



<http://www.hdgrp.co.kr>

# HYUNDAE GRP HOT PRESSED PANEL WATER TANK



U.A.E Sole Agent  
Mosayebi Fiberglass Est  
U.A.E.

## Introduction

HyunDae - (Panel Brand by Capstone Engineering) employs the application of SMC(Sheet Moulding Compound) using Isophthalic unsaturated Polyester resin having low shrink characteristics and excellent physical properties which is approved and permissible for potable water application. HyunDae, have utilized(Hot pressed moulding) a basic technology for press moulding SMC, in order to produce and manufacture GRP water tank, of high quality.



Figure1. Capstone's Business Development Direction



Figure2. Pictures of Capstone Engineering

# Keep the water clean

## Integrated Production System and Total Quality Management System

### ○ UPR Resin Composite



Reactor



Monitoring



Inspection

### ○ Glass Fiber Reinforced Plastic Production



Manufacturing



Moulding

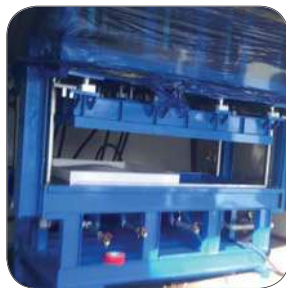


Property Test

### ○ Product Moulding , Inspection and Shipping



Moulding



Hydraulic Pressure Test



Drilling



Product Shipping



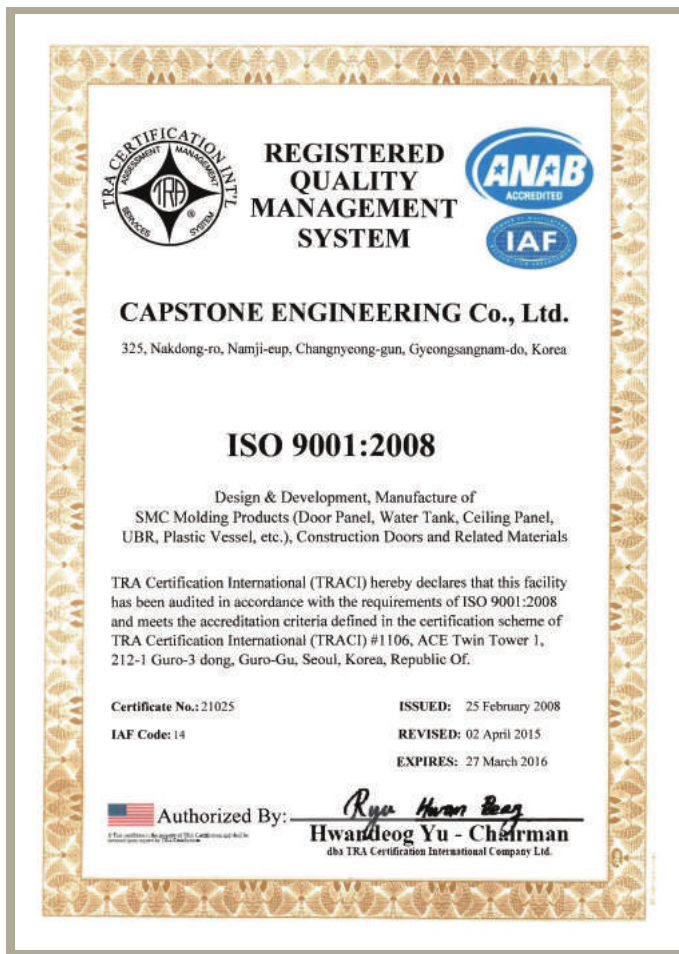
Packing



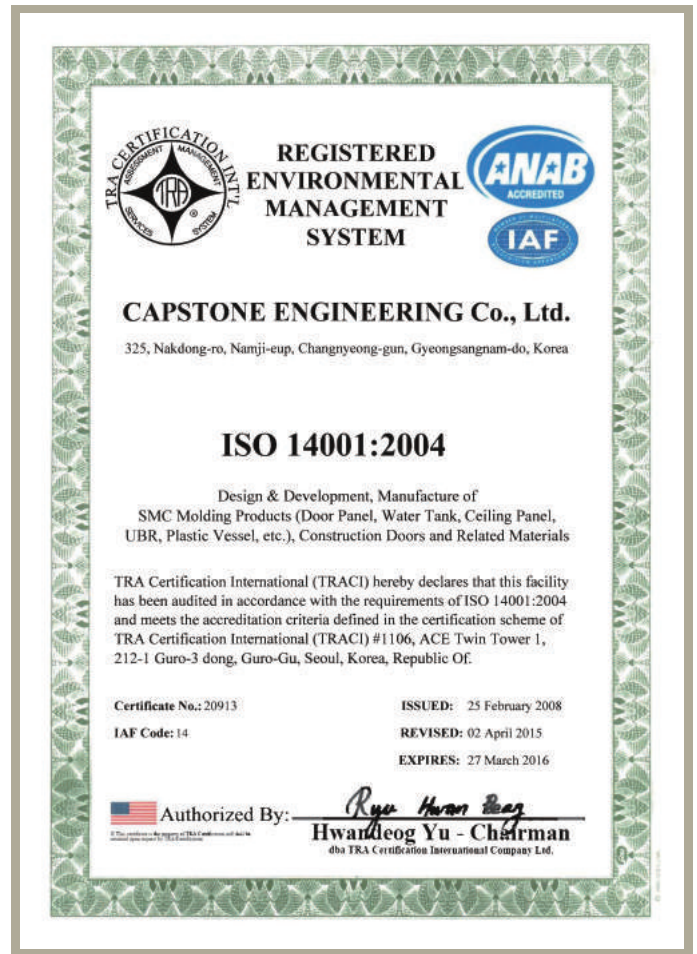
Foaming

## Quality Certification Meeting Foreign Customer's Requirement

○ Quality / Environmental Management System



ISO 9001:2008



ISO 14001:2004

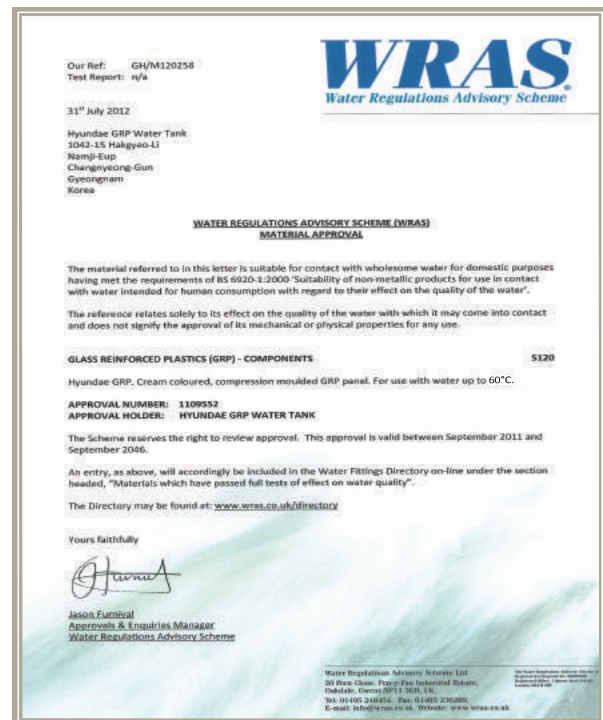
# Keep the water clean

## Keep water clean, Ideal for strong drinking water

**HyunDae GRP Water Tank** is the world leader in panel tank development and manufacturer, and with its abundance of experience and related data, has passed world wide standards. HyunDae offers superior service and a wide range of products, all which have received WRAS, BSEN and ISO approval.



BS EN 13280:2001



WRAS(Water Regulations Advisory Scheme)

### What is **BSEN** Certificate?

Specification for glass fiber reinforced cisterns of one-piece and sectional construction, for the storage, above ground of cold water. The European Standard EN 13280:2001 has the status of a British Standard.

### What is **WRAS** Certificate?

WRAS(Water Regulations Advisory Scheme) certificate is given to the products which meet the requirement related drinking water in UK. The products certified through WRAS are approved as suitable for the regulations of Water Supply & Fittings in UK. WRAS certificate is an indispensable requisite for the water tank manufacturer and certified product and fittings can only keep the customer's health.

## Drinking Water Certification meeting Abu Dhabi Authority Requirement

Abu Dhabi Food Control Authority  
Laboratory Division  
Abu Dhabi

**ANALYSIS REPORT**

TEST REPORT NO. **A10024164001**

DATE: 10/04/2013

Sample Received : 01/04/2013  
Start of Analysis : 01/04/2013  
End of Analysis : 04/04/2013

Customer Name: **Mussabiy Fibreglass Establishment**  
Customer Address: **Mussafah Industrial M13**

Sample Ref. No. : A10024164001  
Sample Name : Unbottled Drinking Water- Hyundai Tank  
Brand : N/M  
Origin : N/M  
Batch No. : N/M  
Net Weight : N/M  
Container Type : Plastic Bottle

Sample Source : PVT SECTOR  
Prod. Date : N/M  
Expiry Date : N/M  
Sample Receipt Condition : Chilled (+1 to +5) C

Parameter	Results	Unit	Methodology/Procedure No.
<b>Sensory/Physical Evaluation</b>			
Physical Evaluation	Compliant		Sensory Evaluation/LAB-DFM-MV-02
<b>Chemical and Radioactive Contamination Analysis</b>			
Parameter	Results	Unit	Methodology/Procedure No.
*Sulfate	23.61	ppm	ICS-3000/LAD-DFM-CP-15
*Phosphate	BCL	ppm	ICS-3000/LAD-DFM-CP-15
*Lead	0.042	ppb	ICP-MS/LAD-DFM-CP-16
*Mercury	BCL	ppb	ICS-3000/LAD-DFM-CP-14
*Boron de	BCL	ppb	ICS-3000/LAD-DFM-CP-15
*Zinc	0.165	ppb	ICP-MS/LAD-DFM-CP-16
Chloride	BCL	ppm	pH meter/Ion Selective Electrode /LAD-DFM-CP-01
*Chloride	43.22	ppm	ICS-3000/LAD-DFM-CP-15
Total Dissolved Solids(TDS)	142.52	ppm	Conductivity meter/LAD-DFM-CP-05
*Fluoride	0.61	ppm	ICS-3000/LAD-DFM-CP-15
*Nitrate (as NO3)	BCL	ppm	ICS-3000/LAD-DFM-CP-15
*Nitrite (as NO2)	BCL	ppm	ICS-3000/LAD-DFM-CP-15
*Cadmium *54	BCL	Bq/L	Gamma Spectrometry/LAD-DFM-R-01
*Cadmium *57	BCL	Bq/L	Gamma Spectrometry/LAD-DFM-R-01
pH	7.260		pH meter/LAD-DFM-CP-06

Formal No: FI-LAB-LIMS-03    Issue No: 03    Issue Date: 30.10.2011    Page 1 of 2

Abu Dhabi Food Control Authority  
Laboratory Division  
Abu Dhabi

**ANALYSIS REPORT**

TEST REPORT NO. **A10024164001**

Parameter	Results	Unit	Methodology/Procedure No.
*Total (water)	ND	/100 ml	Membrane Filtration Techniques/LAB-DFM-MICRO-32
*Heterotrophic aerobiosis (Water)	ND	/100 ml	Membrane Filtration Techniques/LAB-DFM-MICRO-36
*Total coliforms (Water)	ND	/100 ml	Membrane Filtration Techniques/LAB-DFM-MICRO-31
*Coliform (Water)	ND	/100 ml	Membrane Filtration Techniques/LAB-DFM-MICRO-32
*Enterococci in water	ND	/100 ml	Membrane Filtration Techniques/LAB-DFM-MICRO-35

N.M: Not Mentioned, N.D: Not Detected, BCL: Below Detection Level

**Comments**  
Investigated parameters are physically, chemically and microbiologically compliant with the regulations. Ref: (U.A.E.S.GEO 149 / 2010, Regulation and Operation, Date: 7 July 2009)

**Dr. Salama Suhail Al Muhain**  
Director Laboratories

Disclaimer 1: This data is for information only and does not constitute a warranty.  
Disclaimer 2: The above comment/interpretation is based on the overall test results but is not part of the UKAS accreditation.  
Disclaimer 3: Test reports show results which only relate to the items tested and cannot be used for any commercial purpose such as procurement or any other related.  
Disclaimer 4: This starts (\*) marks those tests that have been subcontracted to other laboratories.

End of Report

Formal No: FI-LAB-LIMS-03    Issue No: 03    Issue Date: 30.10.2011    Page 2 of 2

### Advantages of HyunDae Tank (Hot Pressed Moulding)–using SMC

- Moulding at 150 deg C temperature.
- Excellent ultra violet resistance characteristics, which doesn't allow growth of ALGAE and Micro-organisms.
- Strength, excellent performance with stable construction and performance.
- Dense, smooth finish allows effective cleaning and resistance to bacteriological growth.
- Sunlight Transmission Test-comply to high standards.

### Dis-Advantages of other tank (Using cold cured or Hand Lay up method)

- Delamination under exposure to direct sunlight.
- Panels have non uniform finishing with blistering on panel surface.
- Panels are not Homogeneous with variable strength.
- No Resistance to ultra violet effect and poor performance.

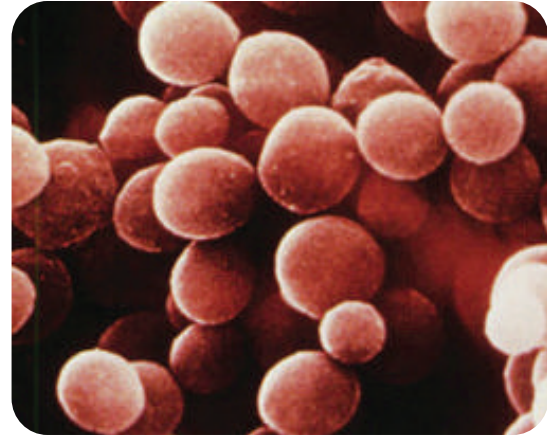
## Antibacterial Water Tank

Antibacterial Water Tank developed by HyunDae.

Excellent Antibacterial Effect on the Coliform Bacillus and Staphylococcus aureus causing food poisoning to make the Hyundai tank drinkable water.



Coliform Bacillus



Staphylococcus aureus

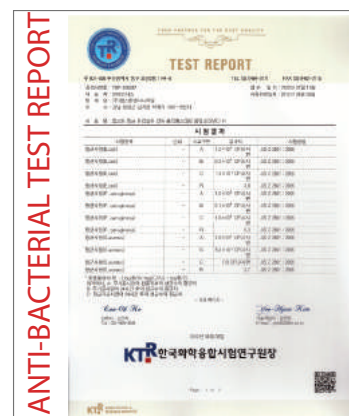
### ANTI-BACTERIAL TEST RESULT

Item of Test	Section	Result	Antibacterial activity	Test Method
Coliform Bacillus	A	$1.2 \times 10^5$ CFU		JIS Z 2801:2006
	B	$9.3 \times 10^6$ CFU		JIS Z 2801:2006
	C	$1.4 \times 10^3$ CFU	<b>99.99%</b>	JIS Z 2801:2006
Staphylococcus aureus	A	$1.2 \times 10^5$ CFU		JIS Z 2801:2006
	B	$5.3 \times 10^4$ CFU		JIS Z 2801:2006
	C	$1 \times 10$ CFU	<b>99.90%</b>	JIS Z 2801:2006

section A : a number of bacteria after inoculation on specimen

section B : a number of bacteria after 24 hours on non-antibacterial specimen

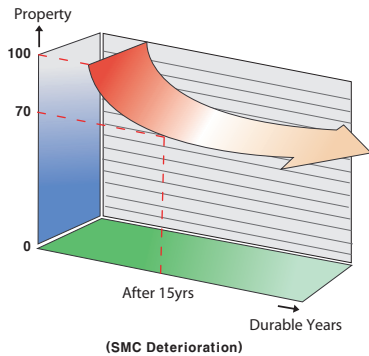
section C : a number of bacteria after 24 hours on antibacterial specimen



HyunDae GRP Water Tank is the high-quality water tank designed by the specification with optimized raw material and design made by the best mechanical engineer and chemical engineer.

## Excellent Long Term durability

HyunDae GRP Water Tank is designed to maintain up to 70% of first physical property based on excellent raw material and product design technology for fifteen years.

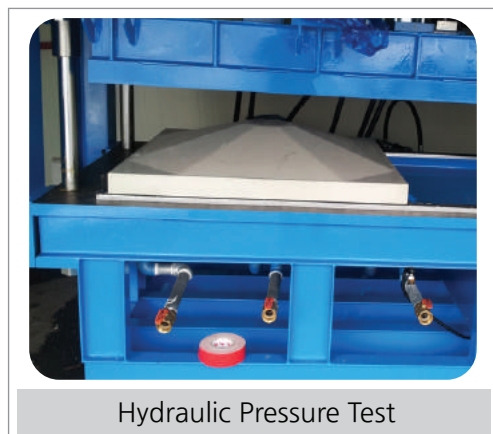
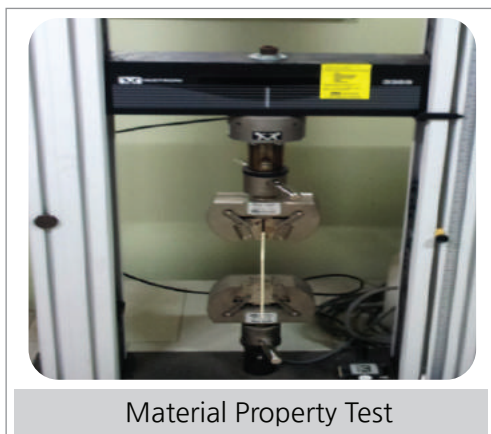
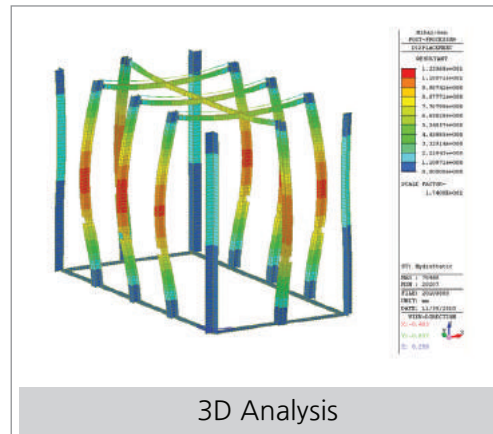
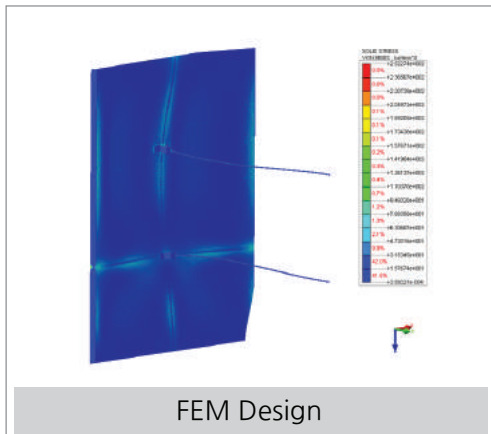


Design: Durable Water, Fixed Load, Snow Load  
External Force: Wind Load, Load due to Occupancy, Seismic load

Item	Design Condition
Earth Quake	Horizontal Seismic Force $kh=2/3G$
Hydrostatic Load	Tank Height $\times 0.1\text{kgf/cm}^2$
Snow Load	$60\text{kg/m}^2$
Wind Load	Below $60\text{m/sec}$
Illumination Intensity Rate	Below $0.1\%$
Water Temp.	Below $60^\circ\text{C}$

< The above results are the SMC material property degradation by lapse of time results, but the same results which satisfied the entire specified requirement about maintenance.>

**Specification of optimum design** Finite through Element Method (FEM) using computer and procurement of reliability through quality maintenance of designed material property using instron and hydrau-



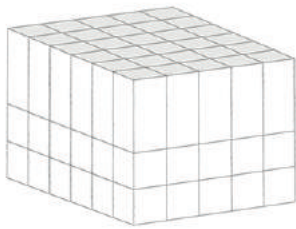


## Free Capacity Design

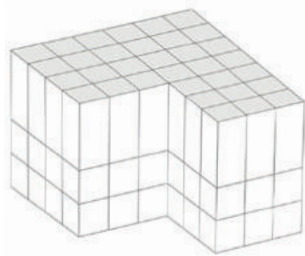
**HyunDae GRP Water Tank** is suitable for large-sized reservoirs as its structure utilizes horizontal and vertical spaces at the maximum through the use of diverse size of panels.

### Available Design Height and Capacity

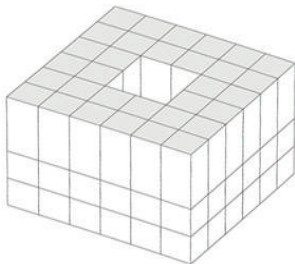
Available Height	Available Capacity
1.0 ~ 5.0 m / 0.5m distance	1 ~ 3,000 Ton



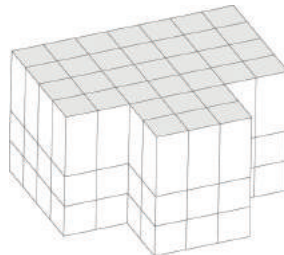
picture 1. General Type



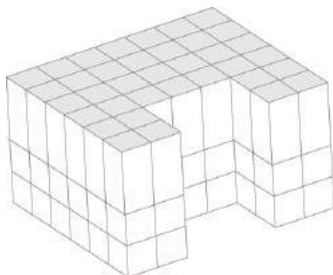
picture 2. Corner "L" Type



picture 3. Corner "□" Type



picture 4. Corner "T" Type



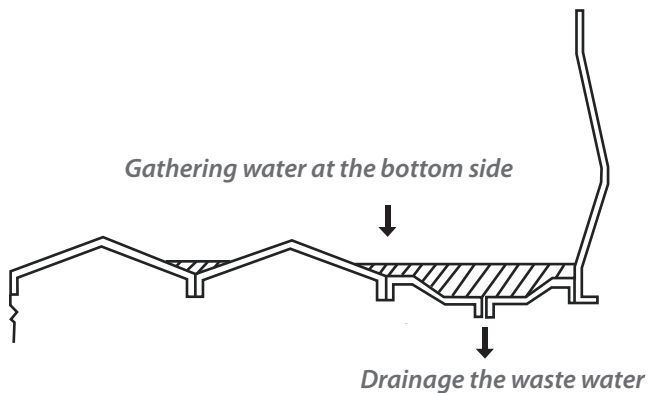
picture 5. Corner "C" Type

### Features of HyunDae Water Tank

1. Strong & Long Durability as made by Korea's excellent hot pressed SMC technique.
2. Easy cleaning & maintenance with safe and clean internal/external reinforcement.
3. Drains completely at roof and bottom as it use specially designed roof panel and drainage panel.
4. Prevent leakage completely by using extruded rubber sealant type(EVA)
5. Prevent the algae growth in the tank. HyunDae tank FRP panel type are made by SMC hot pressed method, which has high opaque quality. This opaque quality prevent the evaporation of sterilizer, and stop the algae growth.
6. Stable construction and safety factor of 6 design are realized by using strong panels and reinforcement material.
7. Various shape tanks are available by combination of strong panels making the assembly very easy.

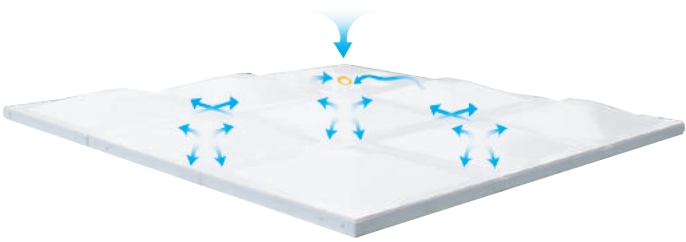
## Perfect Base Drainage Structure

HyunDae GRP Water Tank is designed to maintain much better water quality by applying bottom drainage structure which can discharge dust precipitated during use and other sludge completely when cleaning



The combination of convex base panels with a concave drainage panel ensures complete and faster drainage.

A unique feature of HyundaiGRP panel type water tank, the concave drain panel was especially designed to facilitate periodic tank cleaning and inspection.

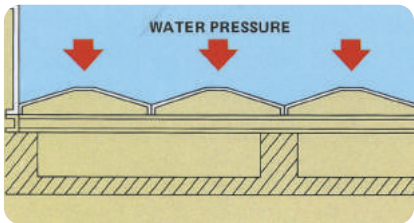


<Detailed illustration>

## Prevention of Base Panel Water Leakage

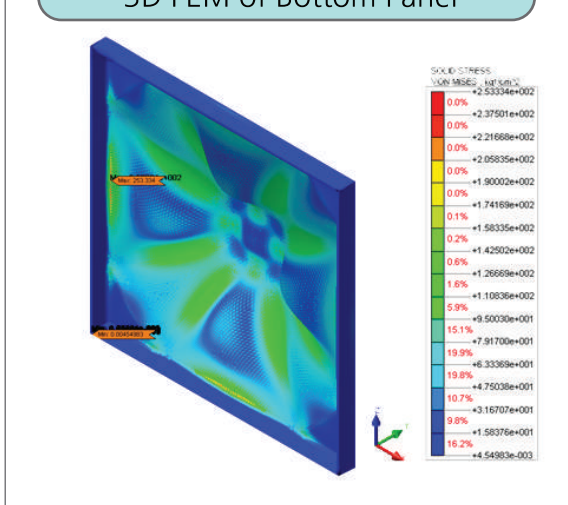
HyunDae GRP Water Tank is designed panel through exact FEM 3D simulation with optimum thickness and shape and completely prevented the leakage which can be occurred by panel deformation, crack and others due to water pressure.

Water Pressure Closes Joints



**Water Pressure Mechanism**  
The water pressure make by filling the tank seals, the joints preventing leakage.

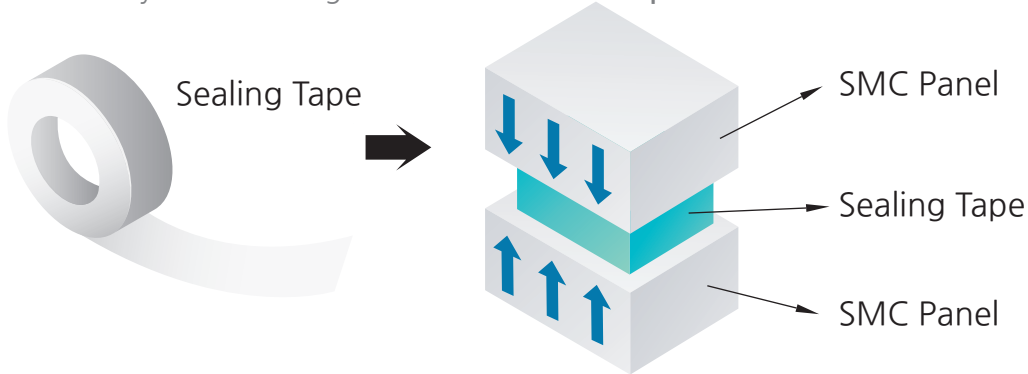
3D FEM of Bottom Panel



# Keep the water clean

## Excellent Water Tightness

EVA foam sealing tape (Synthetic extruded rubber) can maintain complete water tightness by using with excellent weather-ability and restoring force and harmless to potable water and human body.



Above 95% of thickness restoration in the early stage by compressing sealant.

### EVA Property Test Report



### PSB Test Report for the Sealing Tape



PVC Foam sealing tape	EVA Foam sealing tape
-----------------------	-----------------------

The mean dissolved oxygen difference (MDOD) of the test and reference materials were as follows:

Test Materials	MDOD (mg/l)	Requirements of SS 375 : Part 1 : Specification (MDOD, mg/l)
Negative reference	- 0.01	0.0 ± 0.6
Positive reference	5.87	7.5 ± 2.5
Test product (Single sample)	6.26	< 1.69

The results obtained show that the sample does not comply with the requirements of SS 375 : Part 2:4 for the growth of aquatic micro-organisms test.

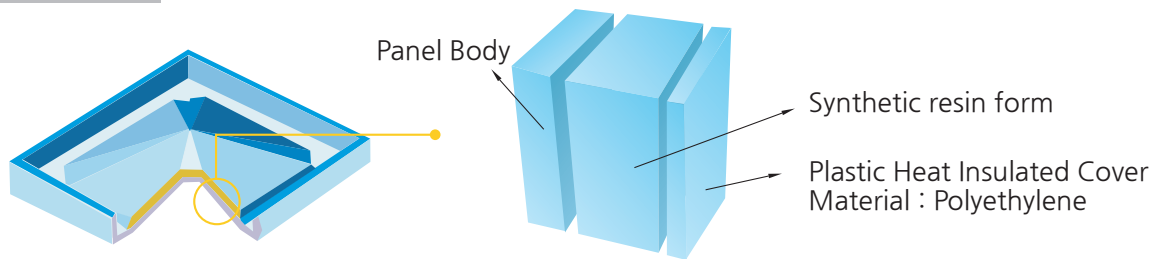
Test Materials	MDOD (mg/l)	Requirements of SS 375 : Part 1 : Specification (MDOD, mg/l)
Negative reference	0.06	0.0 ± 0.6
Positive reference	5.40	7.5 ± 2.5
Test product (Single sample)	0.22	< 1.69

The results obtained show that the sample complies with the requirements of SS 375 : Part 2:4 for the growth of aquatic micro-organisms test.

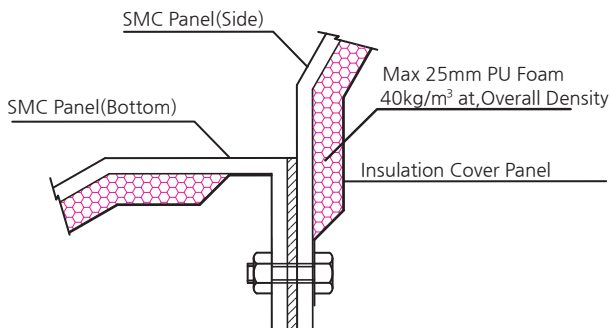
## Excellent Thermal Effects

**Excellent Insulation** from SMC material, **Polyurethane Insulation Foam** Prevents freezing and dew condensation due to the excellent thermal effect with **three layer insulation structure of insulation material and cover** and minimization of water temperature changes according to the environmental temperature change.

### Heat Insulation Structure



### Typical Cross Section



The HyunDae Insulated panel has specially developed low thermal conductive rigid polyurethane foam 40kg/m<sup>3</sup> at, overall density between the GRP single panel and GRP cover as shown beside. 25mm(standard for Insulation) 50mm (optional)

### Comparison of Thermal Conductivity according to Materials

Item	Unit	Physical Properties	Test Method
Thermal Expansion Co-efficient of Thermal Transmission	Deg.C	2.1 x 10 <sup>-5</sup>	ASTM D696
1 Water-Panel-Air	Kcal/m h. °C	Max 5.0	ASTM D696
2 Water-Insulated Panel-Air	Kcal/m h. °C	Max 0.9	
Thermal Conductivity (Non Insulated Panel)	Kcal/m h. °C	Max 0.15	ASTM D696
Thermal Conductivity (Insulated Panel)	Kcal/m h. °C	Max 0.02	ASTM D696
Thermal Expansion Co-Efficient	1 °C	0.000016	ASTM 4811:2005

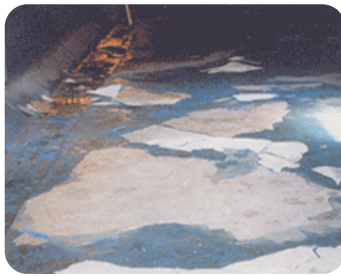
# Keep the water clean

## Best Hygienic Properties

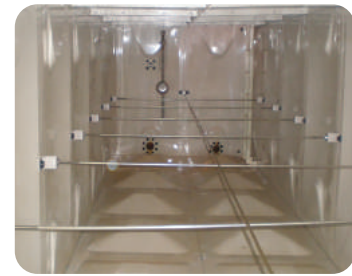
HyunDae GRP Water Tank has adopted panels that completely block the direct sunlight to avoid the growth of algae and other micro-organisms. And by assembling tanks with anti-rust accessories, it can keep water clean. Refer to the PSB test report with SS375 based on the Food Sanitation Standards and Sunlight Transmission test as below.

### Rust Proofing

■ Poor Sanitation On Other Tank



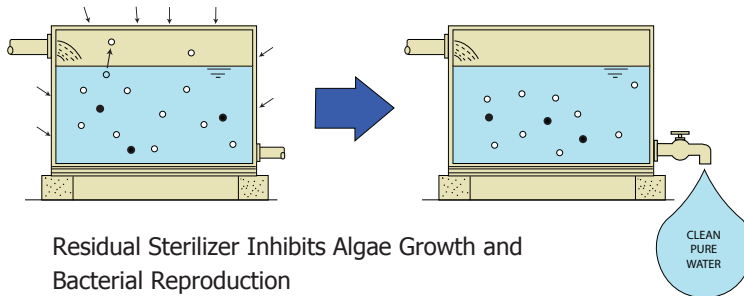
■ HyunDae GRP Water Tank



### Low Sunlight Transmission

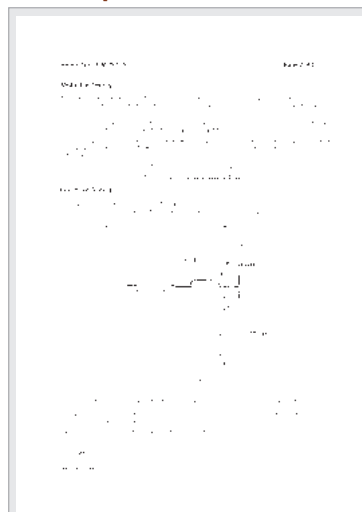
#### Opaque GRP Panels

(Negligible Growth)  
Evaporation of Sterilizer

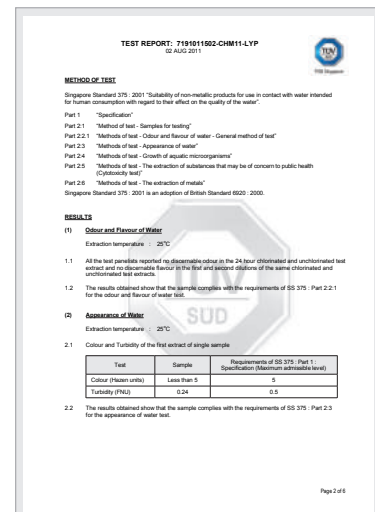


Legend ○ sterilizer ● spores (Algae)

### Sunlight Transmission Test Report



### PSB Test Report(SS375)



## HyunDae Panel Property Test

ITEM	Unit	Physical Properties	Test Method
Density	kg/m <sup>2</sup>	1,800	ISO 1183
Tensile Strength	Mpa	108	ISO 3268
Water Absorption	%	0.05	ISO 62
Impact Strength		No cracking	ISO 179
Flexural Strength	Mpa	185	ISO 178
Flexural Modulus	Gpa	13	ISO 178
Barcol Hardness	%	55	KSM 4811:2005
Glass Fiber Content	%	31.4	KSM 4811:2005
Resin Content		Min 58	KSM 4811:2005
Light Transmission / Opacity		0	KSM 4811:2005
Toxicity		Nil	KSM 4811:2005
Micro Biological Growth		Nil	KSM 4811:2005
Bending Strength	Mpa	190-200	KSM 4811:2005
Elastic Modules in Band	Gpa	15.9	KSM 4811:2005
Compression Strength	Mpa	100	KSM 4811:2005
Liquefaction Test(Turbidness)	Degree	Below 0.1	KSM 4811:2005
Liquefaction Test(Chromaticity)	Degree	Below 1	KSM 4811:2005
Ultra Violet Rays		None	ISO 62
Cavity	%	Max 2	ISO 62
Young Modulus	kg/m <sup>2</sup>	1.40 x 10 <sup>5</sup>	ISO 178
Shear Strength	kg/m <sup>2</sup>	Min 870	ISO 178

## HyunDae Panel Solubity Test

Item of Test	Performance Test Standard	Performance of Our Company	Test Method
Odor and Taste	None	None	KSF-4811
Turbidity	below 2.0	below 0.5	KSF-4811
Chromaticity	below 5.0	below 1.0	KSF-4811
Heavy metal(pb)	below 0.1 ppm	None	KSF-4811
Potassium permanganate (KMnO <sub>4</sub> ) Consumption	below 10 ppm	1.1	KSF-4811
PH	5.6 ~ 8.6	6.56	KSF-4811
Phenol	below 0.005 ppm	None	KSF-4811
Evaporation residue	below 30 ppm	14	KSF-4811
Residual chlorine	below 0.2 ppm	0.1	KSF-4811

\* Panel performance is satisfied with KS(KSF-4811)

## Specification for Base Concrete Work and the Installation Guide

### Base Concrete

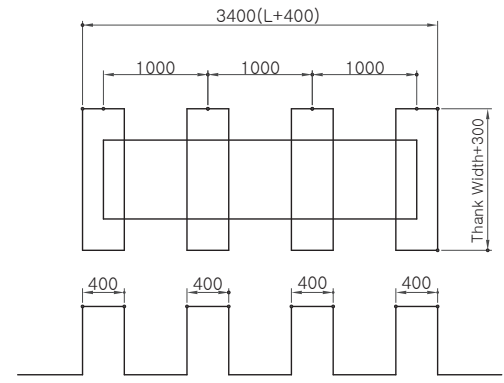
#### Installation Standard of Base Concrete

Width : **400mm**

Height : above **450mm**

Space : 1m (**center to center**)

Outer Size :  $(W+300\text{mm}) \times (L+400\text{mm})$



Customers should construct a concrete base according to the design specifications and firmness of the site.

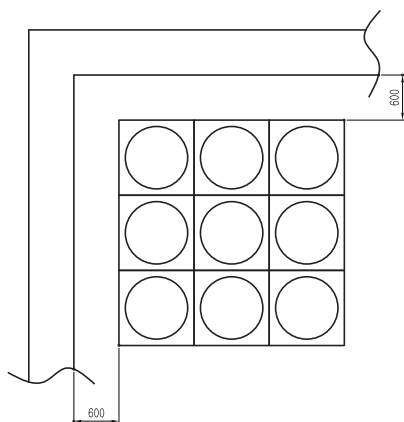
The required width of the base concrete must be at between **300mm** and **400mm**.

The required Height of the base concrete must be minimum **450mm**.

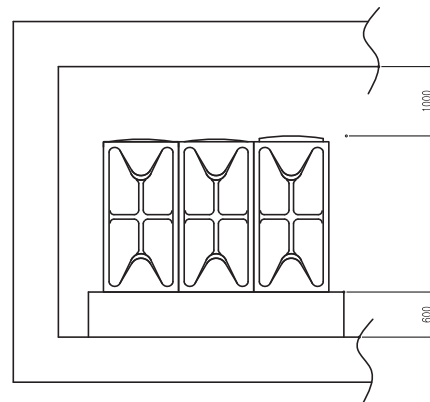
The distance from centre to centre of the concrete bases is **1000mm**(or **500mm** in case of 1000x500 panel)

### Installation Space

For maintenance purposes, at least 600mm and 1,000mm of space away from walls and ceiling, respectively are required.

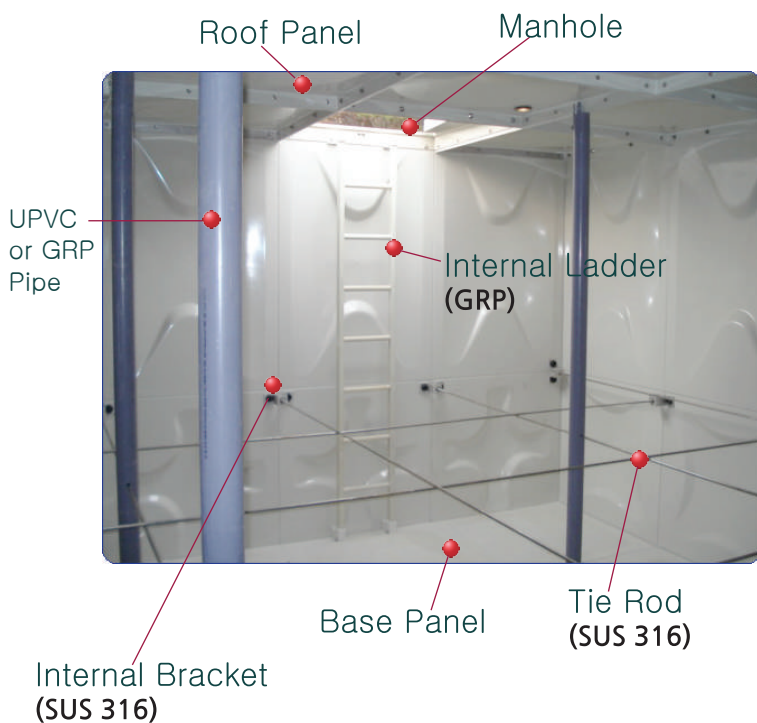
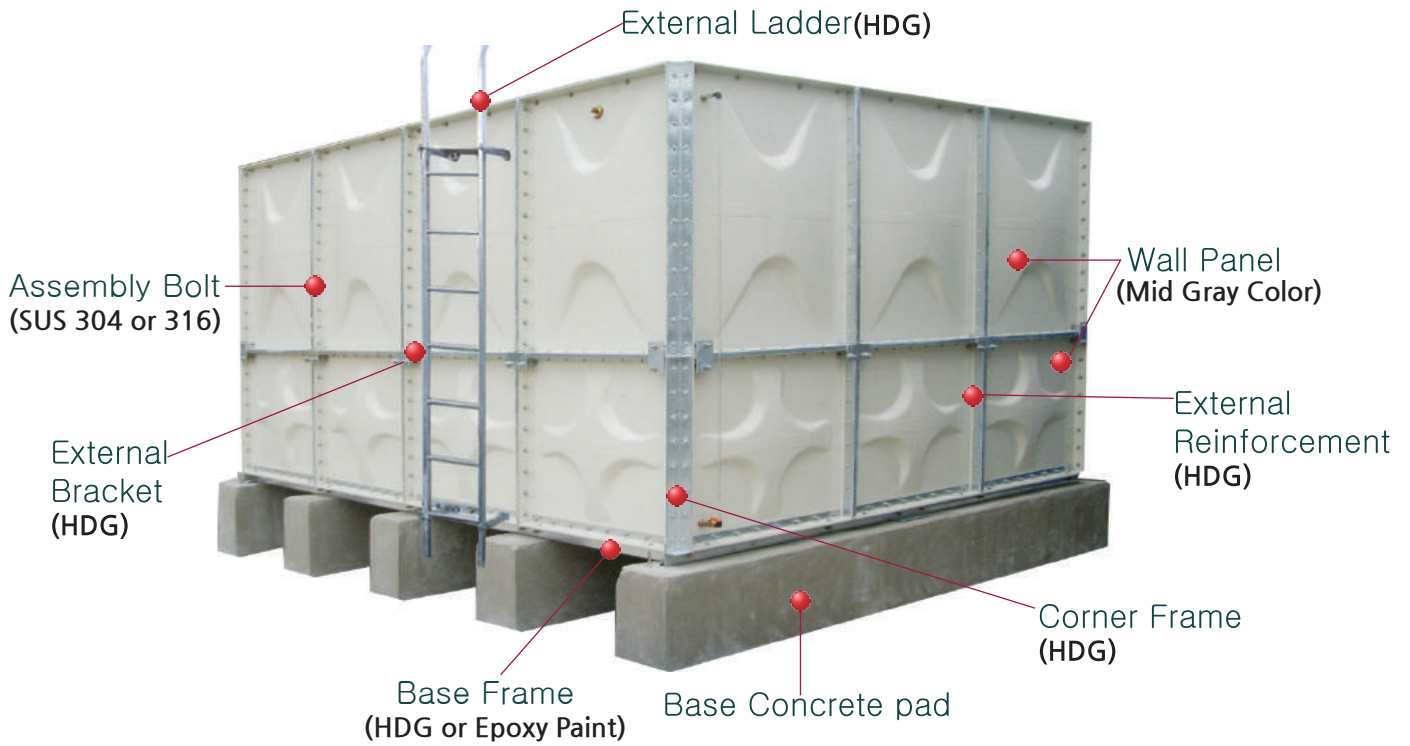


Plane figure



Side View

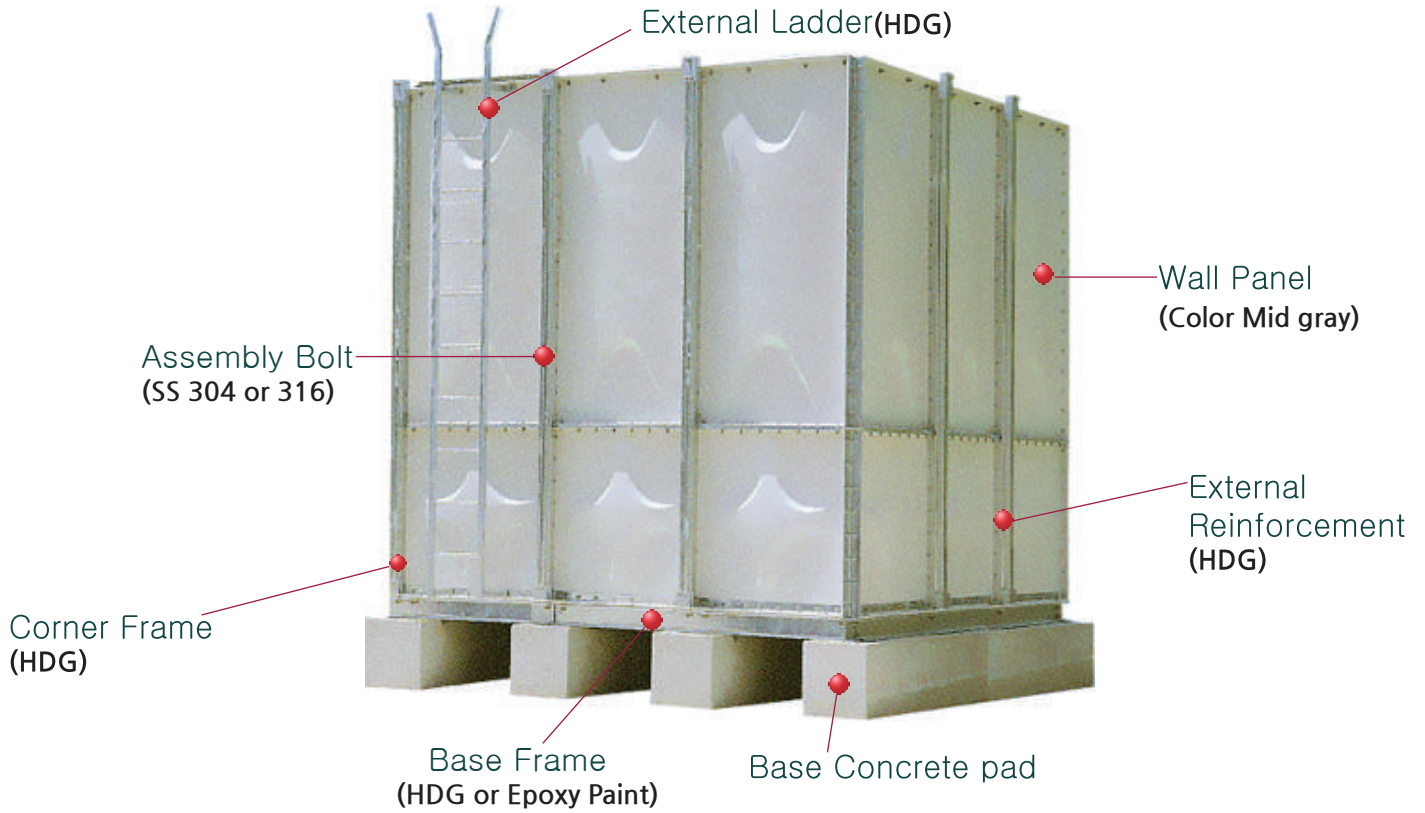
## Internal Reinforcement System



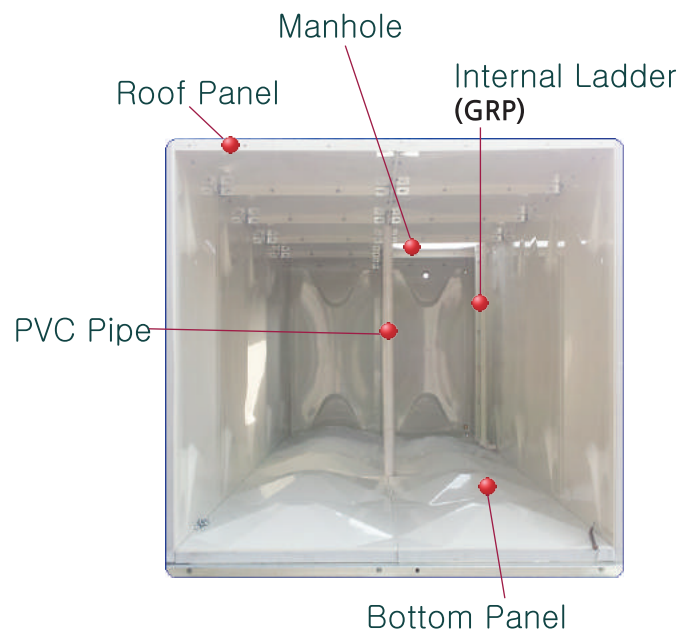
Components	Material
External Reinforcement	HDG
Internal Reinforcement	SS316
External Ladder	HDG
Internal Ladder	GRP
Air Ventilation	PVC
Sealant Tape	EVA Foam
Fasteners(External)	HDG
Fasteners(Internal)	SS316
Steel Skid Base – I Beam in both directions	HDG or Epoxy Paint (welded or bolted)
Water Level Indicator	HDG
Manhole Cover	GRP
Pipe Lifting the Roof	UPVC or GRP



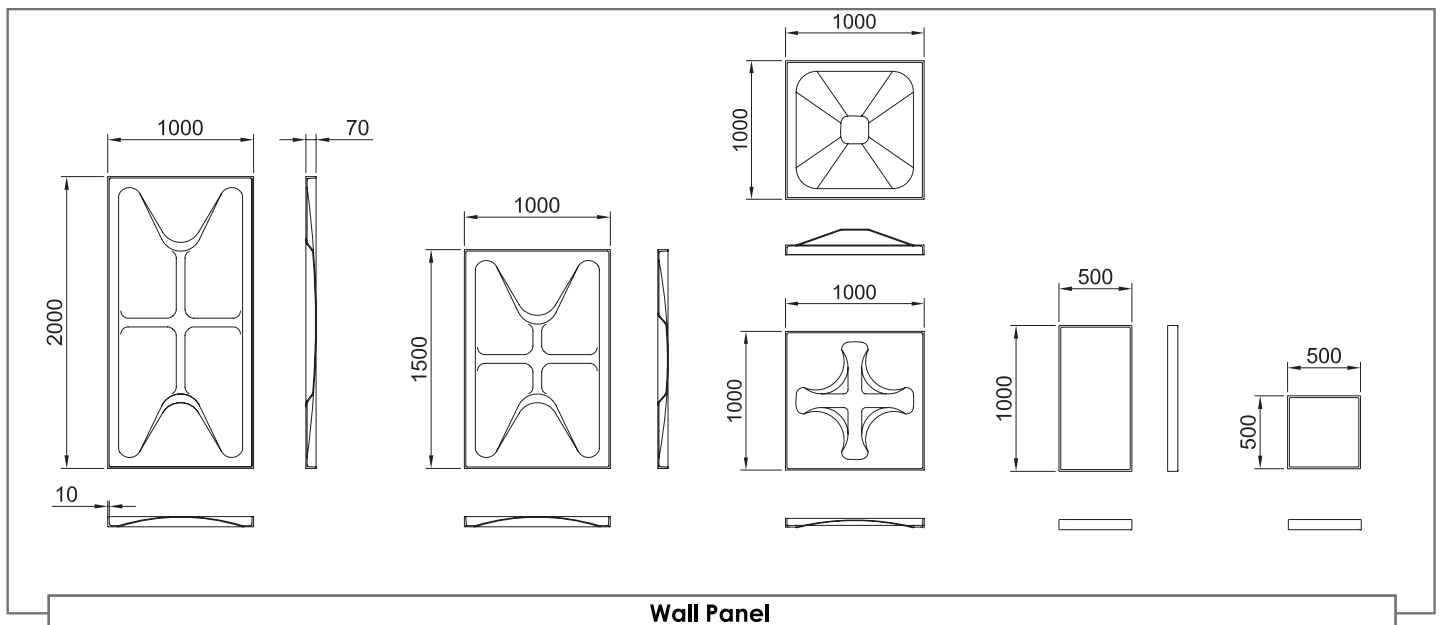
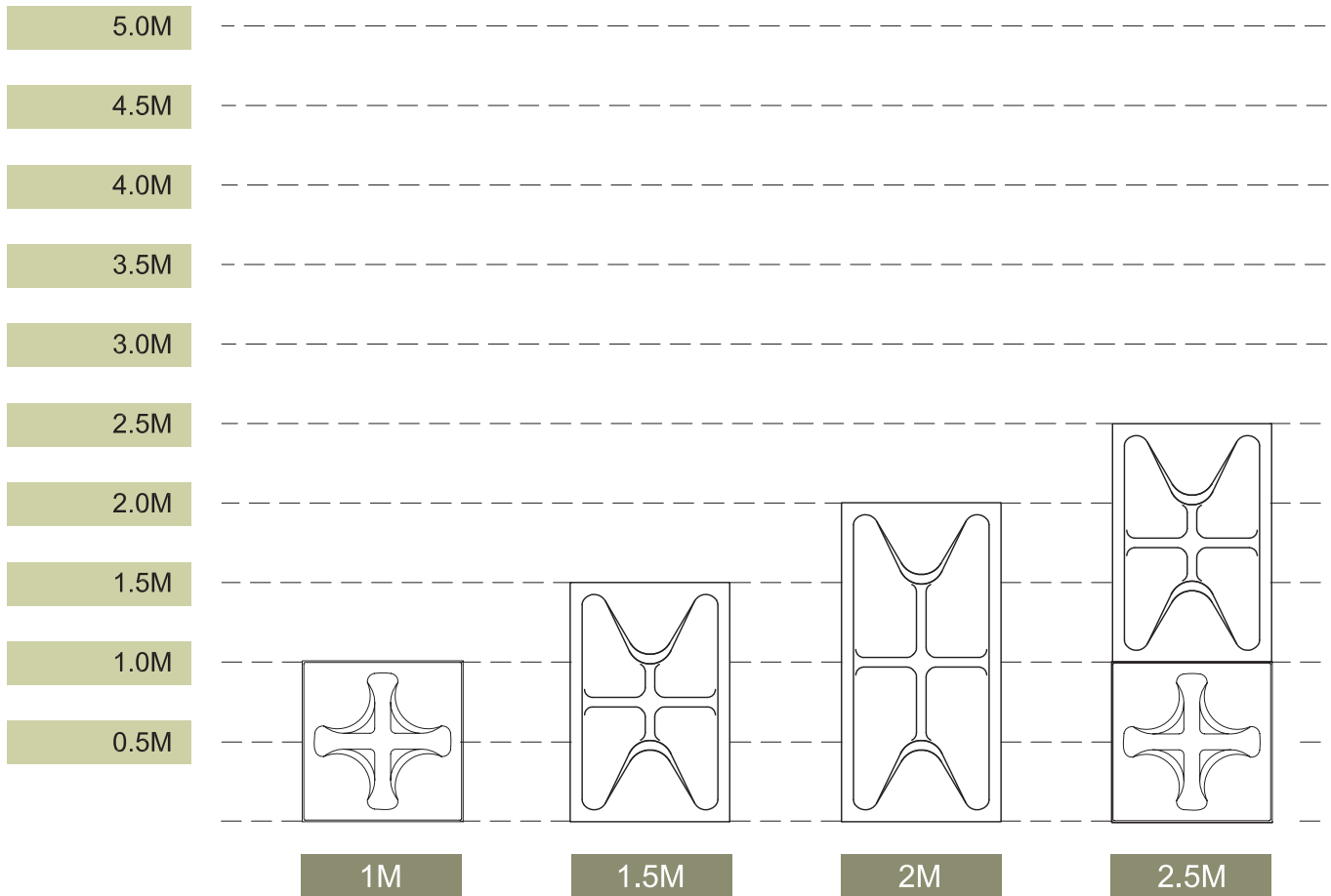
## External Reinforcement System



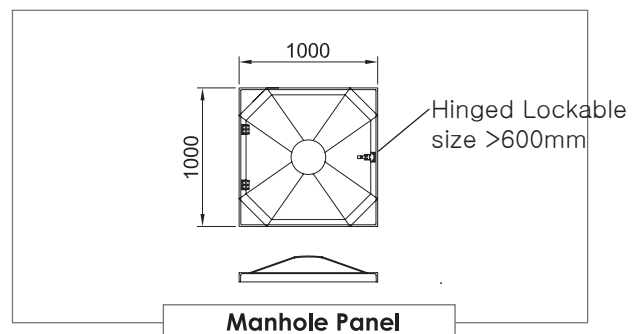
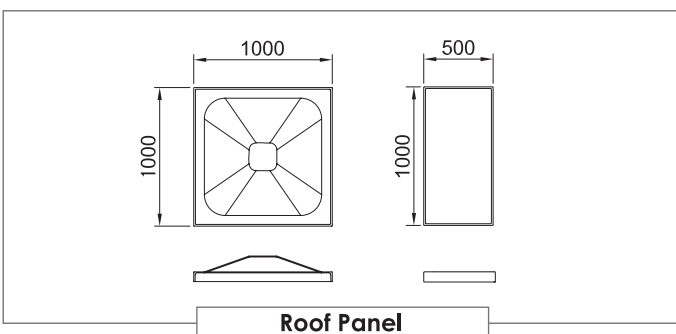
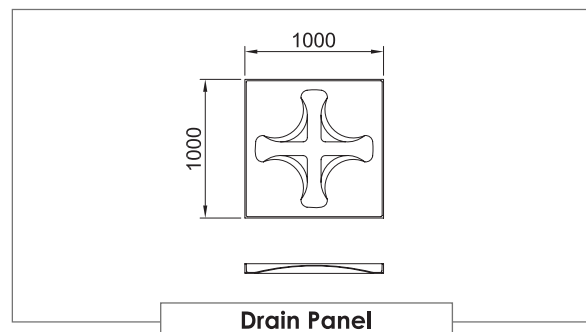
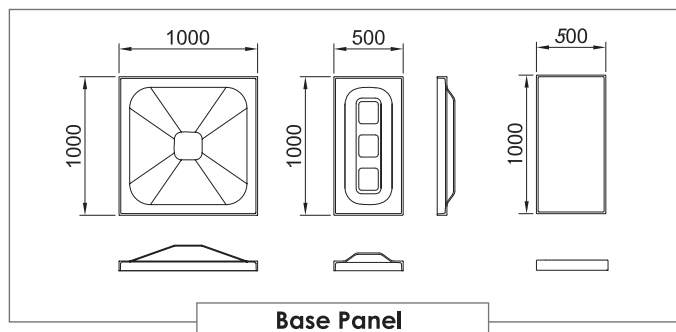
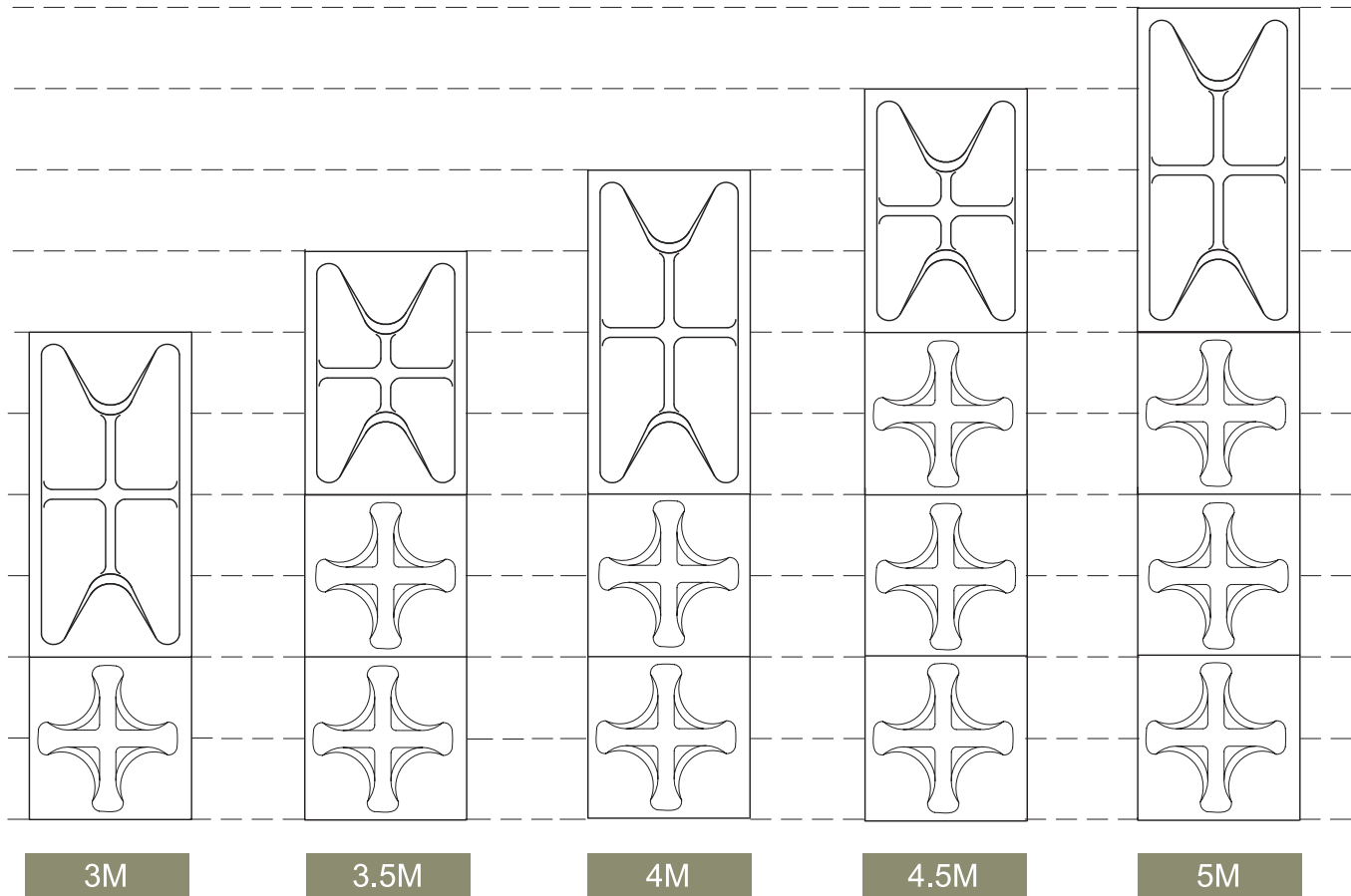
Components	Material
External Reinforcement	HDG
External Ladder	HDG
Internal Ladder	GRP
Air Ventilation	PVC
Sealant Tape	EVA Foam
Fasteners(External)	HDG
Steel Skid Base - I Beam in both directions	HDG or Epoxy Paint (welded or bolted)
Water Level Indicator	HDG
Manhole Cover	GRP
Pipe Lifting the Roof	PVC or GRP



## Wall Panel Composition by Height & Panel Shape



## Wall Panel Composition by Height & Panel Shape





## **Sole Agent**

Mosayebi Fiberglass Est  
Mussaffah M13, Plot 80  
Abu Dhabi UAE  
P.O BOX 8697

Tel.No. : 00971 2 5559323  
Fax No.: 00971 2 5552013  
Mobile : 00971 50 4428956  
Email us : gfa@emirates.net.ae  
mosayebi@polyaoun.com



<http://www.hdgrp.co.kr>