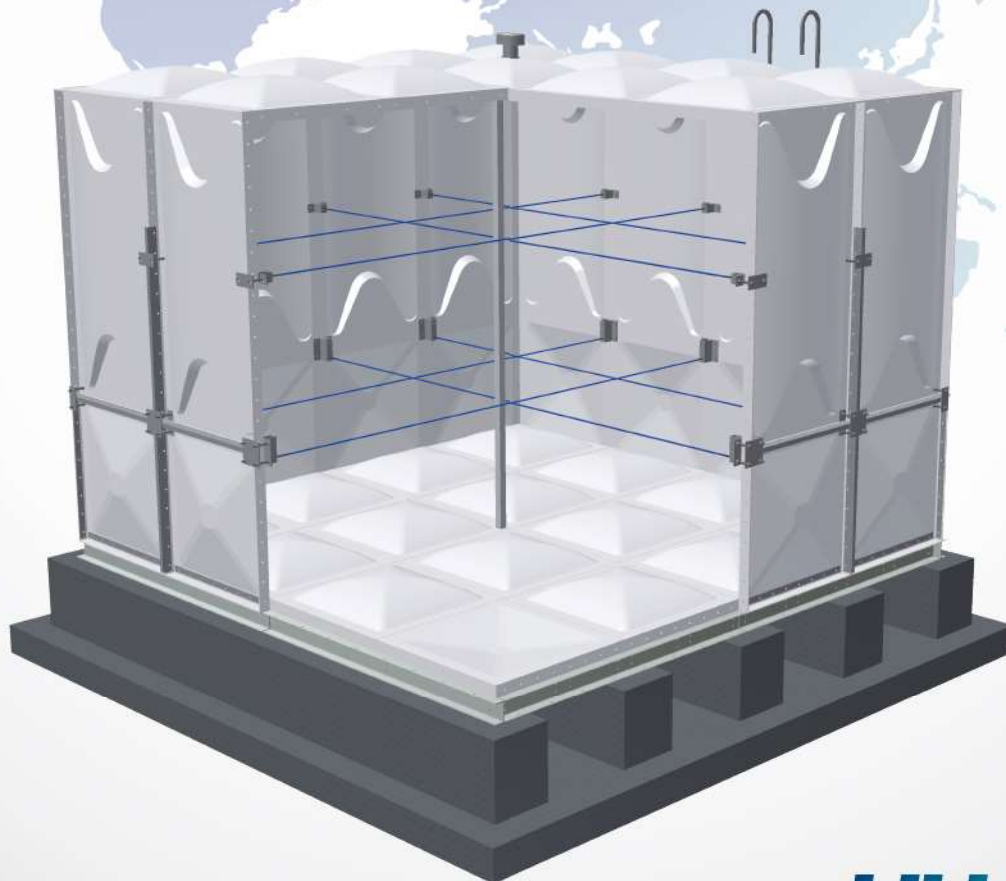


Your choice for clean and healthy water

DOHA Clean Tank

■ External Reinforcement System ■ Internal Reinforcement System



WRAS
APPROVED
PRODUCT



HY (주)하영SMC
hayoung

Desire for Clean Water

We deliver the cleanness as it is



Being equipped with the best facilities and the best quality in Korea, We will always be with customers.

With over 40 years of know-how, All people in Hayoung SMC are working hard to produce best water tank in the world with the mindset that our product can help to keep better life and health of people in the world.

we have been making efforts to deliver clean and hygienic water through our continuous technology development and quality control, We will supply the best product in order to serve the very best satisfaction for our customer.

Hayoung SMC is always around of the customers who need clean and hygienic water with World Best Water Tank.

02 DOHA Clean Tank



Photos of cutting edge facilities of Hayoung SMC Inc.

We produce best quality products in the cutting edge precision facilities



Hydraulic press for molding panels



After forming



Punching facilities for panel holes

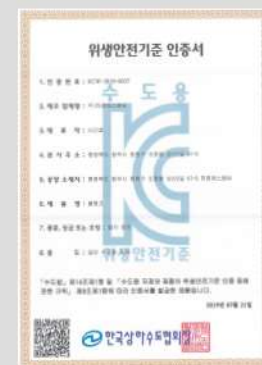
Certificates of Hayoung SMC Inc.



ISO-9001



Test report from KTR



KC



PSB Product Certificate(SG)



WRAS Certificate of UK

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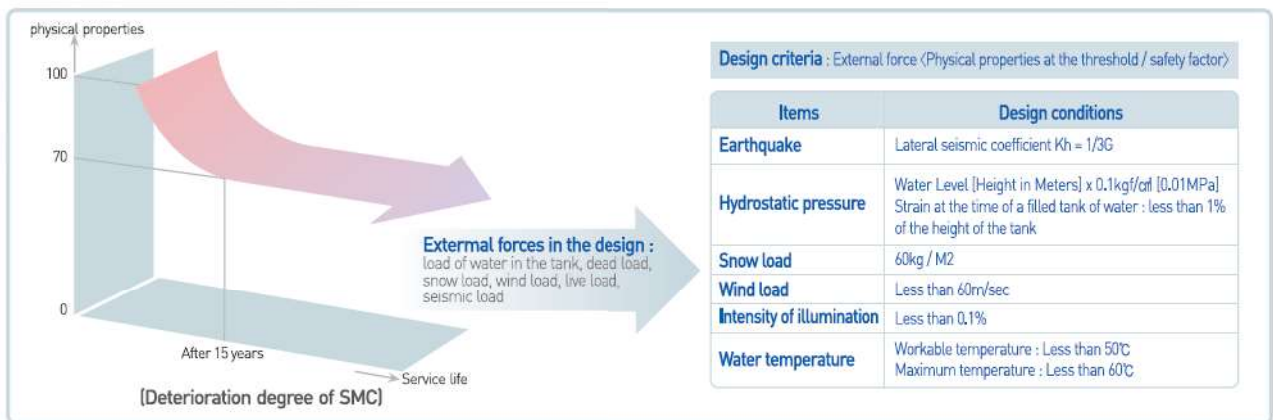
Safety

We pursue the best system through strict design criteria, quality management, and reliable structural strength analysis.

The basic of structure analysis is designed by safety factors against threshold values.

Hayoung SMC Inc. know-how lies in the optimal safety factor in consideration of external force in the design that is expected base on physical properties after long-term use of SMC material for more than 15 years.

In designing, the DOHA Clean Tank ignores initial value(100%) of the physical properties of SMC material and considers the safety factor to a minimum value(70%). Therefore, the DOHA Clean Tank guarantees long-term endurance.



※ Overseas quality certificates : PSB(Singapore), WRAS 60°C(U.K)

Free capacity design

Using panels of various sizes, the DOHA Clean Tank utilizes horizontal and vertical space at the maximum and those are suitable for an underground reserve tank of large capacity. It operates a corner-type system.

Possible height to install tank

1.0M ~ 5.0M in heigh

Possible capacity to install tank

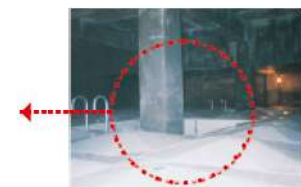
1Ton ~ 5,000 Tons

(The capacity exceeding 5000 tons can be installed by separate design)

Large capacity type :



Cube - type tank, corner-type tank(□, ∟, U-type tank)



(Corner : real example of □-type tank)

Best Hygienic Properties

With the use of excellent corrosion-resistant panels, the surface of the tank is uniformly smooth without any moss growth and therefore, enables long-term use as the panels inhibit the proliferation of bacteria and other various germs by perfectly blocking all light from outside.

► Materials for Reinforced Components

Inside	for Liquid part	Stainless Steel(STS)
	for Air part	Plastic or corrosion-resistant material
Outside		Steel+ hot galvanizing

► Products with Inferior Hygienic Properties



▲ When light penetrates in the tank :
Moss and microorganism grow.



▲ When general STS bolts are used
in the air area :
Corrosion occurs due to chloride gas.



▲ Welded type air area of the STS tank :
Corrosion occurs due to chloride gas.

Performance evaluation criteria of the panel

	Item	Performance criteria	DOHA CLEAN TANK
Mechanic strength	1) Tensile strength	More than 60 Mpa	97.6 Mpa
	2) Flexural strength	More than 80 Mpa	254 Mpa
	3) Flexural modulus	More than 6000 Mpa	16,400 Mpa
	4) Barcol hardness	More than 30	71
	5) Absorption	Less than 1%	0.05%
	6) Glassfiber content	More than 25%	More than 30%
	7) Panel gravity	1.8	1.8
	8) Impact strength	More than 80 Kj/m2	97 Kj/m2
	9) Light transmission	Less than 0.1%	0.00%
	10) Thermal conductivity	Less than 0.02 kcal/m·hr·°C	0.02 kcal/m·hr·°C
Elution of toxic substances	1) Heavy metals	Less than 0.1% ppm	Not detected
	2) Consumption of KMnO4	Less than 10 ppm	0.3 ppm
	3) pH	5.8 ~ 8.6	7.6
	4) Phenol	Less than 0.005 ppm	Not detected
	5) Odor & Taste	No defects	No defects

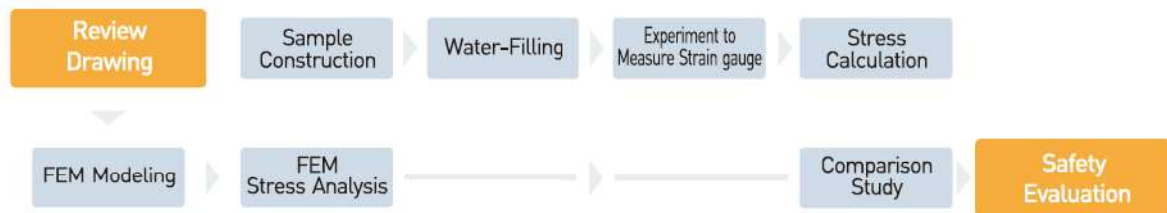
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Optimal structural design

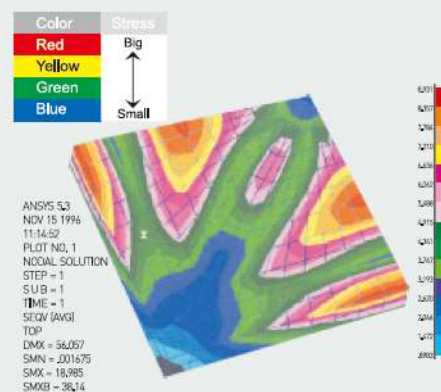
We performed structure analysis by the Finite Element Method to secure credibility on a reinforcement system and the intensity of panels and pursue the optimal design.

By inputting all possible factors such as hydrostatic pressure, seismic load, snow load, wind load, etc., We estimated the stress and distortion level. Through intensive reinforcement on the part with maximum stress, We aimed to design the best stable system.

Structural Analysis Flow chart



Stress analysis of the panel(FEM)



By modeling the radial symmetrical cubic to 1/4 size, We estimate the strain level of each part when the load is input. On the part where the stress has been intensified, we set the load again or increase the thickness of the panel in order to pursue an ideal model and develop a high-strength panel.

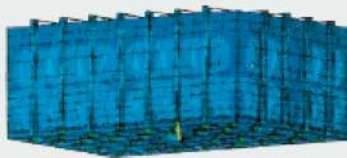
Hydraulic pressure test



Filling with the water in the hydraulic press of a unit panel and increasing the press by 0.05kg f/cm² every minute, we check failure pressure of the panel and set the grade (thickness/weight) by height accordingly.

DOHA Clean Tank provides perfect structural safety based on years of experience and know-how in structural design

Stress analysis of the system (FEM)



Color	Stress
Red	Big
Yellow	
Green	
Blue	Small

ANSYS 5.3
NOV 15 1996
11:14:52
PLOT NO. 1
NODAL SOLUTION
STEP = 1
SUB = 1

TIME=1
SEQV (AVG)
TOP
DMX = 56.057
SMN = .001675
SMX = 18.985
SMXB = 38.14

.001675	8.439
2.111	10.548
4.22	12.657
6.33	14.767
	16.876
	18.985

We conduct modeling of the overall basic design system in order to evaluate the stress level when inputting load and find out the location of peak stress. Through repetitive complementary design works, we build the best optimal system that will be reliable.



▲ Strain gauge test scene

Test for verification

Long-term Durability Test(Field test)

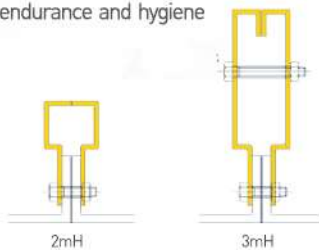
Generally, there is more than one water depletion and filling up a water tank per day, on the average. Therefore, if the tank is used for 15 years, approximately 4000 times of water circulation would occur and the tank would undergo about 4000 repetitive loads. Through the field test before launching new products into the market, the Hi Tank undergoes actually expected repetitive loads by letting the water circulate for 6 months day and night using two tanks. After checking for water leakage and other defects from such tests to guarantee safety and endurance, we launch the product into the market.



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External reinforcement beam

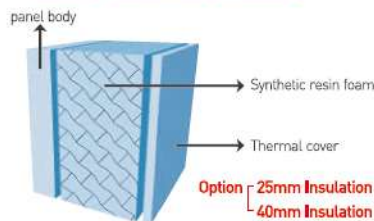
- External reinforcement design that is structurally safe without internal reinforcement material.
- Reinforcement structure focusing on endurance and hygiene



Outstanding thermal effect(option)

- With the excellent insulation effect of the material and single-unit polyurethane thermal material, our tank demonstrates outstanding thermal effect and prevents freezing and dew condensation. (Adapted weatherproof-treated thermal cover)

※ For side panel
- Weatherproof-treated(added ASA material)

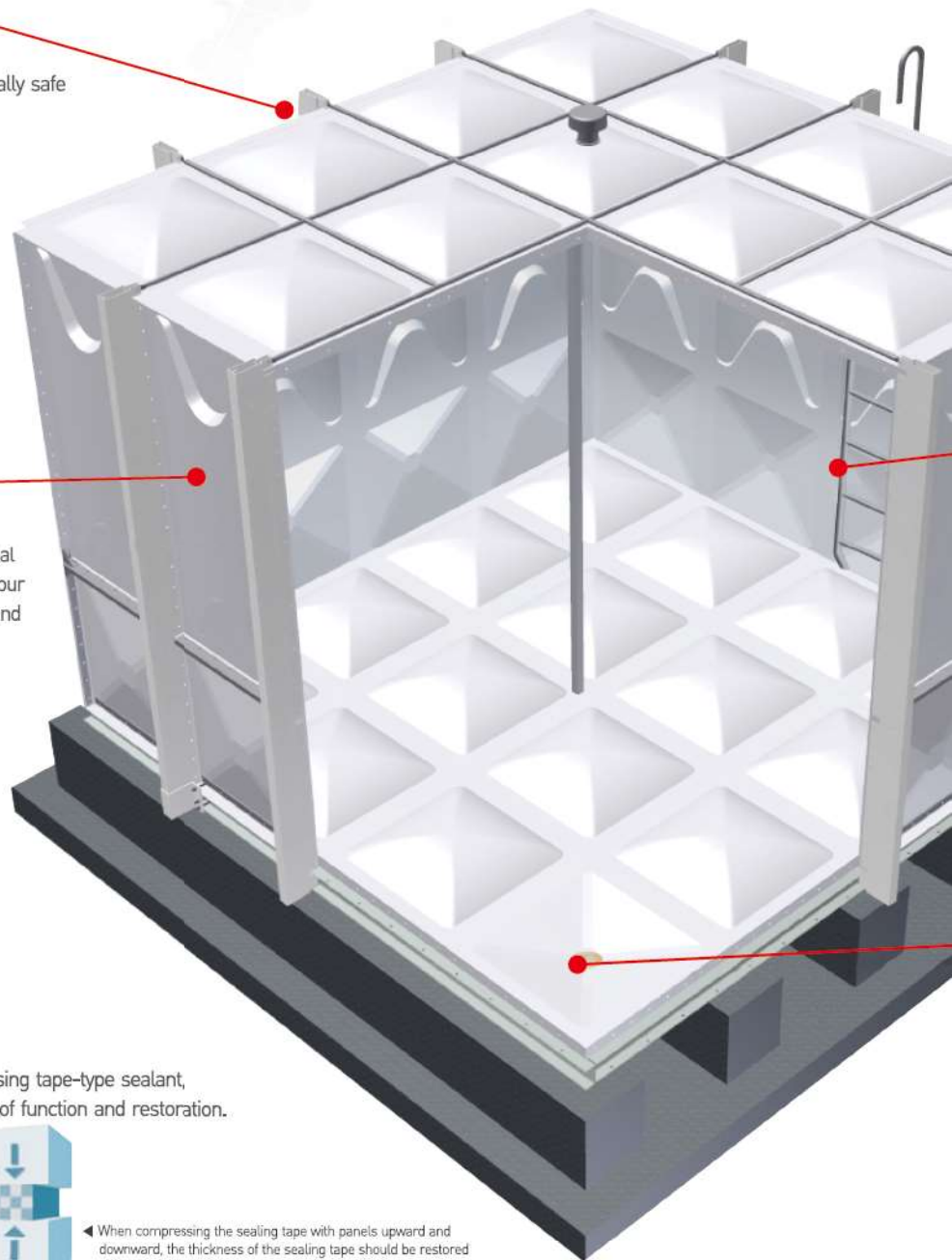


Watertight Construction of the Panel

- Maintains perfect watertight function by using tape-type sealant, a PVC foam with an excellent weatherproof function and restoration.



◀ When compressing the sealing tape with panels upward and downward, the thickness of the sealing tape should be restored to the 95% of the initial thickness in 24 hours from the panels,



We provide perfect hygiene and convenience for cleaning with an **External Reinforcement System** that has no possibility of containing rusty water.

External ladder

- Considering the safety when entering the manhole, the grip part of the ladder is made in round form.
- Easy to use and excellent in appearance.

Roof support / Internal ladder

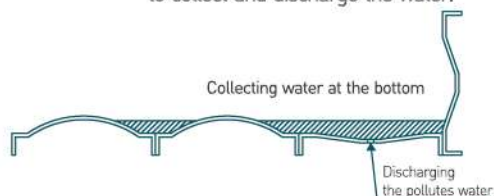
- Used reinforced plastic which is same material for the panel, contains no rust and does have excellent mechanical strength,

Hot dip galvanized bolts

- The coated surface doesn't get damaged when assembling with an impact wrench to a thickness of a coating surface more than $40\mu\text{m}$ in thickness.

Drainage structure at the bottom

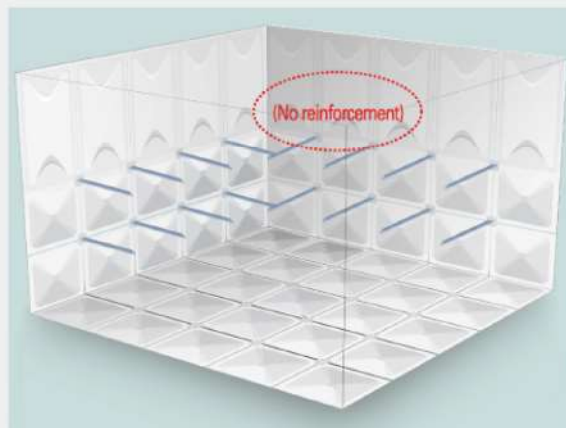
- We use a drainage panel on the bottom to collect and discharge the water.



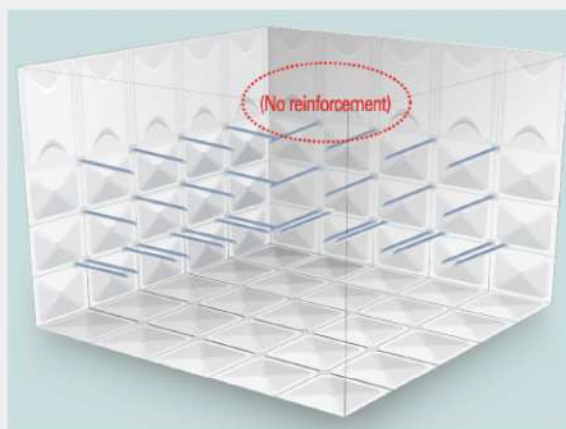
3.5 ~ 5mH Reinforcement system

The water tank exceeding 3mH in height adapts an internal/external complex reinforcement system that minimizes using reinforcement materials inside the tank and secures hygienic and structural safety.

※ In particular, in order to prevent erosion due to chlorine gas, the structure without an inside reinforcement stay is applied to the top part.



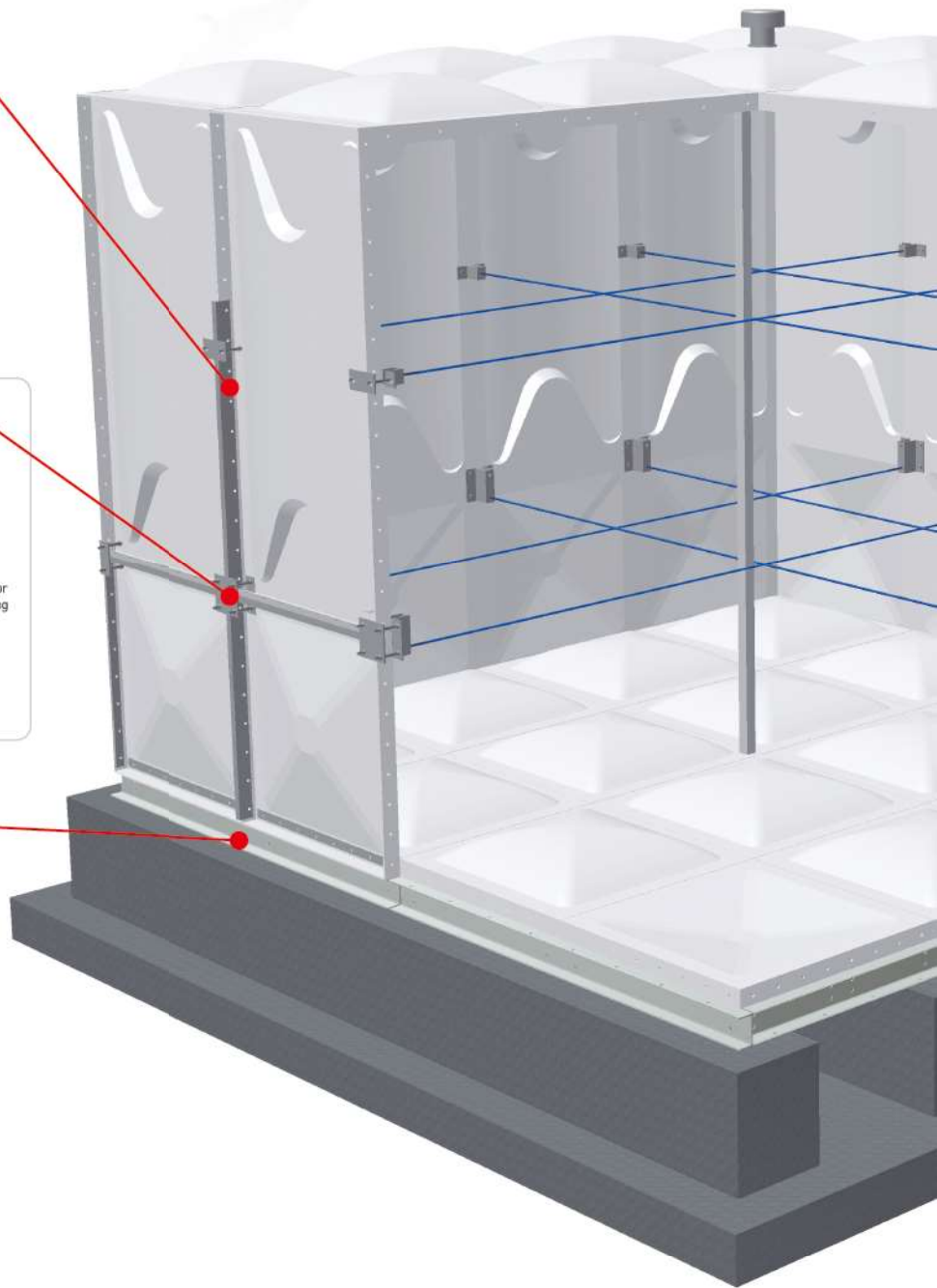
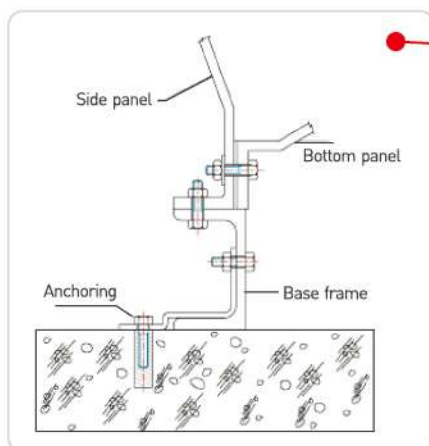
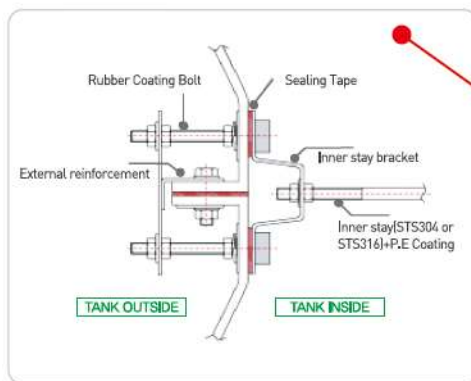
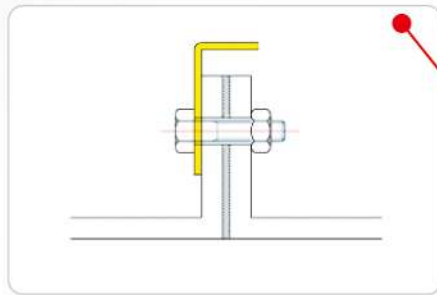
▲ Inside of the 3.5 ~ 4mH three-dimensional view

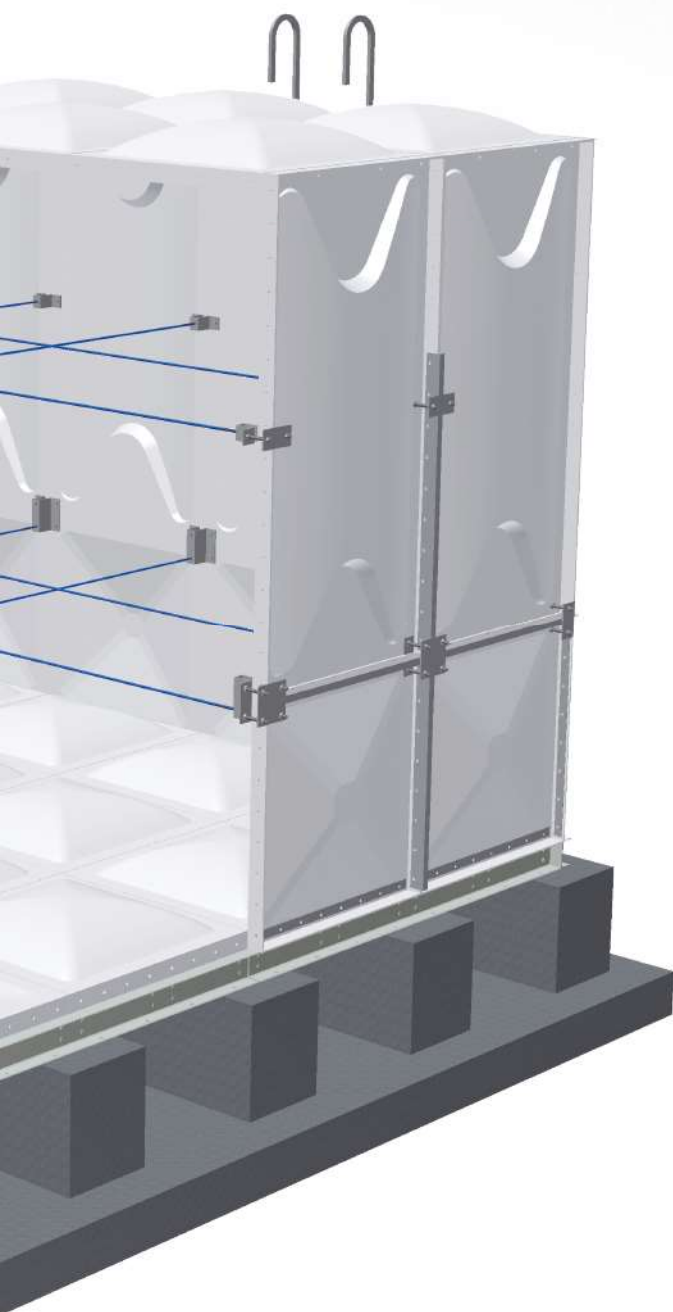


▲ Inside of the 4.5 ~ 5mH three-dimensional view

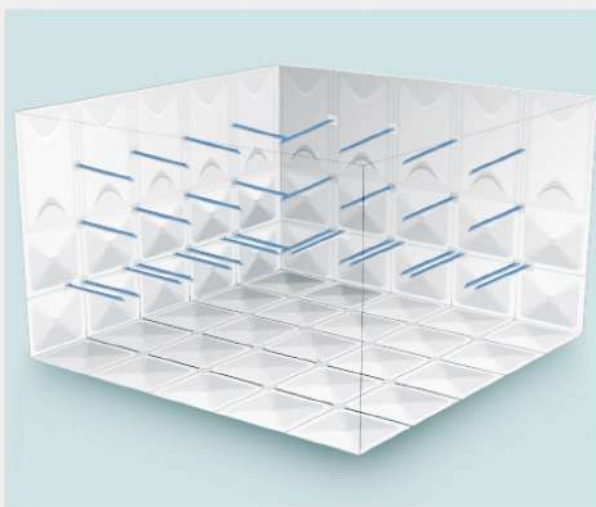
Internal reinforcement system provides the followings.

- In the event that the space for installing a tank is narrow, a proper reinforcement system enhances the utility of the installation space.
- By applying a PE coating to the inner stay rust generation is minimized on the stainless steel part on the top part.

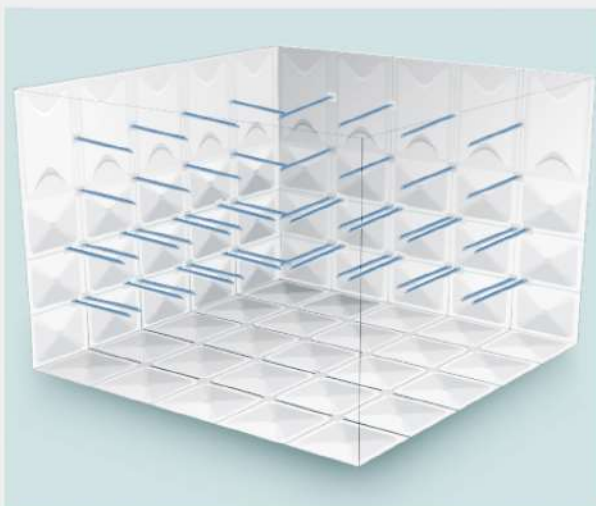




Internal reinforcement system



▲ Inside of the 3.5 ~ 4mH three-dimensional view



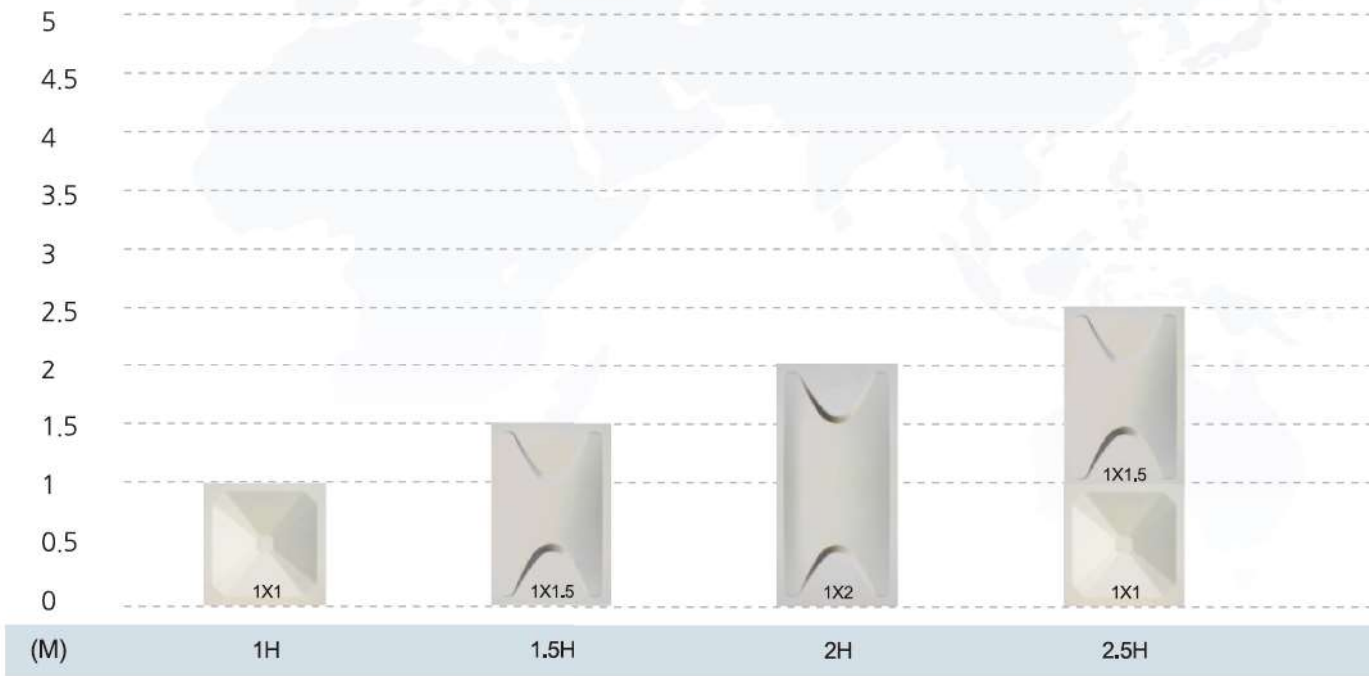
▲ Inside of the 4.5 ~ 5mH three-dimensional view



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Composition of panel

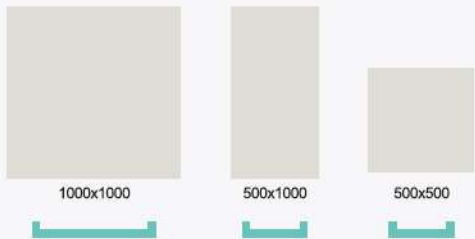
Standard composition of side panels by height



Note) 1. The composition method may vary according to site circumstances.

Panel Shapes

Common panels



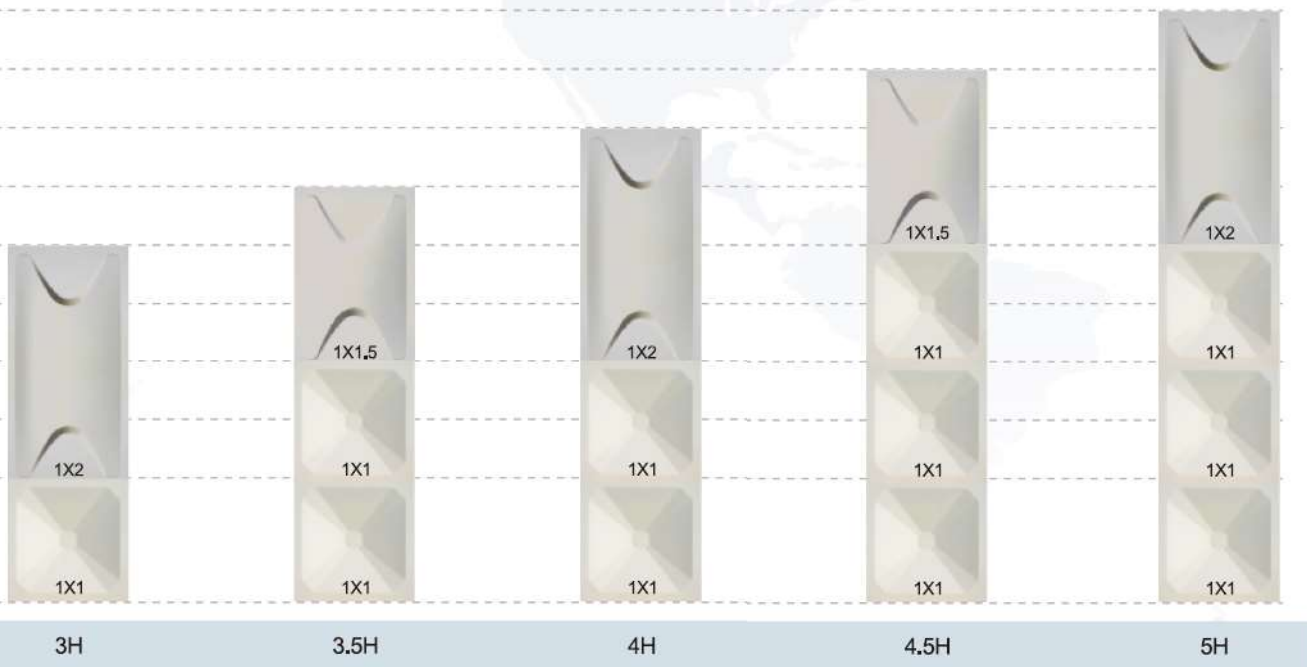
Side panels



DOHA Clean Tank utilizes space effectively by using panels of diverse sizes.

■ The real outline dimensions (W,L,H) are as follows.

W	L	H
Normal dimension + 150mm	Normal dimension + 150mm	Normal dimension + 100mm



Bottom panels



1000x1000



Roof panels



1000x1000



Drainage panels / Manhole panels



1000x1000



1000x1000

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Specification and space for concrete foundation

Based on PAD production

Width : More than 400mm

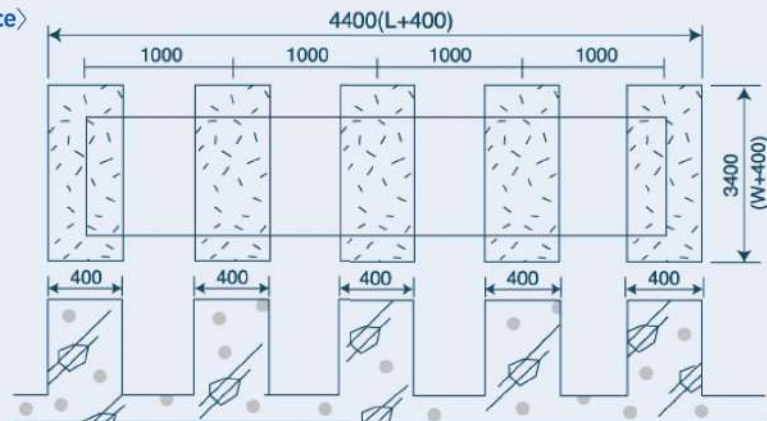
Height : More than 600mm(including base frame)

Interval distance : Less than 1m at maximum

Outline dimension : $W, L+400\text{mm}$

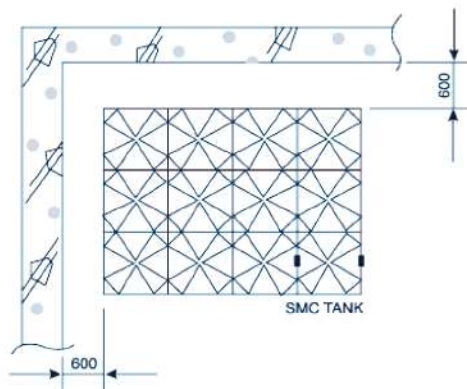
Horizontality degree : Less than 1/500(Maintains smoothness at the upper part)

〈Drawing for reference〉
ex) 3Wx4Lx2H

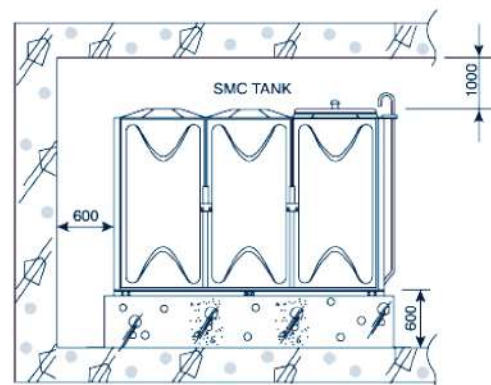


Installation space

A space for 600mm apart from the walls in four directions(1000mm for the upper part) is required for the installation of a tank and for its inspection and maintenance.



〈Floor Plan〉



〈Side View〉

For Reference

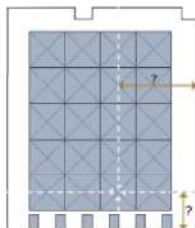
Scope of Construction

1. Foundation work

- The foundation work should be publicized by the customer with the specifications designed in consideration of ground endurance for the tank to be installed.
- Construction with anchor bolts will be done by our company.
- The concrete strength for the foundation work should be more than 180kg/cm²
- The thickness of the finishing mortar on the foundation concrete should be less than 20mm.

2. Pipe work

- Our company supplies the sockets for piping in advance to the location requested by the customer. Therefore, customers should decide on the inlet and outlet for water, the overflow, and the size and location of drainage accurately when ordering the tank.



Cautions for Handling

1. Transportation

Take precaution to avoid any partial great force such as an intensified load or shock to the tank.
Be sure to put buffering materials on the part where a rope or vehicle contacts.



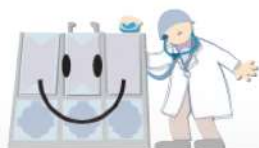
2. Piping

- When doing piping work, install the support strut to prevent excessive load to inlets and outlets.
- Install the pipes beginning from the tank and take precautions to prevent a biased load.
- Avoid flammables when doing welding work.



3. Repair and maintenance

- In case of non-use for a long period of time, be sure to drain the water from the tank.
- Since the tank is for storing water for living, regular safety inspection is required. (More than twice a year)



Regulations for Installation Criteria for Construction (February 28, 1998)

Installation Criteria for Water Tanks(related to Article 3)

1. Foundation work

1. The upper part of a water tank shall be installed from more than 100cm from the construction and the other side be a distance of more than 60cm.

2. The outlet for the water shall be installed at the bottom of the opposite side from the inlet and apart from the bottom of the tank so as not to discharge the sediments on the bottom. Install the water partition in order to prevent stagnation in the tank.

3. Install more than one square manhole of which one side is more than 90cm or a round manhole of more than 90cm in diameter so that any person or equipment may enter for cleaning. Take the necessary actions to prevent any dust or foreign substances from entering into the tank through the manhole. Provided, the side or diameter of the manhole in a small tank of less than 5m³ in size may be more than 60cm for installation.

4. The outlet for sediment shall be installed on the bottom part of the tank. The bottom of the tank shall be inclined more than 1/100 degrees toward the outlet for each discharge.

5. For cleaning, hygiene inspection, and repair, a tank shall be partitioned into more than two parts, or more than two tanks shall be installed, except for the small-size tank of less than 5m³

6. An alarm shall be installed for warning when the water level in tank exceeds or reduces to a certain level. The alarm receiver shall be installed in the control center.

7. In the event that the tank is installed underground, it shall be installed more than 5 meters away from toxic facilities such as excretions or wastes faculties and equipment shall be installed so that people cannot access around the manhole easily. In the event of an unavoidable situation where the tank has to be installed not more than 5 meters away from toxic facilities, a blocking fence shall be installed around the tank.

8. The materials for the tank and the ladder to the tank, etc., shall be anti-corrosion such as fiber reinforced plastic, stainless steel, concrete, etc.

9. A pipe for air purification and the overflow pipe for controlling the water level shall be installed in the tank. Take actions to prevent any polluted substances such as insects from entering into the pipe.

High Quality / GRP Panel / Water Tank

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Hayoung SMC Inc. is a company that leads in protecting clean environment and nature preservation.



Certificates of Hayoung SMC Inc.

ISO-9000 | PSB Product Certificate(SG) | WRAS Certificate(UK)

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