



WRAS
APPROVED
PRODUCT



SUNG IL GRP WATER TANK



Hot Press Moulded GRP Sectional Panel Tank



SUNG IL

- GRP Building Materials Company -

SUNG IL CO., LTD.

SUNG IL GRP WATER TANK

◆ 20 million dollars exporting of GRP building materials ◆

Excellent in Clean & Hygienic and Non-leakage.

GRP Sectional Water Tank for Easy to Design and Installation.

Korea Certificate

Korea : KCW-2013-0135
(Korea water and wastewater works Association)

Authority Certificate

U.K : WRAS BS6920

Singapore : PSB SS245 : 1995
SS375 : 2001

Patents Status in Korea

Heat Insulation Panel : No. 0495287
Water Inspection Panel : No. 2004 - 0008395
Elvan Water Tank Panel : No. 2004 - 00011977
Water Tank Panel : No. 2005 - 0001929
No. 2005 - 0001930

● **SUNG IL GRP Water Tank always keeps water clean.**

Various Capacity Design

Various size panels can use limited space for its best using way so can satisfy your needs.

Watertightness

The joints sealed with special sealing tape especially developed for water tank.

Intensity and Durability

Glass fiber Reinforced Panel is mulded under condition of high temperature and pressure to maintain the best endurance.
Since using stainless steel for inside structure, plated steel for outside and HDG for outside, it shows best performance against corrosion.

Heat Insulation and Dewdrops Prevention

The heat insulation panel with 4 layer structured improves heat insulation effect, Protects water from dewdrops and minimizes temperature variation of the stored water.



Hot Press Factory

Differentiated SUNGIL GRP Water Tank

GRP Water Tank Panel

ITEM	Unique Characteristics of SUNGIL (Strong Point)	Other Companies
GRP Sheet	SUNGIL produces high-quality and differentiated GRP Sheet in the own GRP Sheet (Raw material) plant	No GRP Sheet plant
Competitive price for panel	Competitive pricing for Panel caused by SUNGIL own GRP Sheet using	Low press machines
High-pressure Press Facility	Machines high strength panel with High-pressure Press machines (2500Ton ~ 3000Ton) (Possible to install : 6M Height, over 10,000m ²)	Generally using 500-1000ton Low press machines
2 PCS Production at a time for Bottom & Wall Panel	2 PCS Production at a time (it is possible to ensure competitive price)	Low Press : 1 PC Production at a time (Strength & Output decline)
2X1M Roof Panel	2X1M Roof Panel production (it is possible to ensure competitive price)	1X1M Roof Panel only
Manhole Panel	Double Sealant Structure of Manhole cover (No Dust and pollutant)	Single sealant structure
Heat Insulated Panel	As using the patented insulation panel cover(Patent number-0495287), secure the perfect insulation & prevent a defect	As using ABS & not using nonwoven, there are many defect factors

GRP Water Tank Reinforced materials

ITEM	Unique Characteristics of SUNGIL (Strong Point)	Other Companies
The safety factor for Skid Base	The patented Skid Base of SUNGIL for Water tank (Design registration-0664436) has a better safety factor than general Skid Base	As using general Skid base, there is more unstable and weak against Earthquake
Earthquake resistant design for Skid base	The design of Skid Base of SUNGIL is lower(Height) & wider(Width) than general one, so there is more stable and strong against Earthquake	
TIE ROD	Preventing corrosion & rusting issues with PET Coating	Not using PET Coating
Powder painting for internal STS materials	Preventing corrosion & rusting issues with powder Coating on the internal STS materials	No powder Coating
STS 316 washer for internal	As Using STS 304 bolt with STS 316 washer for internal, solve rusting issue	STS 304 washer for internal
Epoxy coating on Internal Bolting hole	Epoxy coating on the all internal bolting parts & connection part for preventing corrosion and rusting issue	No Epoxy coating
Using Bolt cap	Preventing rusting issue with using bolt cap(PVC) for all roof panel bolts and external bolts	Not using Bolt cap
GRP Roof support	As using GRP Roof support, it is better easy to install tie rod and strong against loading	Using PVC roof support
HDG Bolt for external bolt	As using HDG bolt for external bolt, prevent the rusting issue (with Bolt cap)	Using galvanizing Bolt
Name plate for water tank	It is easy to check the safety management rules with name plate on the water tank	No name plate

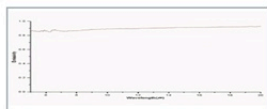


GRP Sheet(Raw Material)Factory

Antibacterial GRP water tank

Antibacterial GRP water tank Efficacy

- Heavy metal decomposition
- Cement toxicity neutralization
- Excellent antibacterial
- Infrared radiation
- A gush of more than 40 kinds of minerals



Infrared radiation rate

Escherichia coli test (test method : KICM-FIR-1003 : 2009)			
Sample	Initial concentration (CUF/mL)	After 24hr (CUF/mL)	Bacterial reduction
Specimen	3.1×10^5	4.6×10^3	-
Evan GRP	3.1×10^5	< 10	99.9

※ Test : Korea Conformity Laboratories

※ CUF : colony forming unit, ※ Escherichia coli ATCC 8739, Staphylococcus aureus ATCC 6538P

staphylococcus aureus (test method : KICM-FIR-1003 : 2009)			
Sample	Initial concentration (CUF/mL)	After 24hr (CUF/mL)	Bacterial reduction
Specimen	2.9×10^5	3.5×10^2	-
Evan GRP	2.9×10^5	2.7×10^2	99.9



Colon bacillus Test

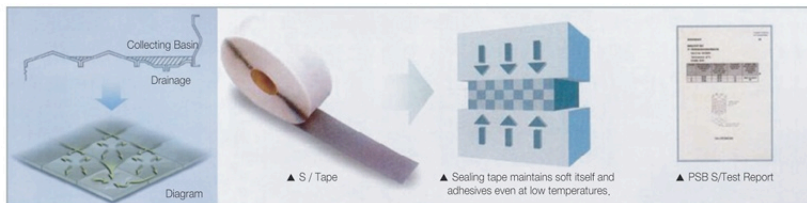


Staphylococcus aureus Test



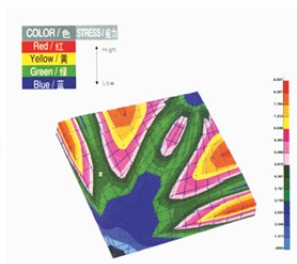
Best Watertight - Sealing Tape / Bottom Drain System

- Especially developed sealing tape maintains perfect non-leakage of the Water Tank.
- The dome shaped bottom panel with a concave drain panel facilitates complete and quick drainage



System design (FEM)

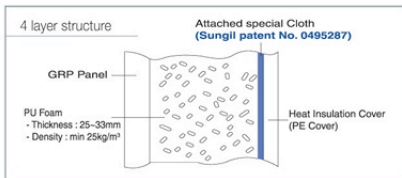
- Safe and robust panel construction is designed considering the stress concentration on the panel when load is applied by FEM. And we always satisfy all safety requirements such as strength, durability and stability with rigid design regulation and quality control.



Excellent Heat Insulation

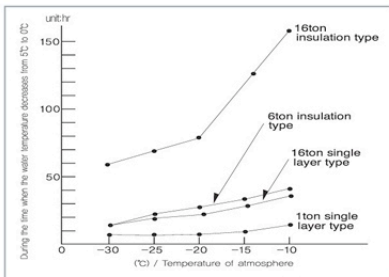
Feature of insulation panels

- The heat insulation panel with 4 layer structure improves heat insulation effect, Protects water condensation on the outside of the tank and minimizes temperature variation of the stored water.



During the time when the water temperature decreases from 5° to 0°

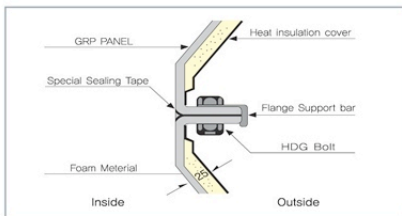
Capacity	Classification	Temperature of Atmosphere		
		-10°C	-20°C	-30°C
16tons	Single Layer Type	35 hr	20 hr	13,5 hr
	Insulation Type	164 hr	81 hr	58,5 hr
1tons	Single Layer Type	11 hr	6 hr	4 hr
	Insulation Type	37,5 hr	23 hr	13,5 hr



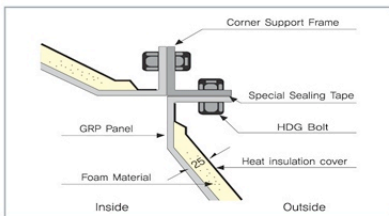
※ Test condition

- Tank is filled with water
- No further water supply, or drainage during the test

Drawing of the panel joint part / corner part



- Heat insulation foam core thickness : 25~33mm



S-Type Skid Base System

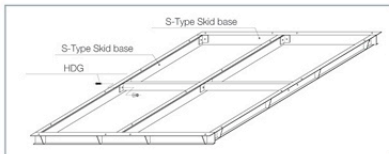
- Water tank height - 3M, 5M
- Water level - 85% of water tank height

- Stress intensity of S-Type Skid base system : 3M

item	Skid base
Bending stress(kg/cm ²) $\sigma = M_{max} / Z$	0,213 x 100,000 / 20,3 = 1,049
Shearing stress(kg/cm ²) $\tau = S \times Q / (b \times l)$	0,638 x 1,000 x 45,6 / (0,4 x 123,9) = 587

- Stress intensity of S-Type Skid base system : 5M

item	Skid base
Bending stress(kg/cm ²) $\sigma = M_{max} / Z$	0,354 x 100,000 / 36,2 = 978
Shearing stress(kg/cm ²) $\tau = S \times Q / (b \times l)$	1,063 x 1,000 x 83,9 / (0,45 x 298,5) = 664



• Result

height	item	S-Type Skid base	Result
3m	Bending stress (kg/cm ²)	1,049	allowable stress (1,200) ■ O.K
	Shearing stress (kg/cm ²)	587	allowable stress (680) ■ O.K
5m	Bending stress (kg/cm ²)	978	allowable stress (1,200) ■ O.K
	Bending stress (kg/cm ²)	664	allowable stress (680) ■ O.K

Installation Conditions and Design Standard of Sectional GRP Water Tank

Intensity and Endurance

Section	Design Standard
Hydrostatic Pressure	Water pressure reinforcement 6 times standard Transformation rate in filled up with water : Less than 1% form Water tank Height
Wind Force	Less than 60m/sec
Earthquake Force	Horizon intensity kh = 1/3G
Snow load	60Kg/m ² , Snow fall less than 30cm
Illumination Rate	Less than 0,1%
Out-fit Force	No leakage under condition of vertical 100Kg after install of 100A Fitting
Water Temperature	Usable temperature : Less than 30°C / Limited temperature : Max 70°C
Water quality	Tap water, well water : chlorine below 50mg/l ² Seawater : application Externally Reinforced water tank (max 3m height)

Easy Capacity Design

Section	Available Design Conditions
Height	1,0 ~ 6,0 M
Capacity	1 ~ 5,000 ton
Shape	Square, ▽ Shape, □ Shape, ▢ Shape etc.

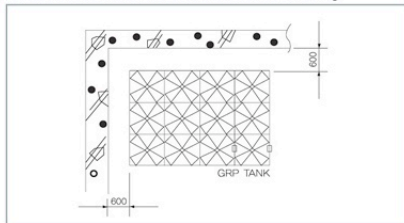
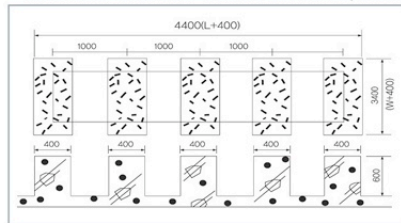
Heat Insulation

Division	Thermal Conduction Kcal/mhr °C	
	Single Layer Type	Insulation Type
Steel, STS	37	37
GRP Tank	0,15(Over 370 times)	0,017

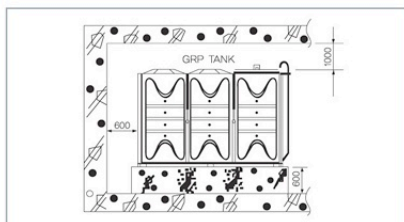
Installation Standard (Pad and Space)

Standard of Base Concrete PAD Installation and Space

- For maintenance of GRP tank, it needs extra space at least 600mm from wall and 1,000mm from ceiling.



Width	Over 400mm
Height	Over 600mm (Skid Base Include)
Space	less than MAX 1M
Outer Dimension	W, L + 400mm
Horizontal Degree	Less than 1/500

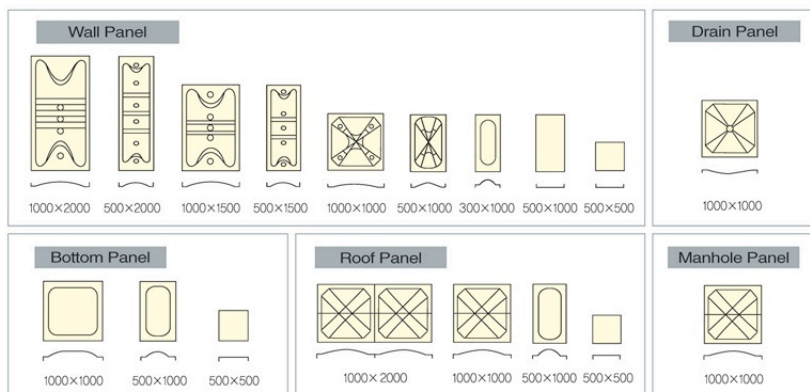


Panel Physical Properties

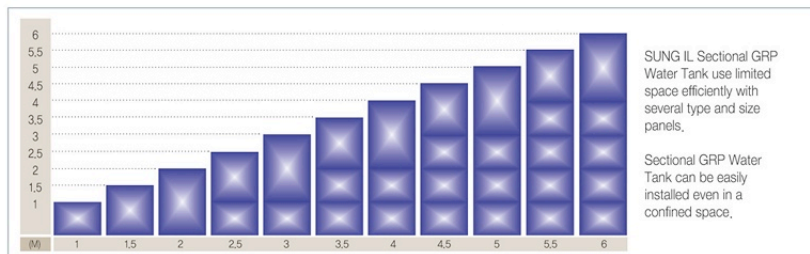
item	Unit	Physical Properties	Test Method
Specific Gravity (23°C/23°C)		1.8	KS M 3016:2006(A)
Tensile Strength	MPa	100~110	KS F 4811:2005
Bending Strength	MPa	190~200	KS F 4811:2005
Elastic Modules in Band	GPa	10~16	KS F 4811:2005
Barcol Hardness	-	50~60	KS F 4811:2005
Compression Strength	MPa	100	KS M 3015:2003
Water Absorption Rate	%	Below 0.05	KS F 4811:2005
Impact Strength (ZOD)	J/m	1,055	KS M 3015:2003
Glass Fiber Content	%	MIN 32,7	KS F 4811:2005

item	Unit	Physical Properties	Test Method
Liquefaction Test (Turbidness)	Degree	Below 0.1	KS F 4811:2005
Liquefaction Test (Chromatolity)	Degree	Below 1	KS F 4811:2005
Thermal Expansion Co - Efficient	1/°C	1,04 × 10 ⁻⁵ /°C	KS M 3015:2003
Thermal Conductivity	Kcal/m.hr.°C	0,017	KS L 9016:1995 (Means of the heat flow meter apparatus)
Light Transmittance		0,00%	KS M 4811:2005
Toxicity		NIL	KS M 4811:2005
Micro Biological Growth		NIL	KS M 4811:2005
PH(25°C)		7,6	KS M 4811:2005

GRP Panel Type and Size



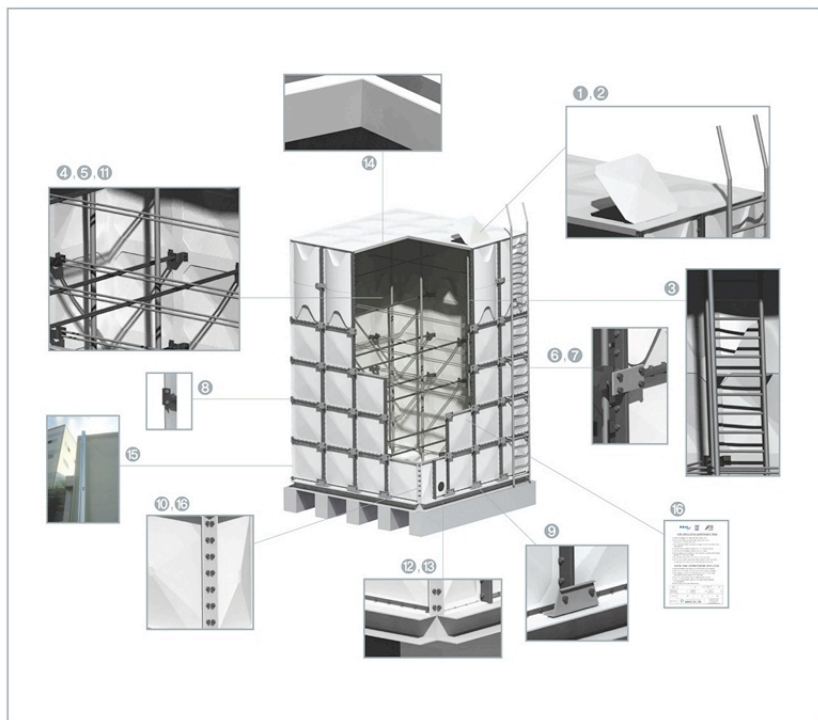
GRP Panel Composition by Height



※ Externally Reinforced System : less than 5m Height

Internally Reinforced System

- It is possible that various capacity' s design and flexible space should be used by GRP panels standardized
- Excellent watertightness, hygienic conditions and non-leakage applied internally reinforced stay(Stainless)



No.	Name	Material
1.	Manhole panel	GRP
2.	External ladder	SS41(HDG)
3.	Internal ladder	GRP (Pultrusion)
4.	Internal Tie Rod	STS 304(PET coating) or STS 316
5.	Internal bracket	STS 304(Powder coating) or STS 316
6.	External reinforced bar	SS41(HDG)
7.	External bracket	SS41(HDG, Fixing cross part)
8.	Corner bracket	SS41(HDG)
9.	Bottom bracket	SS41(HDG)
10.	Corner frame	SS41(HDG)

No.	Name	Material
11.	Roof support pipe	GRP (Pultrusion)
12.	Base frame	SS41 (HDG)
13.	Bolts and Nuts	Inside : STS 304 or 316, Roof Panel : HDG+PVC Bolt cap
		Outside : HDG Bolt + PVC Bolt cap
		Connection : HDG Rubber Head Bolt Size : M10,12,14
14.	Sealing Tape	PVC Foam(Maintain water proof with flexibility)
15.	Water Level Gauge	Socket + PE(Clear Type Tube)
16.	Name Plate	Aluminum(Water Tank Safety Management Instructions)

Features of Internally Reinforced System

Excellent Hygienic Conditions

- Minimized rust appearance of roof-sectional stainless parts inner Water Tank in accordance with basical options that are internally reinforced stays and brackets with PET coating.
- Prevented rust appearance of Chlorine Gas through the assembly bolts added PVC bolt-caps of roof section inner Water Tank

Outstanding View

- Prevented white peril or rust appearance through external assembly bolts added bolt-caps of Water Tank, and outstanding view

Easy to Assembly

- Easy to assembly through internal and external optimized options of reinforced system.

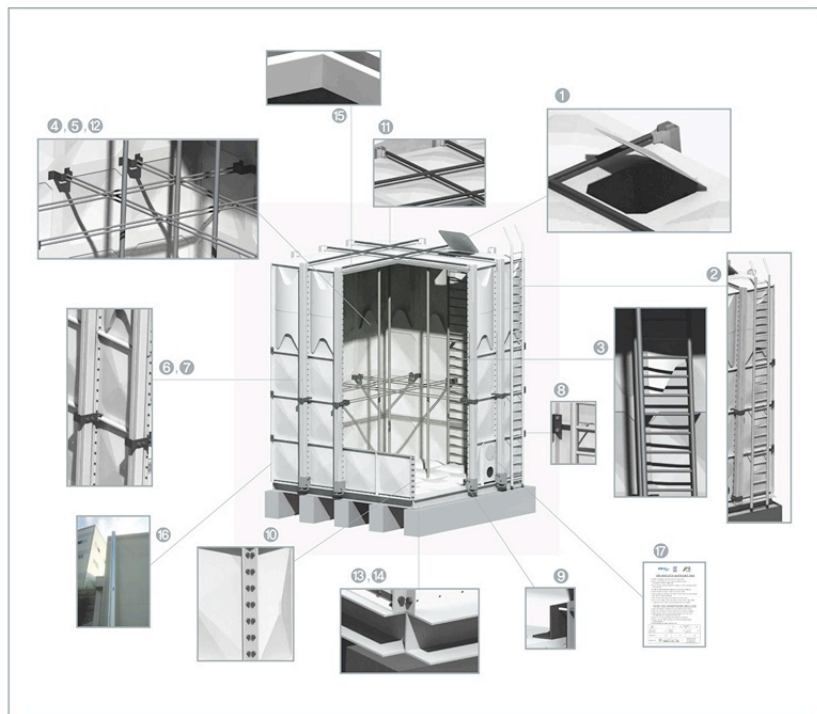
Best Structure Stability

- SUNG IL CO., LTD's internally Reinforced System is verified structure stability of water tanks which have built in domestic and international sites for 20years.

- Location : Cheonan Industrial Complex Reservoir
- Size(M): $34 \times (15+15) \times 5h = 5,100m^3$



Externally Reinforced System



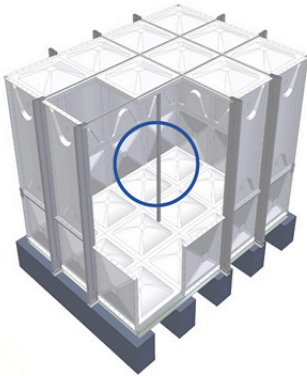
No.	Name	Material
1.	Manhole panel	GRP
2.	External ladder	SS41 (HDG)
3.	Internal ladder	GRP (Pultrusion)
4.	Internal Tie Rod	STS 304(PET coating) or STS 316
5.	Internal bracket	STS 304(Powder coating) or STS 316
6.	External Pair Frame	SS41 (HDG)
7.	External bracket	SS41 (HDG, Fixing cross part)
8.	Corner bracket	SS41 (HDG)
9.	Bottom bracket	SS41 (HDG)
10.	Corner frame	SS41 (HDG)

No.	Name	Material
11.	External support pipe	SS41 (HDG)
12.	Roof support pipe	GRP (Pultrusion)
13.	Base frame	SS41 (HDG)
14.	Bolts and Nuts	Inside: STS 304 or 316, Roof Panel : HDG+PVC Bolt cap
		Outside : HDG Bolt + PVC cap
		Connection : HDG Rubber Head Bolt
		Size : M10,12,14
15.	Sealing Tape	PVC Foam(Maintain water proof with flexibility)
16.	Water Level Gauge	Socket + PE(Clear Type Tube)
17.	Name Plate	Aluminum(Water Tank Safety Management Instructions)

Features of Externally Reinforced System

Externally Reinforced System

Water tank Height 1.5M~4M :
No TIE-ROD
(Width 6M Over : Application of additional Tie-Rod)



Water tank Height 4.5M~5M :
Application of Tie-Rod on 2MH Part
(Width 6M Over : Application of additional Tie-Rod)



Outstanding of Externally Reinforced Water Tank

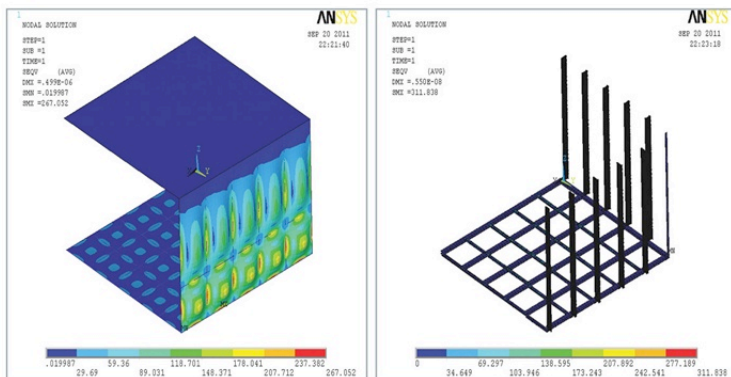
- To minimize rust appearance inner Water Tank
(No metallic parts inside of water tank less than 3mH)
- 3.5~5m Roof section(Chlorine GAS stay)
Removing the reason for rust appearance
- Easy to maintenance cleaning, through
optimization of inside parts

- Location : Head office water tank
- Size(M) : 3 X 4 X 5h

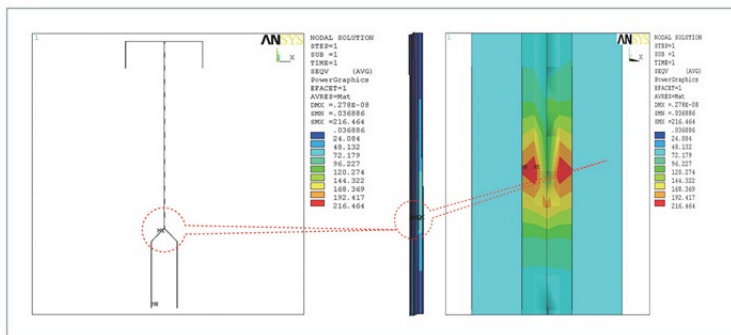


Externally Reinforced System Structural Analysis

FEM - Water Tank Height (3MH-75m³)



FEM - External Pair Frame (3MH-75m³)



MODEL	MATERIAL	STRESS(MPa)	YIELD STRESS(MPa)	SAFETY FACTOR	RESULT
Pair Frame	SS41(HDG)	216	240	0,9	OK

Externally Reinforced System

Externally Reinforced System for Partition Type



Externally Reinforced Water Tank



Partition Type Water Tank

- It is possible to eliminate unusable space, and utilize the maximum space, by installing a partition type tank. Economical and effective for maintenance.

Special feature

- Utilizing maximum capacity

In the basement or other confined areas, it is possible to eliminate unusable space, and utilize the maximum space, by installing a partition type tank.

- Various uses

If partition type tanks are installed, one section can be used for drinking water, and the other section for service water (Ex. fire fighting).

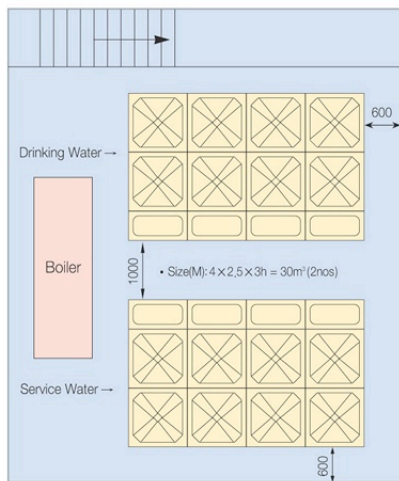
- Easy Maintenance

It is convenient for maintenance, because two tanks can be installed as one unit.

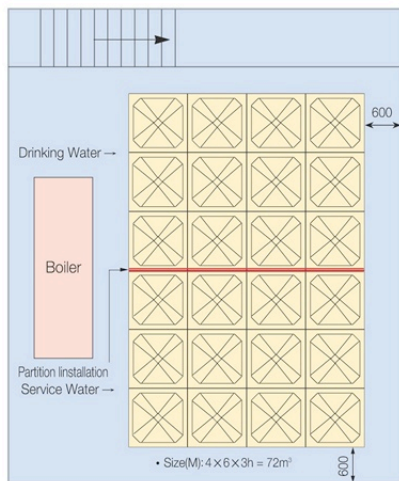
- Cost effectiveness

The cost and installation of 1 partition tank is cheaper than 2 separate tanks.

Partition Installation



(Non Partition Type)



(Partition Type)

Effect for Partition Water Tank System

- If tanks for two different uses are needed in a confined area or boiler room, a 72 ton partition type tank can be installed to use half for drinking water, and half for service water. If separate tanks are installed, however, you have to installed two tanks with a maximum of 30 tons, because you need to have 1 meter distance between tanks for maintenance and operating space.

PROJECT REFERENCES

Korea

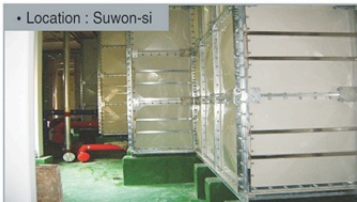
• Location : Mt. Geumgang Golf Course



• Location : Cheonan Industrial Complex Reservoir



• Location : Suwon-si



• Location : Gimhae-si Hyundai I-Park



Overseas

• Location : Vladivostok



• Location : Iran



• Location : Abu Dhabi



• Location : Australia



Sectional GRP Water Tank Installation Processing

- Low installation cost and easy to install by several type and size panels



Base Concrete PAD



Bottom Panel Assembly



Wall Panel Assembly 1



Wall Panel Assembly 2



Roof Panel Assembly



GRP Water Tank

Installation and Caution

- 1) Customers are requested to make foundation pad construction according to the designed specifications and the strength of the side.
- 2) Check the evenness of foundation pad and the flatness of base material.
- 3) Check rust of the external reinforced material and any bolts and nuts, their tightness.
- 4) Check installed state of the external ladders and water level gauge.
- 5) Check bending of the water tank wall panel(maximum up to 1% of water tank height) and check skewness of the water tank.
- 6) Check a corrosion inhibitor coating on the internal reinforced material and bolts tightness.
- 7) Check drooping the internal reinforced stay and check assembled state the internal bracket.
- 8) Check assembled state of the internal ladder and roof supports(PVC pipe)
- 9) Check the size of socket for plumbing will be installed.
- 10) Check assembled state of a socket for plumbing.
- 11) After the socket for plumbing are in place, the plumbing and heat insulation must be done by customer.

Maintenance Control

- To keep the tank clean and ensure its safe use, please perform the following inspection and maintenance work.
- SUNG IL GRP Panel tanks are designed and manufactured for long-term service. Maintenance and inspection must be conducted to secure hygienic and long life. To facilitate easy and safe maintenance and inspection, a proper space must be secured around water tanks.

Maintenance Control

- 1) Caution the damage to the water tank from outside shock.
- 2) Do not use the GRP water tank for other unapproved purpose.
(For example "chemical storage tank")
- 3) Do not dismantle internal components or change it to other components without official approval.
- 4) Prohibit to install unapproved components or non-consent equipment.
- 5) Check the water level gage at least one time per a month.
- 6) Keep the 80% water level of the water tank height.
- 7) Clean the inner side of water tank at least two time per a year.
- 8) In case of partition water tank system, keep under 50% water level of the water tank height in the opposite side, as cleaning.
- 9) Do not use any organic solvent such thinner, acetone, chlorine bleach when cleaning inner side of water tank and recommend with soft material.

- Location : Head office water tank
- Size(M) : 3 X 4 X 6h



Maintenance item

Maintenance item	Interval	Remarks
Water leakage and deformation of the tank	Once a month	If the water tank leaks or deformed immediately contact the local sales representatives.
Turbid water	Once a month	Check the inner parts of the tank, the outlet and the other places for turbid water.
Manhole cover	Once a month	Make sure that the manhole cover is completely shut. Always keep it locked.
Looseness of the bolts and nuts	Once every six month	Retighten any loose bolts and nuts.
Internal & external pressure other than hydrostatic pressure	Once a month	If any pressure other than hydrostatic pressure applied to the tank, immediately return the tank to its normal state.



Head Office View



- GRP Building Materials Company -

SUNG IL CO., LTD.

20, Gimhae-daero 1031 Beon-gil, Hallim-myeon,
Gimhae-si, Gyeongsangnam-do, Korea

Tel.82-55-346-1490-6 Fax.82-55-346-1498

Homepage : www.sungilgrp.co.kr

E-mail : sungil@sungilgrp.co.kr