

Various tanks supported

Equipment tanks, septic tanks, firefighting water tanks, Aqua in Pit tanks, etc.

With both the robustness of steel plates and corrosion resistance of FRP, these tanks offer toughness and perfect water tightness.

They can be manufactured in various sizes.

We also have water circulating storage tanks that are directly connected to water pipes and can be used for drinking water.



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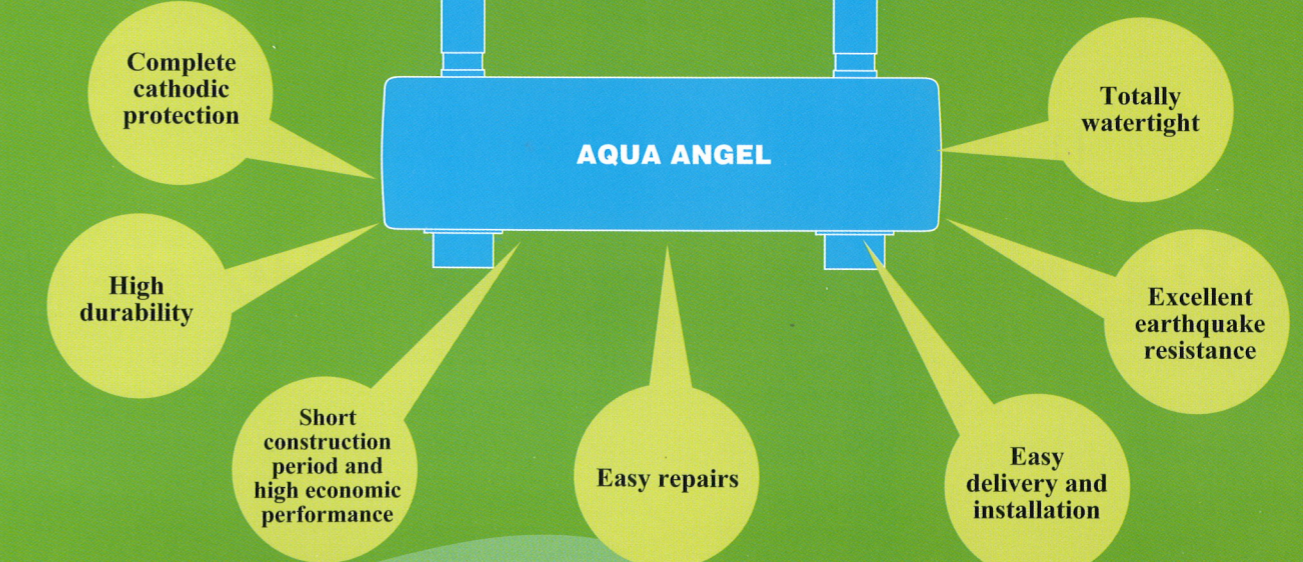
Distributors

Earthquake-resistant design incorporating know-how from
fabrication of steel/FRP composite underground tanks

AQUA ANGEL

Earthquake-Resistant Water Tanks FSF/FSV Series

Certified Products by Fire Equipment & Safety Center of Japan



Aqua Angel is a series of earthquake-resistant and firefighting water tanks capable of safely storing water necessary for emergencies.

The tanks are certified by the Fire Equipment and Safety Center of Japan and are compatible with various installation conditions.

Tamada proprietary technology **Steel plate + seamless Multilayer FRP coating**

Cross-section of earthquake-resistant water tank

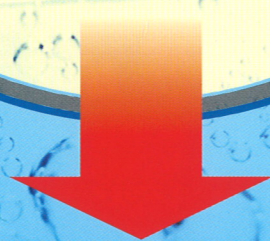
Exterior FRP

Steel plate

Interior FRP

Main features

- The robustness of the steel plate and corrosion resistance of the FRP are combined in a three-layer structure forming the inside and outside of the tank providing strength and total water-tightness.
 - The use of steel plates with excellent resilience provides superior earthquake resistance and eliminates cracks.
 - Seamless FRP coating on the inside and outside completely prevents electrolytic corrosion.
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- The cylindrical shape provides resistance to both soil pressure and internal pressure.
 - The lightweight materials make delivery and installation easy. This leads to shorter construction periods.
 - During emergencies, the stored water can be used as drinking water by employing filters and purifiers.



Safe. Reliable. *No maintenance required for a fifty years.*

Advantages of Aqua Angel

Economic performance

- Reduction of construction costs (labor, heavy machinery)
- Shortening of construction period

Safety

- Semi-permanent thanks to durability, anti-corrosiveness and high water-tightness of FRP
- Cylindrical shape resistant to load and soil pressure

Maintenance

- Because it is a prefabricated product, maintenance and repairs are simple and easy in necessary cases
- Relocation may be possible even after burying

Unitary horizontal cylinder type

Optimal for large areas!
Large, seamless solid finish.

Divided horizontal cylinder type

Optimal for tight spaces!
Construction possible with light equipment vehicle and heavy machinery.

Caisson method type

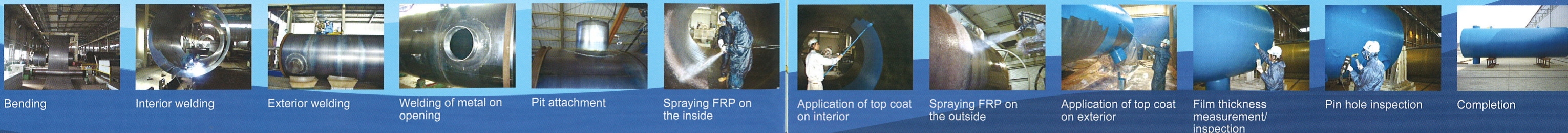
For dangerous areas (very tight spaces). Delivery possible with small trucks by dividing the unit into light weight pieces.

Standard construction time for Aqua Angel

Installation time	3-6 hours
Total number of construction days	8-10 days
Curing time	6-8 hours

Choose according to site conditions.

Example of construction (manufacturing process)



Bending

Interior welding

Exterior welding

Welding of metal on opening

Pit attachment

Spraying FRP on the inside

Application of top coat on interior

Spraying FRP on the outside

Application of top coat on exterior

Film thickness measurement/inspection

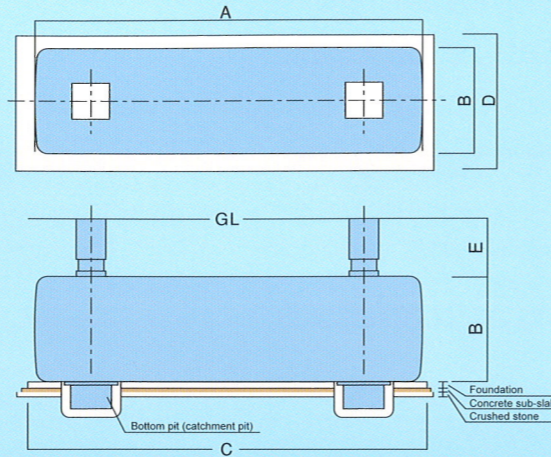
Pin hole inspection

Completion

Unitary horizontal cylinder type

Optimal for large areas! Large, seamless solid finish.

- Delivery by 10-ton truck or low-bed trailer
- Surfacing-prevention work can be performed depending on groundwater level and earth covering conditions.



Specifications

(Unit: mm)

Classification	Firefighting water tank		Earthquake-resistant water tank					
Model number	FSF402	FSF405	FSF412	FSF415	FSF419	FSF607	FSF808	FSF1007
Capacity	40 m ³	40 m ³	40 m ³	40 m ³	40 m ³	60 m ³	80 m ³	100 m ³
A	9,068	6,774	9,068	6,774	9,368	8,500	10,786	13,834
B	2,516	2,972	2,516	2,972	2,420	3,222	3,222	3,222
C	9,500	6,800	9,500	6,800	9,700	8,800	11,200	14,200
D	2,900	3,300	2,900	3,300	2,800	4,000	4,000	4,000
Burial depth	I type	350	400	350	400	500	500	500
	II type (T-20)	500	500	500	500			
	III type (T-25)	700	1000	700	1000			
Weight	4.9t	6.3t	4.9t	6.3t	5.3t	7.8t	9.8t	12.1t
Approval No.	防-96203-1号	防-97230-1号	耐-00008号	耐-00009号	耐-12004号	耐-10002号	耐-12001号	耐-10001号

- * A and B dimensions are the exterior dimensions when the design FRP coating thickness is 2 mm.
- * C and D dimensions are the base dimensions. They do not include the concrete sub-slab or crushed stone dimensions.
- * The C and D dimensions may vary depending on the groundwater level and construction method.
- * The maximum burial depth for FSF607, FSF808 and FSF1007 is 2,000 mm. For other horizontal cylinder type models, the maximum depth is 1,500 mm.
- * One or two pits are attached depending on the site and use.
- * The weight includes two pits, two adjustment fittings (maximum length) and the FRP coating.
- * Models and specifications are subject to change without notice.

Divided horizontal cylinder type

Optimal for tight spaces! Construction possible with light equipment vehicle and heavy machinery.

- Delivery by 4-ton truck or low-bed trailer
- Surfacing-prevention work can be performed depending on groundwater level and earth covering conditions.



Relationship between burial and allowable groundwater level (for installation without straps and foundation)

Firefighting water tank				Earthquake-resistant water tank											
FSF402		FSF405		FSF412		FSF415		FSF419		FSF607		FSF808		FSF1007	
Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)
0.35	1.5	0.4	1.7	0.35	1.5	0.4	1.7	0.35	1.4	0.5	1.8	0.5	1.9	0.5	1.9
0.4	1.5	0.5	1.7	0.4	1.5	0.5	1.7	0.4	1.4	0.6	1.75	0.6	1.8	0.6	1.8
0.5	1.5	0.6	1.6	0.5	1.5	0.6	1.6	0.5	1.35	0.7	1.7	0.7	1.8	0.7	1.8
0.6	1.4	0.7	1.6	0.6	1.4	0.7	1.6	0.6	1.3	0.8	1.65	0.8	1.7	0.8	1.7
0.7	1.3	0.8	1.5	0.7	1.3	0.8	1.5	0.7	1.25	0.9	1.6	0.9	1.7	0.9	1.7
0.8	1.3	0.9	1.4	0.8	1.3	0.9	1.4	0.8	1.2	1.0	1.2	1.0	1.1	1.0	1.1
0.9	1.2	1.0	1.4	0.9	1.2	1.0	1.4	0.9	1.1	1.1	0.9	1.1	1.0	1.1	1.0
1.0	0.5	1.1	0.6	1.0	0.5	1.1	0.6	1.0	0.45	1.2	0.75	1.2	0.9	1.2	0.9
1.1	0.4	1.2	0.5	1.1	0.4	1.2	0.5	1.1	0.3	1.3	0.65	1.3	0.7	1.3	0.8
1.2	0.3	1.3	0.4	1.2	0.3	1.3	0.4	1.2	0.20	1.4	0.5	1.4	0.6	1.4	0.6
1.3	0.2	1.4	0.3	1.3	0.2	1.4	0.3	1.3	0.05	1.5	0.4	1.5	0.5	1.5	0.5
1.4	0	1.5	0.2	1.4	0	1.5	0.2	1.4	0	1.6	0.3	1.6	0.4	1.6	0.4
1.5	0			1.5	0			1.5	0	1.7	0.2	1.7	0.3	1.7	0.3
										1.8	0.05	1.8	0.1	1.8	0.2
										1.9	0	1.9	0	1.9	0
										2.0	0	2.0	0	2.0	0

Solid type

Installation preparations

- Construct flat foundation with concrete. (Foundation may be unnecessary depending on soil quality and groundwater level)
- Lay rubber sheet to prevent damage to tank.

Delivery

- Deliver unitary tank by 10-ton truck or low-bed trailer.

Installation

- Attach designated wire and hooks to lifting lugs on tank and suspend it.
- Crane capacity must be at least 20 tons. (Varies depending on work radius)



- Construct foundation with concrete.
- Install metal fittings to prevent rolling.
- Lay rubber sheet to prevent damage to tank.

Delivery

- Deliver divided tank by 4-ton truck or low-bed trailer.

Suspension

- Crane capacity must be at least 12 tons. (Varies depending on operating radius)



Assembly and installation (Divided type)

- Weld parts together and make solid piece with FRP on inside and outside.



Back filling

- Use earth and sand suited to site or soil generated from excavation or otherwise and exercise caution with back filling.
- Add water while sufficiently compacting backfill.
- Do not drive heavy machinery directly over water tank when back filling.

Construction process

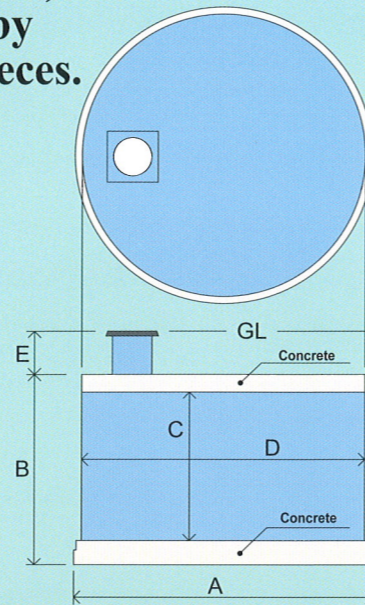
Divided type

* Tank saddle to prevent tipping are available as options.

Caisson method vertical cylinder type

For dangerous areas (very tight spaces).
Delivery possible with small trucks by dividing the unit into light weight pieces.

- Suited to locations with small work sites and narrow passageways.
- No retaining wall is necessary, reducing construction costs.
- The materials are light, so it can be delivered by 1.5t-4t trucks.
- A small crane can be used for installation.
- Soft ground installation is also possible.



Specifications

(Unit: mm)

Classification	Firefighting water tank	Earthquake-resistant water tank				
		FSV40	FSV41	FSV42	FSV60	FSV100
Model number	FSV40	FSV41	FSV42	FSV60	FSV100	
Capacity	40 m ³	40 m ³	40 m ³	60 m ³	100 m ³	
A	4,820	4,820	4,318	5,525	6,375	
B	3,356	3,366	4,004	3,707	4,417	
C	2,429	2,442	3,000	2,777	3,387	
D	4,645	4,645	4,200	5,350	6,200	
E	I type	0	0	500	0	
	II type (T-14)	200	-	-	-	
	II type (T-20)	400	400	500	400	
	III-type (T-25)	600	600	1000	600	
Weight	8.1t	6.7t	8.4t	10.5t	13.7t	
Approval No.	防-99267号	耐-00052-1号 耐-00052-2号	耐-02108-1号	耐-00143号	耐-99129号	

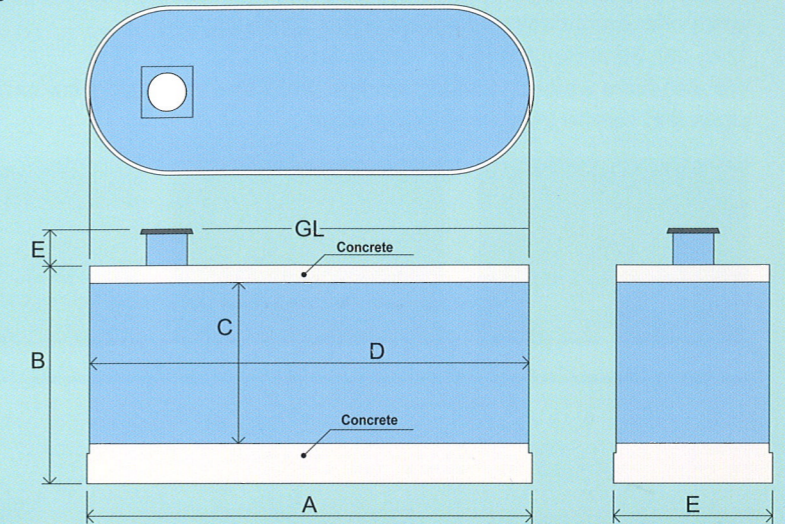
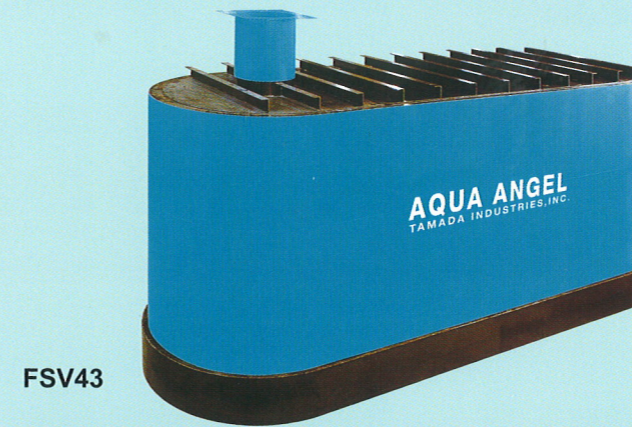
Relationship between burial and groundwater level without straps and foundation

FSV40		FSV41		FSV42		FSV60		FSV100	
Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)	Burial depth (m)	Groundwater level (m)
0	1.15	0	1.25	0.5	1.45	0	1.5	0	2.05
0.1	1.1	0.1	1.2	0.6	1.4	0.1	1.45	0.1	2.0
0.2	1.05	0.2	1.15	0.7	1.35	0.2	1.4	0.2	1.95
0.3	1.0	0.3	1.1	0.8	1.3	0.3	1.35	0.3	1.9
0.4	0.95	0.4	1.05	0.9	1.25	0.4	1.3	0.4	1.85
0.5	0.9	0.5	1.0	1.0	1.2	0.5	1.25	0.5	1.8
0.6	0.85	0.6	0.95	1.1	1.15	0.6	1.2	0.6	1.75
0.7	0.8	0.7	0.9	1.2	1.0	0.7	1.15	0.7	1.7
0.8	0.75	0.8	0.85	1.3	0.9	0.8	1.1	0.8	1.65
0.9	0.65	0.9	0.75	1.4	0.8	0.9	1.05	0.9	1.6
1.0	0.45	1.0	0.65	1.5	0.65	1.0	1.0	1.0	1.55
1.1	0.35	1.1	0.5			1.1	0.9	1.1	1.5
1.2	0.2	1.2	0.35			1.2	0.8	1.2	1.45
1.3	0.1	1.3	0.25			1.3	0.65	1.3	1.4
1.4	0	1.4	0.1			1.4	0.55	1.4	0.3
1.5	0	1.5	0			1.5	0.4	1.5	0.1

- * A dimensions are maximum outer diameter of jig for excavation.
- * The maximum earth covering depth for vertical cylinder type is 1,500 mm.
- * Weight of pile cap and deck slab concrete not included.
- * One or two pits are attached depending on the site and use.
- * B dimensions vary depending on groundwater level and construction method.
- * FSV41 Tai-00052-1 (耐-00052-1号) is either in four or eight sections, and Tai-00052-2 (耐-00052-2号) is either in three or six sections.
- * Models and specifications are subject to change without notice.
- * The weight includes two pits, two adjustment fittings (maximum length) and the FRP coating.

Caisson method long cylinder type

Employing an elliptical cylindrical shape for the water tank enables burying in small spaces where construction was not possible before.



Specifications

Classification	Earthquake-resistant water tank	
Model number	FSV43	
Capacity	40 m ³	
A	7,140	
B	3,499	
C	2,600	
D	7,022	
E	2,568	
F	I type	350
	II type (T-20)	500
	III-type (T-25)	700
Weight	8.3t	
Approval No.	耐-04001-1号	

FSV43 upper load earth covering conditions

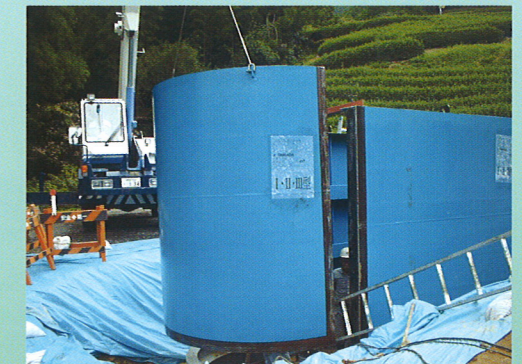
	I type	0.35-1.5m
II type	0.5-1.5m	
III type	0.7-1.5m	

Relationship between earth covering and groundwater level (dry possible)

FSV43	
Earth covering (m)	Groundwater level (m)
0.35	1.3
0.4	1.25
0.5	1.2
0.6	1.15
0.7	1.1
0.8	1.05
0.9	1.0
1.0	0.95
1.1	0.8
1.2	0.7
1.3	0.55
1.4	0.45
1.5	0.3

Assembly

- Number of parts: 3
- Number of parts: 4 (standard)
- Number of parts: 3 (standard)
- Number of parts: 22 (standard)
- Number of parts: 4 (standard)



Construction process



1. Excavation at installation location and delivery

- Excavate burial site with excavator.
- Perform base leveling on installation surface and make it flat.
- Deliver divided tank with small truck.



2. Suspension

- As with solid type, suspend tank from hangers.
- Crane capacity must be at least 7.5 tons.



3. Assembly

- Weld parts together and make solid piece with FRP on inside and outside.



4. Subsidence excavation

- Excavate with excavator or clamshell and dig deeper little by little.



5. Base/top plate installation

- After getting down to position, attach base/top plates.



6. Back filling

- Use earth and sand suited to site or soil generated from excavation or otherwise and exercise caution with back filling.
- Do not drive heavy machinery directly over water tank when back filling.