shall be those which have been treated using the same resin as that of the inner surface.

(2) The specimens to be used in the tests shall be as given in Table 3.

Table 3. Specimens

Name of test	Type of specimen	Quantity	Testing method
Tensile strength	No. 2 or No. 3	5	7.3.2
Bending strength and bending modulus of elasticity	No. 2 or No. 3	5	7.3.3
Glassfiber content	No. 2 or No. 3	3	7.3.4
Barcol hardness	No. 2 or No. 3	3	7.3.5
Water absorption rate	No. 2 or No. 3	—	7.3.6
Water leakage	No. 1	—	7.3.7
Deflection when filled with water	No. 1	—	7.3.8
Strength of take-out opening	No. 1	—	7.3.9
Dissolution resistance	No. 3	—	7.3.10
Chemical resistance	No. 3	—	7.3.11
Shading performance	No. 1	—	7.3.12

7.3 Testing Methods

7.3.1 Appearance Regarding the appearance, examine the flaws, protrusions, pinholes, traces of repair and bulges by a visual inspection.

7.3.2 Tensile Strength Measure the tensile strength in accordance with JIS K 7054.

7.3.3 Bending Strength and Bending Modulus of Elasticity Measure the bending strength and bending modulus of elasticity in accordance with JIS K 7055.

7.3.4 Glassfiber Content Measure the glassfiber content in accordance with JIS K 7052.

7.3.5 Barcol Hardness Measure the barcol hardness in accordance with JIS K 7060.

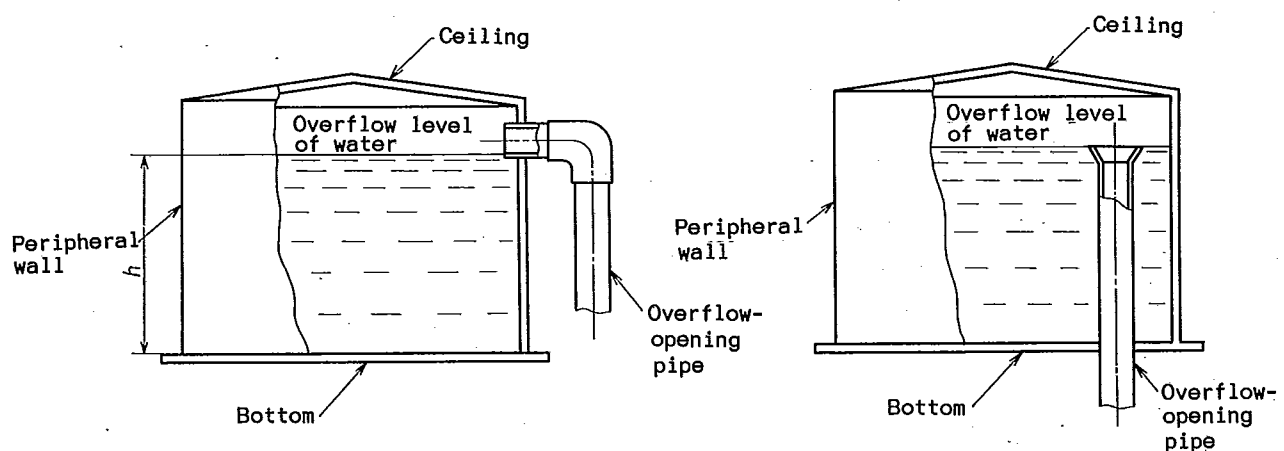
7.3.6 Water Absorption Measure the water absorption in accordance with 5.2.6 of JIS K 6919.

7.3.7 Water Leakage In the measurement of the water leakage, place a water tank on the horizontal supporting frame⁽²⁾ of 45 cm or over in height, and after this has been filled with water⁽³⁾ leave standing for 60 min or over, and examine the presence of water leakage, as it stands.

Notes (2) The supporting frame is that equivalent to the supporting method at the actual service condition.

(3) "Filled with water" means that condition where the water has been filled to "h" given in Fig. 4.

Fig. 4. Water Leakage
(Example Figure)



7.3.8 Deflection When Filled with Water In the measurement of the deflection when filled with water, place a water tank, as given in Fig. 5, on the horizontal supporting frame of 45 cm or over in height, attach the dial gauge of 0.01 mm in the minimum scale, feed water in the same manner as 7.3.7, and after this has been filled with water leave standing for 60 min or more, and measure the maximum displacements of the peripheral wall and bottom, as it stands.

Furthermore, regarding the spherical shaped water tank, measure the maximum displacement of the apex excluding the manhole.

Calculate the deflection W_1 (%) of the peripheral wall and the deflection W_2 (%) of the bottom from the following formulae:

$$\text{Deflection of peripheral wall } W_1 (\%) = \frac{d_1}{H} \times 100$$

$$\text{Deflection of bottom } W_2 (\%) = \frac{d_2}{L} \times 100$$

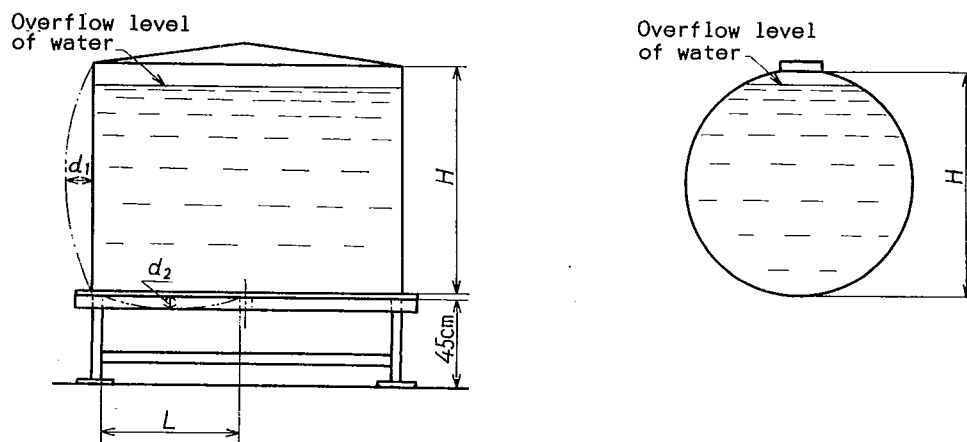
where d_1 : maximum displacement of peripheral wall (mm)

d_2 : maximum displacement of bottom (mm)

L : minimum supporting distance of supporting frame (mm)

H : height of water tank (mm)

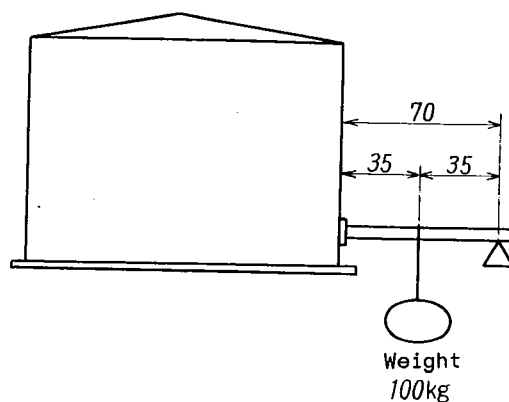
Fig. 5. Deflection When Filled with Water
(Example Figure)



7.3.9 Strength of Take-out Opening In the measurement of the strength of the take-out opening, as given in Fig. 6, attach a steel pipe to the one side of the take-out opening, support the other end at the span of 70 cm, apply the weight of 100 kg in mass at centre, and after it has been left standing for 60 min examine the presence of water leakage, as it stands.

Fig. 6. Strength of Take-out Opening
(Example Figure)

Unit: cm



7.3.10 Dissolution Resistance Measure the dissolution resistance in accordance with the specifications of 2. of Appendix 1.

7.3.11 Chemical Resistance Measure the chemical resistance in accordance with the specifications of 3. of Appendix 1.