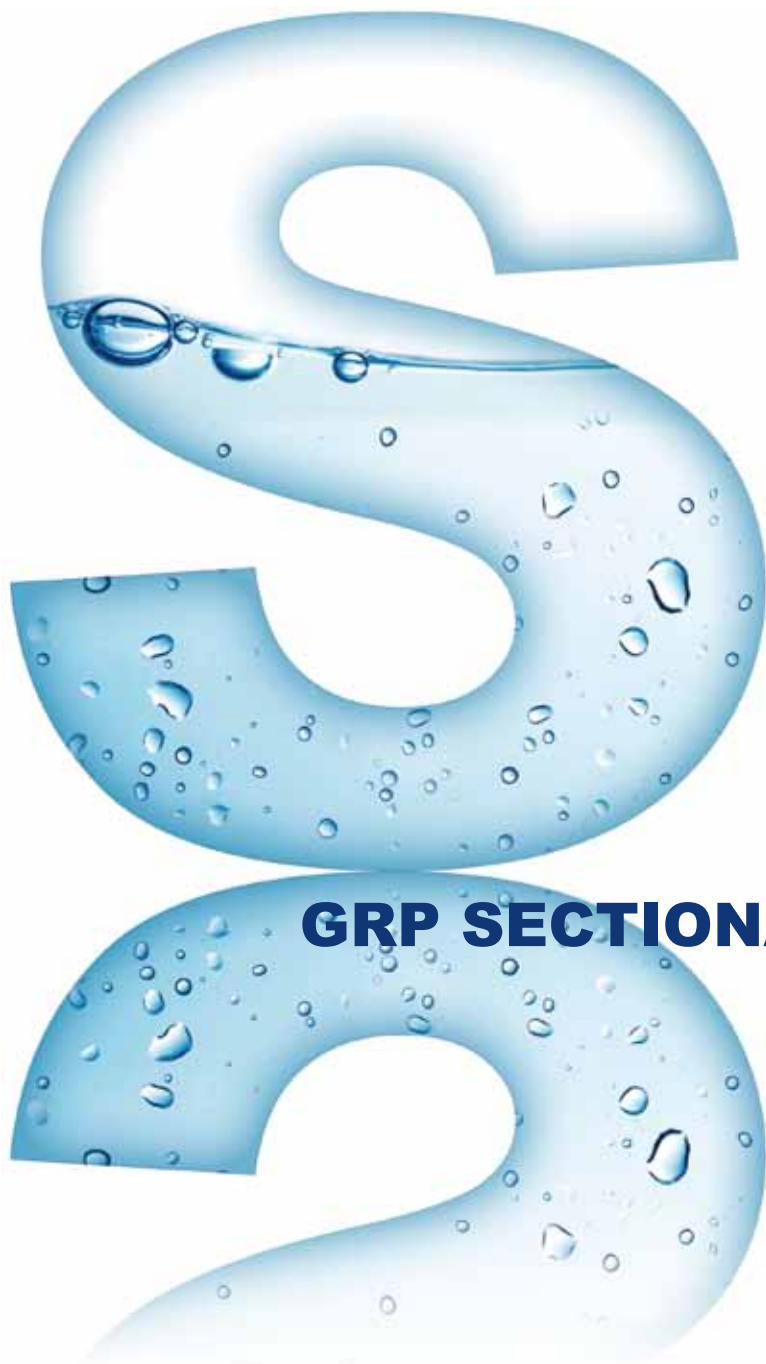


**SEKISUI**



**GRP SECTIONAL WATER TANKS**

**EKISUI**  
**EKI2011**



# Panel Tanks and Sekisui Aqua Systems

The selection of a panel tank is not something that can be accomplished merely on the basis of cost. Within the criteria of that selection process, the quality of the product must come first. Its ability to preserve cleanliness, to protect health and safety, and to maintain confidence are especially indispensable conditions for the storage of water so vital to our lives.

Sekisui is the pioneer and world leader in panel tank development and manufacture, and, with its abundance of experience and related data, has passed numerous world-wide standards. Sekisui offers superior service and a wide range of products, all which have received WRAS and ISO approvals.



The role of a water storage tank is to endure the changes that occur in the environment and, most importantly, to protect the cleanliness of its contents: all-important water.

The most elementary function of such a tank is to endure natural disasters and to protect the integrity of the water over the long-term during the changes in temperature between summer and winter, as well as from even rain and wind.

In order to accomplish this, it is essential that each water storage tank excel in such points as its ease of construction, material quality, hygienic properties and maintenance management.

At Sekisui, we are involved in the ongoing development of water storage systems for the secure preservation of one of our all-important resource: water.

Sekisui products offer some of the most important aspects of a water storage system: the ideal in durability and hygiene and related protective management, and an ease of assembly and installation second to none. And, Sekisui's market is not limited to Japan, but actually holds the largest share of the world-wide panel tank market.

As we gear up for the future, Sekisui is responding to the needs of the marketplace, offering high value-added products, based on the development, expertise and technology acquired from over 50 years experience.



# Sekisui GRP Panel Tanks: Sizes adaptable to any needs

From small tanks to large, Sekisui can fit virtually any order. Tank sizes are selectable to fit each need and desire, and are even expandable!

And, while the standard volume of other companies' tanks is about 40~100 M3, Sekisui Panel Tanks can be installed to handle from 0.25 M3 up to 5,000 M3!

## GRP (Glassfibre Reinforced Polyester) Panel Construction

Our Water Storage Tanks are constructed of panels made from GRP (the same as FRP). Manufactured with our exclusive MMD moulding process, consistency in product

quality is assured. Tank shape and volume can be freely designed with no restrictions based on site location, weather or climate.



- Easy installation with on-site bolt assembly
- Panel assembly allows free design of shape and volume

## Design Conditions

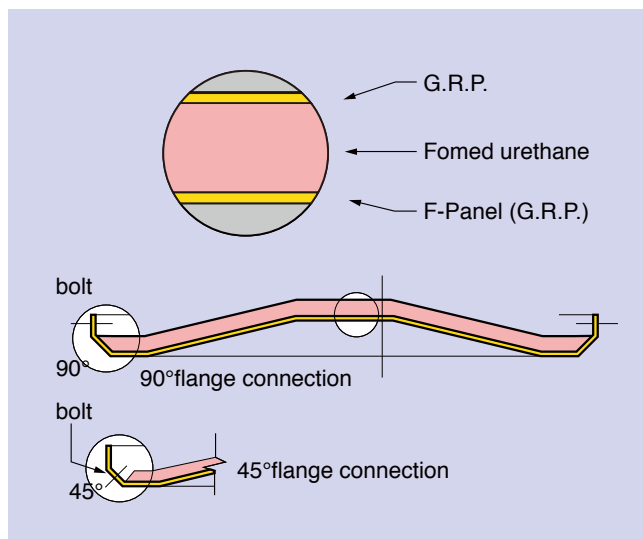
Item	Specifications
<b>Hydrostatic Pressure</b>	The load is determined by the water level in the tank. Hydrostatic Pressure (kPa) = Water Level (Height in meters) $\times$ 9.8 kPa
<b>Wind Load</b>	The load on the side walls of a tank. (Assumes an empty tank.) Wind Load (kPa) = Wind Load Coefficient (C) $\times$ Wind Force q (kPa) C = 1.4 (Rectangular), 0.9 (Cylindrical) q = 120, h = height (m)
<b>Seismic Load</b>	Seismic load shall be designed considering a horizontal acceleration on the principle. Seismic Load (Kg) = Horizontal Seismic Coefficient (K) $\times$ Weight (W) Where K = 0.3 and W is calculated as follows; W = Wt + Wo where Wt : Tank net weight Wo : (Weight of water in a tank) – (Weight of Free Board Water)
<b>pH range</b>	5.8~8.6
<b>Illumination factor</b>	0.1% or below
<b>Colour</b>	Ivory (Mansell value : 2.5Y9/2)

## GRP Insulated panel Construction(option)

This tank is constructed of GRP injected with foamed urethane and is superior in its heat and cold insulation. Appropriate for the insulating needs of such locations as machinery rooms, rooms with high humidity or areas of cold climates.

### Sekisui Insulated Panels Control Water Temperatures Even in the Toughest Conditions

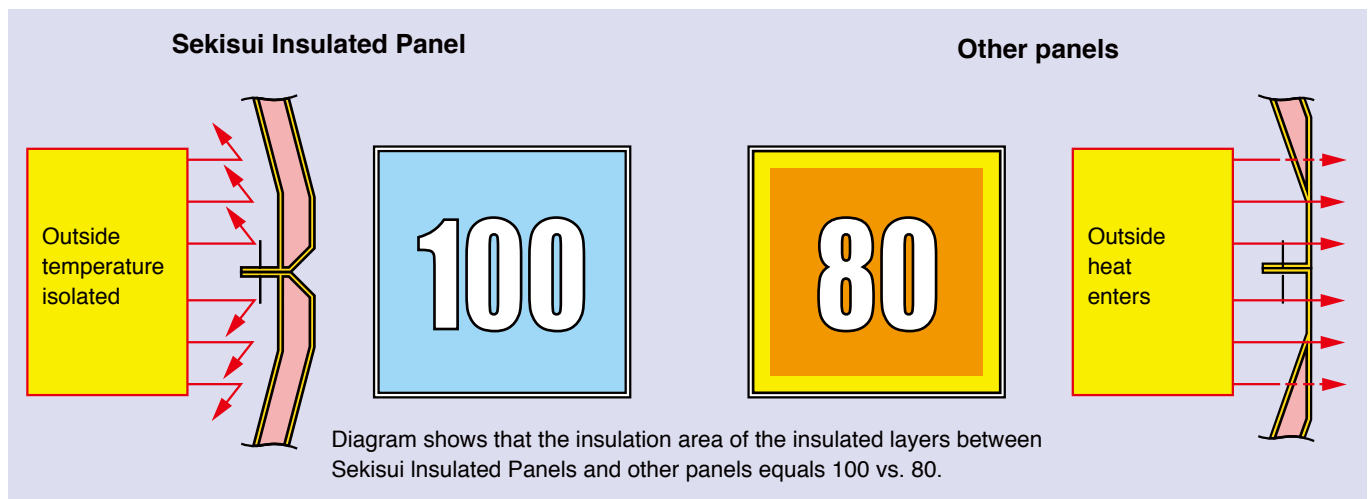
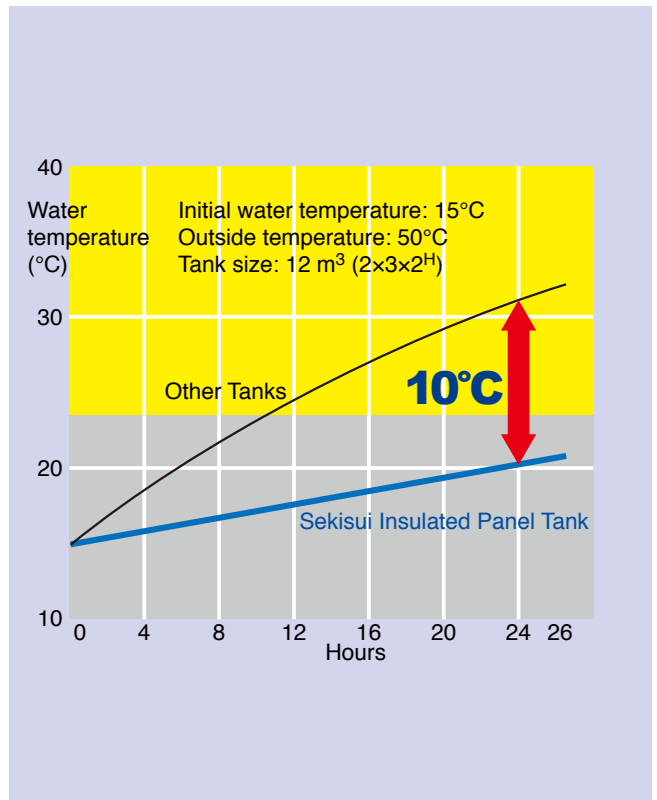
Sekisui Insulated Panel Tanks have been widely adopted for use in desert regions, where the daytime temperatures rise to 50°C, and the night temperatures plunge to under 10°C. Even under such severe weather conditions, Sekisui Insulated Panel Tanks regulate water temperature, giving clean, pure, potable water at all times. When your water is valued, Sekisui Insulated Tanks take good care of it.



### Insulation Performance

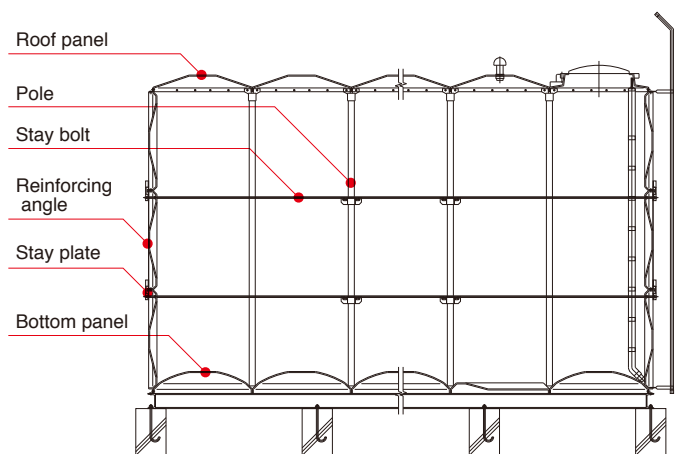
In order to verify the superiority of Sekisui Insulated Tanks over those of other companies, the internal temperatures of 12 m<sup>3</sup> tanks (2 × 3 × 2m. high) were measured over a period of 24 hours under test conditions. The water temperature at the start of the tests was 15°C; the outside temperature was 50°C. After 24 hours, the water temperature in the Sekisui Insulated Tank was a full 10°C cooler.

In severe weather conditions, Sekisui Insulated Tanks protect your valuable water resources better than any others in the market. When you cannot afford to lose water quality, choose Sekisui before all others.



# Reinforcing method

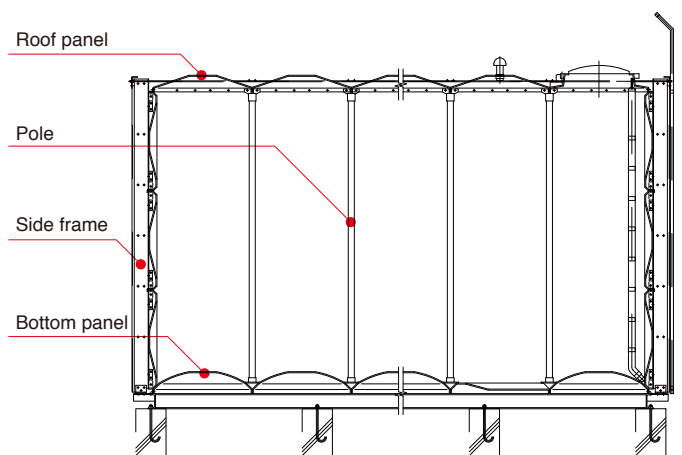
## Internal reinforcement



### Internal reinforcing members

- Stay bolt : Stainless steel
- Pole : PVC

## External reinforcement (option)



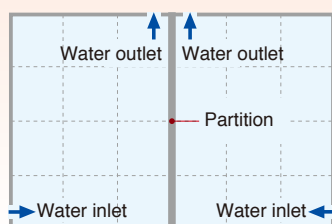
### External reinforcing members

- Side frame : Hot dip galvanized steel
- ※No internal steel members  
suitable for raw corrosive water storage

## Optional Design Features

### Freely designable partitions

Partitions can be designed freely based on panel module dimensions. Please consult Sekisui Aqua Systems as panels cannot be designed to accommodate some shapes.

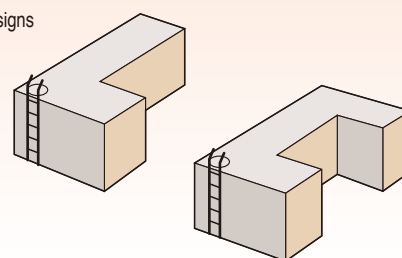


### Irregular shapes

Tanks with irregular shapes can be designed by combining panel modules, allowing available space to be used in as effective a manner as possible.

Contact Sekisui Aqua Systems for more information as some tank designs are not possible due to earthquake-resistance specifications and shape constraints.

#### Example designs



# Sekisui Tanks Making Their Presence Felt Around the World.



U.A.E.



Kuwait



Hawaii, U.S.A.



Taiwan



Oman

# The growth of the Sekisui Panel Tank

The use of Sekisui panel tanks in Japan increased from approximately 1,050 tanks per year in the 1960s to about 12,000 tanks per year in the 2000s.

In Japan, tanks made of concrete and other materials were previously the mainstream, but through regulation and laws regarding water quality standards, as well as the Food Sanitation Act, the use of clean and safe panel tanks has now become the norm.



Our panels and all related parts conform to the water quality standards and Food Sanitation Act recognised by the Waterworks Byelaws of a variety of countries.

## ISO9000 Quality Assurance Certification Received

Sekisui Panel Tanks have received approval of various international standards for quality control and product quality assurance as established by International Standardisation organisations.

In order to receive the ISO 9000 series, our quality control manual was perfected and passed exacting examinations and inspections.

- ISO9001
- ISO14001
- WRAS(U.K.) - Approved product
- Loss Prevention Certification Board,UK
- Ministry of Health,China
- SS 245 (Singapore)
- Food & Sanitation Law (Japan)
- Water Works Law(Japan)
- Algae Prevention Technological Guides (Japan)



Japanese Food and Sanitation Law



Water Works Law in Japan (Water quality)



Sekisui Aqua Systems are qualified as an authorized exporter by Japanese customs, which is awarded to a company superior in security management and corporate compliance.

# SEKISUI PANEL TANKS AROUND THE WORLD



# Sekisui Panel Tank Manufacturing Technology

There are 2 basic methods for the manufacture of panel tanks: MMD (with Long continuous fibreglass mat) and SMC (with chopped fibreglass)

Sekisui utilises its exclusive MMD (Matched Metal Die) method. The MMD method was introduced by Sekisui and it continues to be the most superior method of manufacture today.

On the other hand, other manufacturers all employ the SMC method. The difference between these two methods is that the MMD method uses long continuous strand fibreglass, adding resin and then submitting the mixture to pressure before the final moulding process. The SMC method used by all other

panel tank manufacturers mixes short-chopped strand fibreglass and resin in a “clay-like” mixture.

In terms of product characteristics, this means that panels manufactured under our MMD method are not only thinner and lighter, but the long continuous strand fibreglass makes them a product far superior in strength to all others.

Through our hot press moulding method, stability in product quality is assured even under high volume production.

Tensile strengths & bending strength the are more important.

## Physical Property Comparison

	MMD	SMC	Hand lay-up	Comparison
	SEKISUI	Company A	Company B	
<b>Tensile strength (MPa)</b>	85 ~ 105	58.8 ~ 100	39.2 ~ 68.6	Sekisui tanks attain Singapore Standard “SS245” at 6 times working pressure under hydrostatic pressure tests.
<b>Bending strength (MPa)</b>	170 ~ 200	117.6 ~ 161.7	64.2 ~ 156.8	Other companies’ products are harder, containing about 40% filler, negatively influencing both impact and repetition strength tests.
<b>Water absorption coefficient</b>	Below 0.1%	Over 0.2%	0.2 ~ 0.3%	The superiority of the initial strength of SEKISUI products is additionally evident in its durability over the long term.

## The Different Fibreglass Used in Panel Tanks



Most appropriate for GRP water tank

- Uses long continuous strand fibreglass
- Superior strength and durability
- Suitable for high water pressure applications



Inappropriate for GRP water tank

- Uses short-strand fibreglass
- Low cost = Less fibreglass
- Suitable for low water pressure applications ( Bathtubs and etc. )



# Manufacturing Features

One of the major features of the MMD moulding process is the superiority of strength and its high values in regard to its physical properties. Because the SMC method used by other companies mixes short-chopped strand fibreglass and resin, its physical property values are low, making it unreliable to use bottom panels as the base for larger volume tanks.

While it is possible to reduce the volume of the expensive fibreglass in order to manufacture a less expensive panel, the result is a product of substantially lower quality. And Sekisui simply doesn't sacrifice quality.



## Guarantees of quality in strength and durability supported by an abundance of data

Strength and durability are the key to panel tank quality, and the physical properties of a tank are the most important elements to the guarantee of this quality.

Panel tanks which are strong and durable under changes in water pressure and environmental conditions (temperature,

ultraviolet rays, wind and rain, etc.), are necessary in their role as the vessels which store water, our most precious resource.

Sekisui panel tanks are confirmed under water pressure tests to attain a strength of 6 times the working pressure!

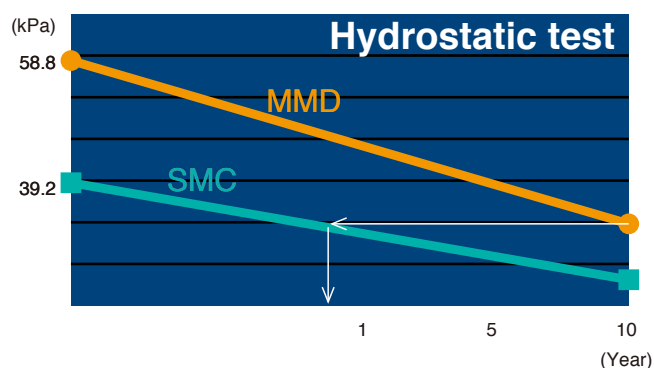
### GRP Basic Physical Property Values

Item	Value
Tensile strength	98.0 MPa
Bending strength	186.0 MPa
Compression strength	225.0 MPa
Shearing strength	94.1 MPa
Young's modulus	9,800 MPa
Impact strength	78.4 kJ/cm <sup>2</sup>
Barcol (hardness)	Over 50
Specific gravity	1.7
Thermal expansion coefficient	2.0×10 <sup>-5</sup> /°C
Thermal conductivity	0.267 W/(m·K)
Water absorption coefficient	Below 0.1 %
Glass content	Over 30 %

※ Test method : JIS standard

### Durability under water pressure

Results of hydrostatic test between Sekisui products and another company's product.



# Earthquake resistance: Superior design proven safe for superior earthquake resistance

The most important point of a tank's design for earthquake resistance is the ability of its rigid construction to survive the specific oscillation frequency of the seismic waves (the oscillation frequency of the strongest wave of an earthquake). Through an abundance of practical test data, Sekisui also offers an earthquake resistant panel tank which utilises our proprietary box frame construction (external reinforced construction) for excellent stability and high rigidity.

Using this wealth of data and accompanying computer analysis, Sekisui is able to offer the utmost precision in design of the most highly reliable panel tank on the market today. And it is through this care in design that we are able to offer an earthquake resistance which can handle a horizontal seismic intensity of 0.3 ~ 2.0G, easily responding to a variety of customer needs.

## Earthquake Simulation Testing

A series of earthquake simulation testing have been conducted by Sekisui since 1970 when the first testing was made. Since then, Sekisui has accumulated ample data related to earthquake motions and earthquake resistance.

Following the Great Hanshin Earthquake in 1995, Sekisui conducted its sixth(6th) earthquake simulation testing in order

to ascertain more excellent earthquake-resistant design.

The following data show the wave height at the water surface and its speed as well as its acceleration and the impact pressure that the tank roof receives.

The graph indicates that the impact pressure on tank roof increases as the wave height speed and acceleration grow.

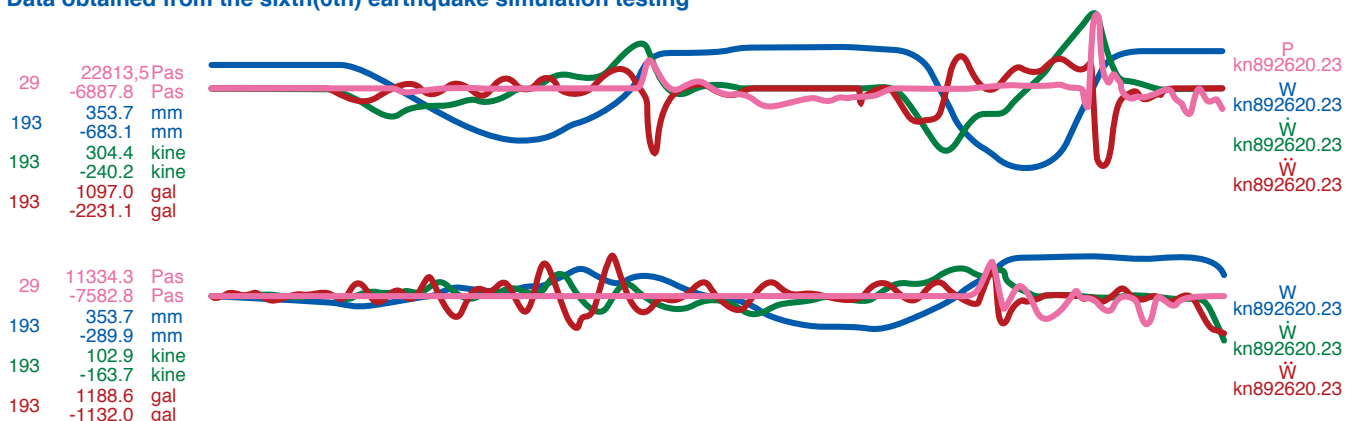


▲The first(1st) earthquake simulation testing (in 1970)



The sixth (6th) earthquake simulation testing ►  
(25th September to 2nd October, 1995)

### Data obtained from the sixth(6th) earthquake simulation testing



## Simple assembly: Panels can be assembled easily by simply bolting them together

Sekisui's objective is efficiency in on-site assembly, and we design every part with ease-of-use and efficient operation in mind.



## Easy Maintenance: Designed for simple cleaning

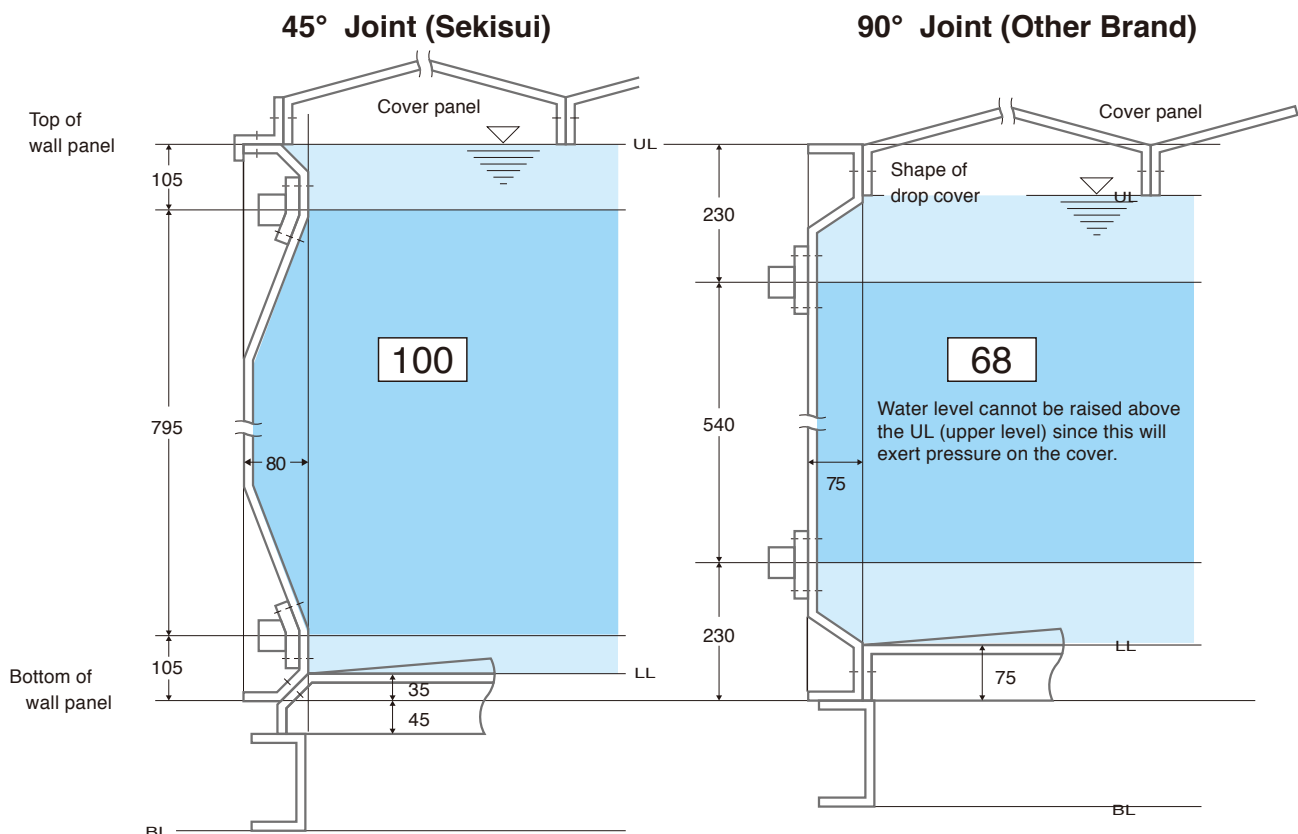
- The bottom of our water storage tanks are equipped with a convex bottom panel. This and the addition of a pit panel allow easy cleaning of the inside of the tank.
- With a diameter of 600 mm, the manhole offers easy access for entering and exiting the tank. And its superior watertight design guarantees that stored water remains unpolluted.

## More Effective Water Storage

Another advantage to Sekisui tanks is that our panels are manufactured with a combined double-flange at an angle of  $45^\circ$  and  $90^\circ$  on all four sides. This assembly construction ensures more effective water storage.

These illustrations indicate a large discrepancy between of our tanks with  $45^\circ$  joints and those tanks by other manufactures which use  $90^\circ$  joints.

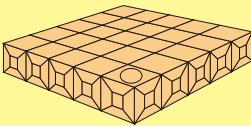
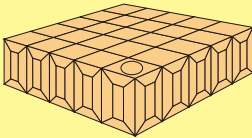
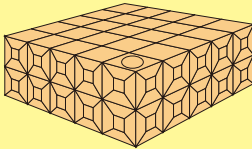
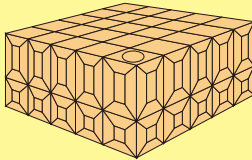
If the effective capacity of a Sekisui tank is taken as 100, then that of other tanks with  $90^\circ$  joints is measured at around 68. Sekisui assembly construction and nozzle design secure more efficient water storage.

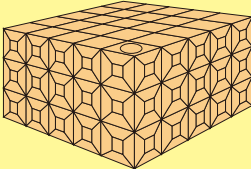
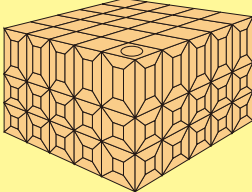
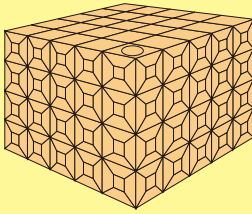


# Panel types and capacity

## Tank height

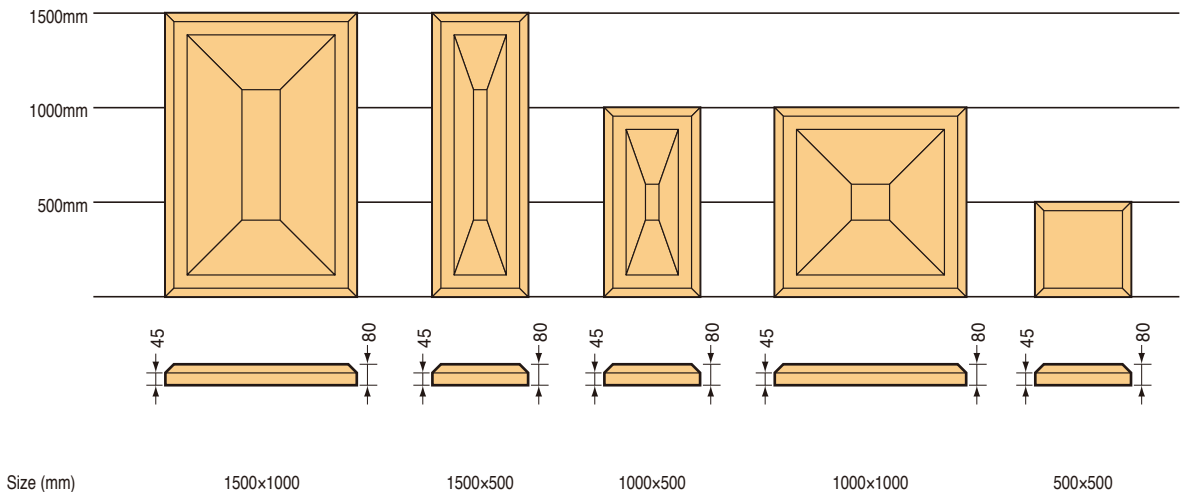
The capacity of the panel tank can be selected from 0.25 M3 up to a maximum of 5,000 M3.

1.0M	1.5M	2.0M	2.5M
			
FS	FH	FW	FT

3.0M	3.5M	4.0M
		
FZ	FK	FQ

## Panel size

In order to ensure the effective volume, panels can be designed to a shape which makes the most use of the space available. Panel types include roof, side and bottom panels.



# Sekisui Tanks Making Their Presence Felt Around the World.



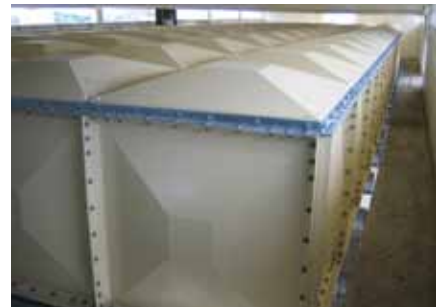
Hong Kong



Hong Kong



Thailand



Singapore



Qatar



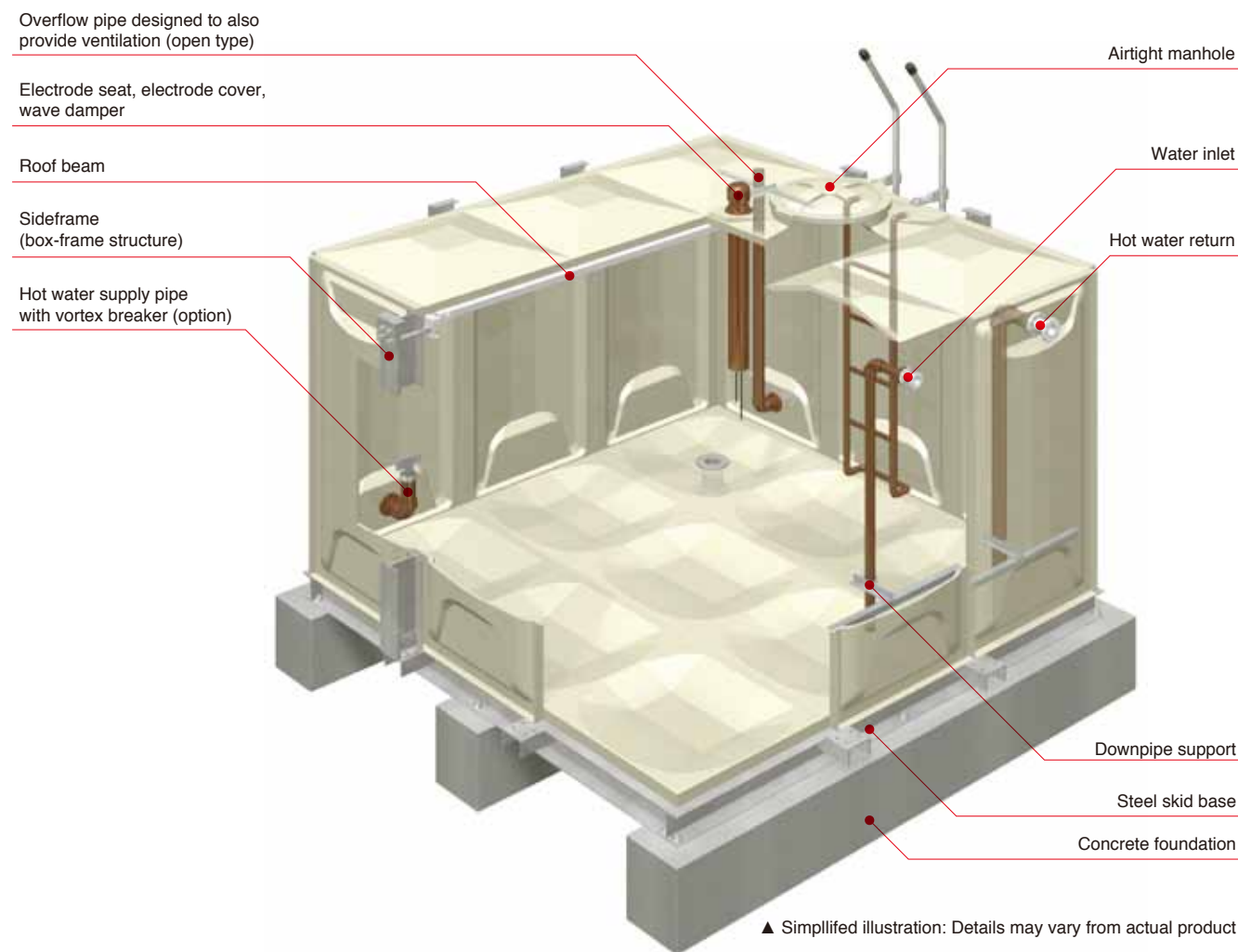
Qatar



U.A.E.

# Hot water storage tanks

Facilitating the design of systems that effectively use thermal energy while offering exceptional workability, heat resistance, and heat retention



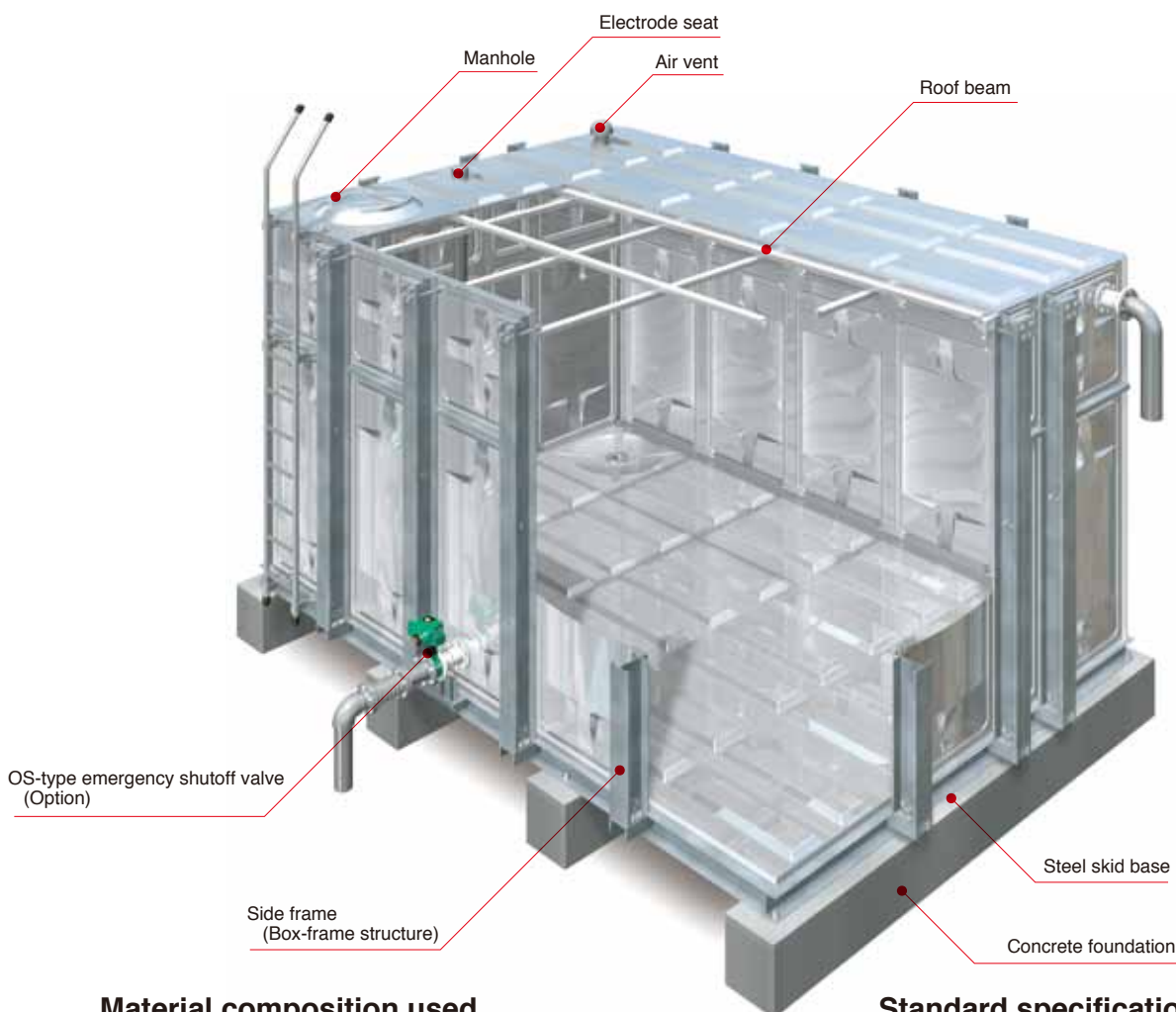
## Standard specifications

Item	Design Specifications	
Maximum continuous operating temperature	80°C	
Insulation specifications	25 mm or 50 mm thick	
Working hydrostatic pressure	Tank height (m)	Static pressure (kPa)
	1.0	7.35
	1.5	12.25
	2.0	17.15
	2.5	22.05
	3.0	26.95
Design life	15 years	
Horizontal seismic load	1.0 G / 1.5 G / 2.0 G (special design)	
Wind load	60m/s	
Snow load	588 Pa (30 cm deep)	
pH level	2 to 10 (see note)	

Note : Special design considerations apply when using with hot spring water.

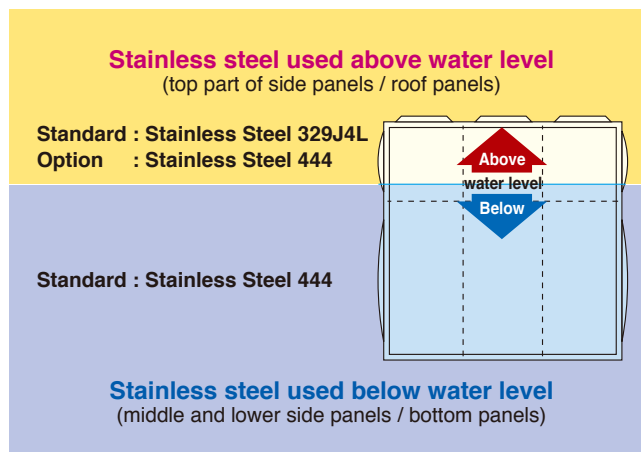
# Stainless steel panel tanks

Environmentally, Safety and Workability Conscious Design



## Material composition used

The standard specification of Sekisui Stainless Panel Tanks is on Stainless Steel 329J4L and 444 for the panels above and below water level respectively.



**!** The full water level must be set at no lower than the bottom of the stainless steel 329J4L panels.  
In case water is stored below stainless steel 329J4L panel part, there will be a chance of corrosion at the part of other stainless steel grade panels.

## Standard specifications

Item	Design specifications	
Working hydrostatic pressure	Water tank height (m)	Static pressure (kPa)
	1.0	7.35
	1.5	12.25
	2.0	17.15
	2.5	22.05
	3.0	26.95
	3.5	30.87
	4.0	35.28
	4.5	39.69
	5.0	44.10
Earthquake	Design horizontal seismic load = 1.0G / 1.5G / 2.0G	
	Vertical seismic load = Horizontal seismic load x 1/2	
	Design horizontal seismic speed = 1.5 / 2.25 / 3.75m/s	
Wind load	60m/s	
Snow buildup	588Pa (Snow depth: 30cm)	
Water temperature	Room temperature (30°C or less)	
pH level	5.8 - 8.6	
Illumination factor	0.1% or less	

# EconoTank

Based on Sekisui's GRP Panel Tank System, the Econotank is perfect for all small capacity water storage systems. It has two major advantages: firstly its assembly and disassembly is very simple, and secondly - as its name implies - the Econotank is very cheap to buy.

Its mobility is another important consideration. A one-ton capacity tank fits easily into the rear of a station wagon, and weighs less than 50 Kg (110 lbs).



# Emergency Shutoff Valve

**(Built-in Shutoff Valve to Safeguard our Vital Water Supply in time of an Earthquake)**

Sekisui has developed the "Sekisui Emergency Shutoff Valve" which safeguards the water stored within a tank even when the pipeline becomes damaged or broken.



# Water level sensor unit

The water level sensor unit allows changes in water level to be managed digitally. Erroneous operation is rare, and the unit makes it easy to change the required water storage volume as desired, even from a remote location. It is ideal for use in water level control systems at facilities such as large commercial buildings and recreational facilities where there are significant differences in water consumption on weekdays and holidays.

Contact Sekisui Aqua for more information.



# Valve Box (Top sump)

While this valve box is especially designed for securing the free board area, it is also an ideal choice when maximum water capacity is required. The free board area is necessary in case of emergency to prevent polluted water from flowing back into the water pipes. In addition to 1 × 1 × 0.5 m, 1 × 2 × 0.5 m valve box is also available.



# Sekisui Tanks An Important Fixture Throughout the World.



Hong Kong



Japan



U.A.E.



Singapore



Hong Kong



Qatar



Taiwan

# Panel Tank Parts and Assembly

- **PVC Nozzle** < Flange type >  
Size: 20 A ~150 A



- **Corner block**  
Material : Stainless steel  
Synthetic rubber



- **Sealing gasket**  
Material : EPDM  
Foamed PVC



- **Gun Metal Nozzle** <Screwed type>  
Size: 13 A ~ 80 A



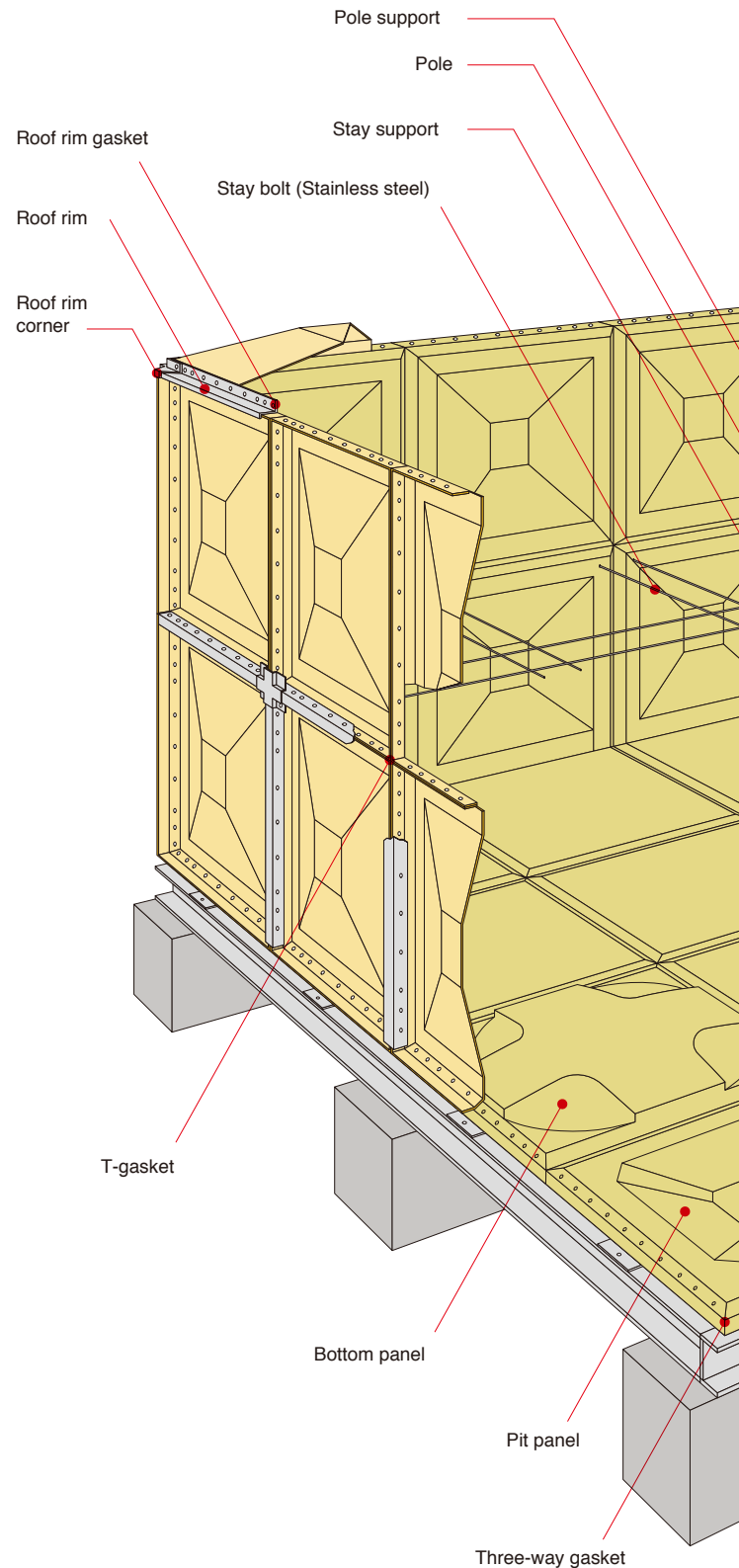
- **Air Vent**  
Material : ABS  
Size: 50 A x 180 mmH  
100 A x 210 mmH



- **Assembly bolt**  
Material: Hot dip galvanized steel  
Size: M10



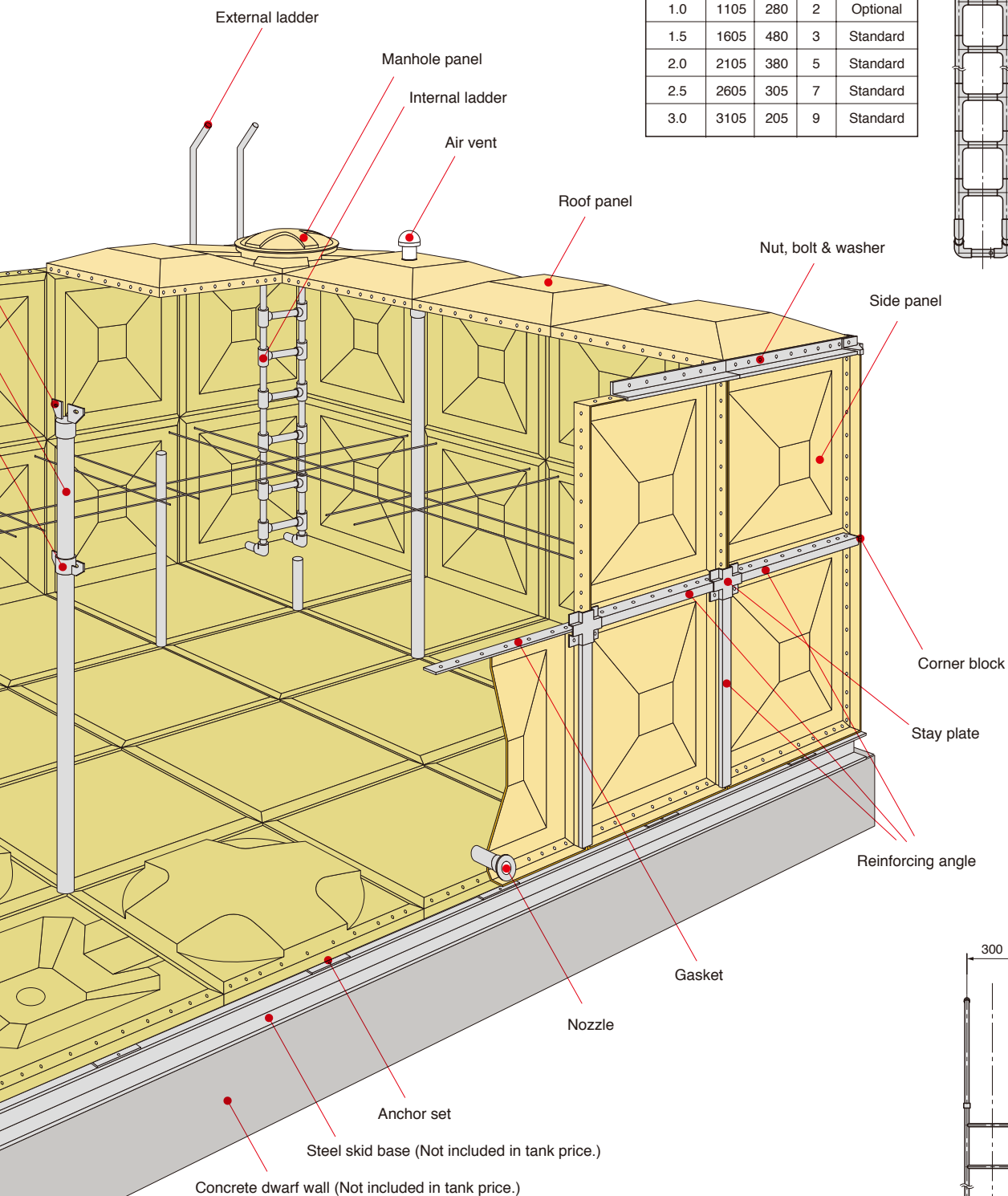
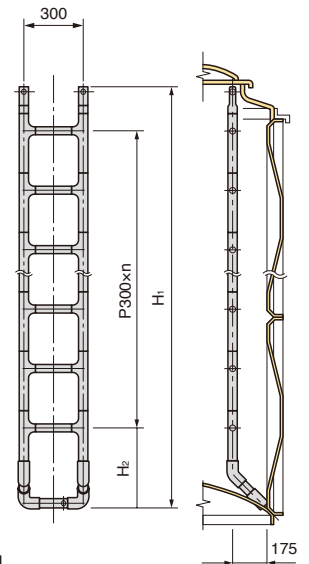
- **Electrode Seat and Cover**  
Material: PVC  
Size: 50 A



● **Internal ladder**  
Material: PVC

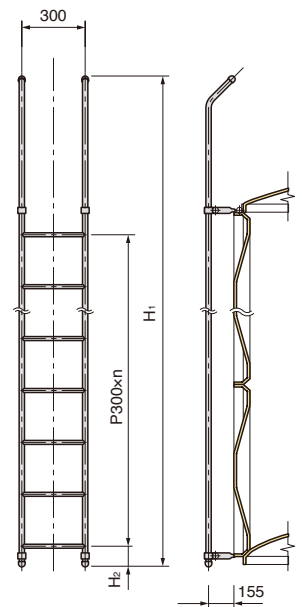
**Dimensions**

Tank Height	H1	H2	n	Notes
1.0	1105	280	2	Optional
1.5	1605	480	3	Standard
2.0	2105	380	5	Standard
2.5	2605	305	7	Standard
3.0	3105	205	9	Standard



**Dimensions**

Tank Height	H1	H2	n	Notes
1.0	1845	313	2	Optional
1.5	2340	213	4	Standard
2.0	2840	113	6	Standard
2.5	3340	313	7	Standard
3.0	3840	213	9	Standard



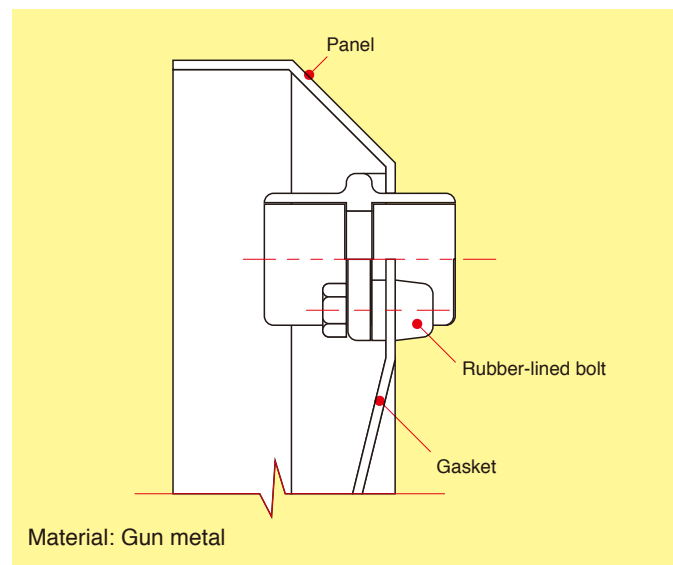
● **External ladder**  
Material : Mild steel + Hot dip galvanizing

# Nozzle Installation

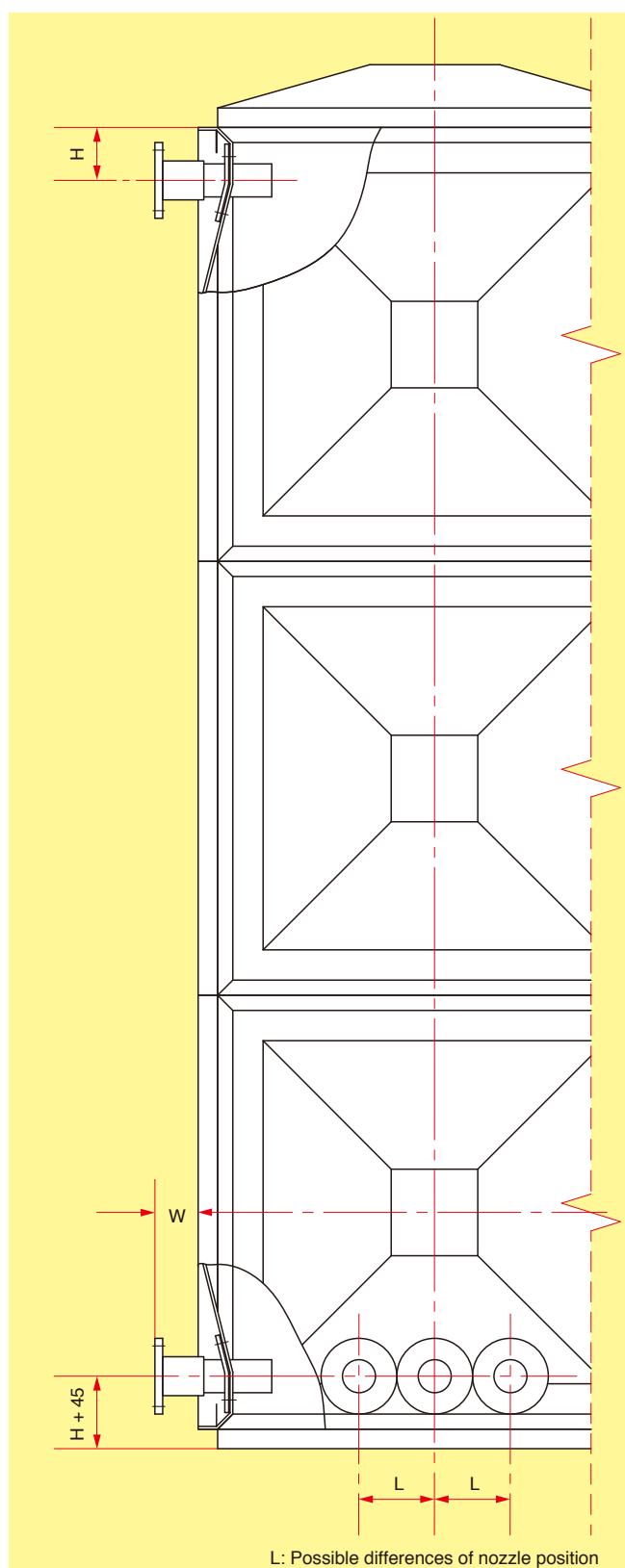
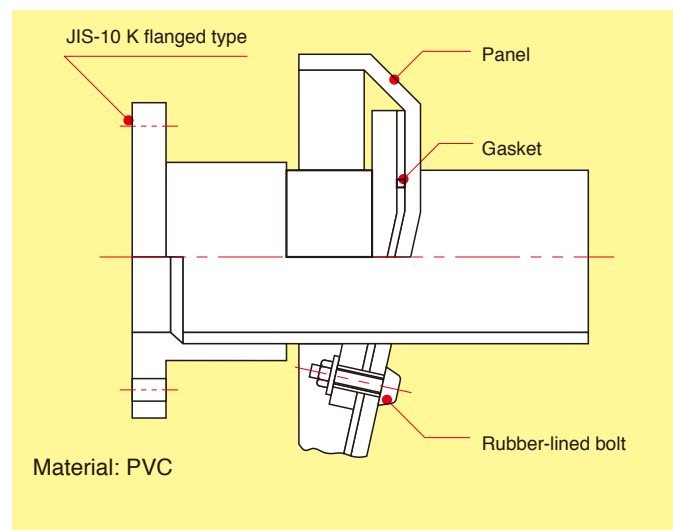
Nozzles are of PVC(flanged type) or gun metal (svrewed type).

Installation position is shown below.

**Standard nozzle: 13 ~ 80 mm dia.**



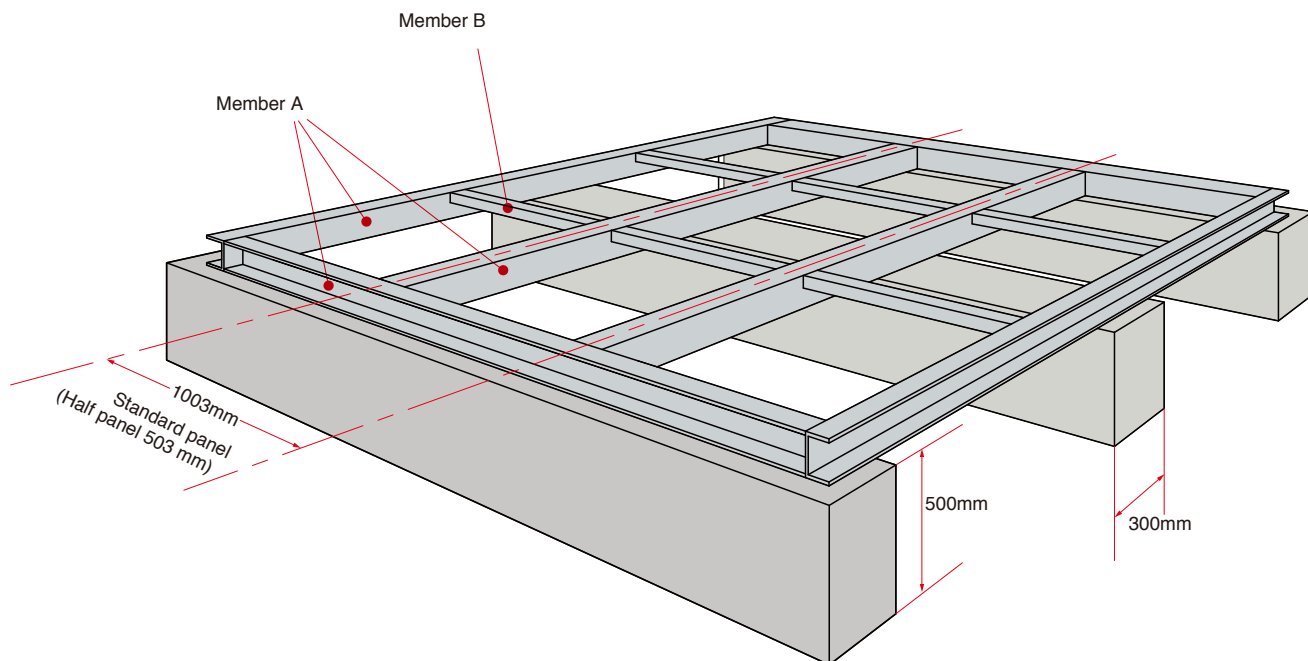
**Standard nozzle: 20 ~ 150 mm dia.**



Nozzle dia.	20	25	30	40	50	65	75	100	125	150
Code	(3/4)	(1)	(1.1/4)	(1.1/2)	(2)	(2.1/2)	(3)	(4)	(5)	(6)
H	70	70	70	70	105	115	125	135	155	170
L	360	350	350	350	295	265	240	215	165	130
W	-	-	-	-	43	52	59	94	125	153

# Steel Skid Base

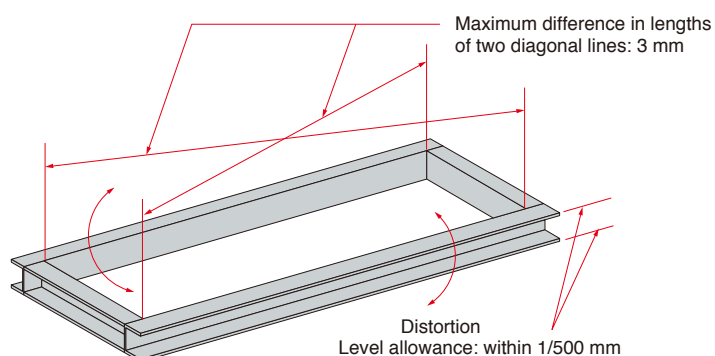
## Basic installation



Sekisui Panel Tanks are mounted on a steel skid base which is a necessity in panel tank installation. Refer to our design plans for the dimensions of related steel members.

## Steel Skid Base Members

Tank height	Material A	Material B
1.0 m	┐ - 125 × 65 × 6	└ - 65 × 65 × 6
1.5 m	┐ - 125 × 65 × 6	└ - 65 × 65 × 6
2.0 m	┐ - 125 × 65 × 6	└ - 65 × 65 × 6
2.5 m	┐ - 150 × 75 × 6.5	└ - 75 × 75 × 6
3.0 m	┐ - 150 × 75 × 6.5	└ - 75 × 75 × 9
3.5 m	┐ - 150 × 75 × 6.5	┐ - 100 × 50 × 5
4.0 m	┐ - 180 × 75 × 7	┐ - 100 × 50 × 5



# A brief look at tank assembly

(Example) FW-20 (2 × 5 × 2 MH)

1. Panel tanks can be assembled easily on-site by simply connecting the bolts.

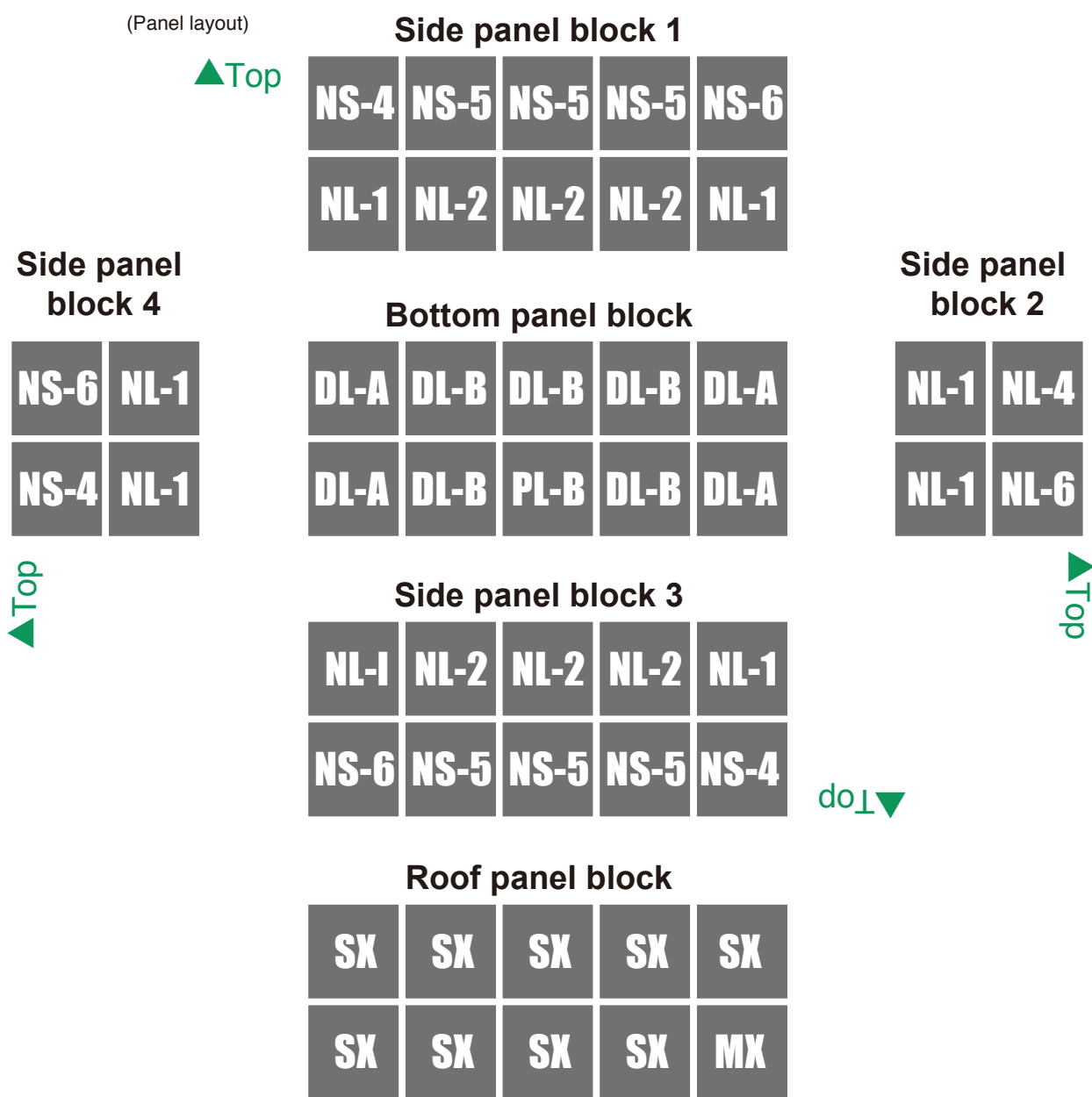
2. Panel tanks are lighter than steel and can be handled with ease.

3. The use of our exclusive 45° and 90° panel flanges eliminates the need for extra parts and simplifies assembly work.

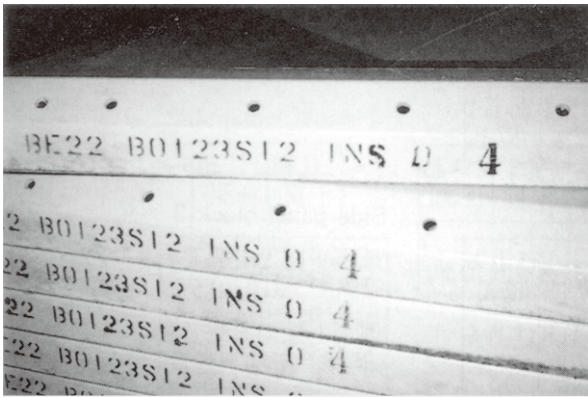
4. Nozzles are designed to fit the shape of the panels, making the use of specialty panels unnecessary and making it easy
- to deal with sudden modifications required on-site.

5. Large size and large capacity tanks can be assembled easily using the same basic assembly procedures.

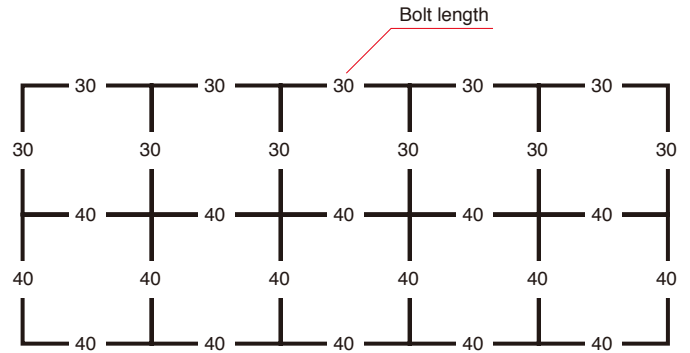
6. Compared to tanks manufactured by other companies, the number of procedures required for the assembly of Sekisui tanks is considerably reduced, thereby reducing costs. For instance, the assembly of the FW-20 (2 × 5 × 2 MH) tank, which will be illustrated here, can be completed by 4 persons in a single day.



2x5x2mH (FW-20m3) tank



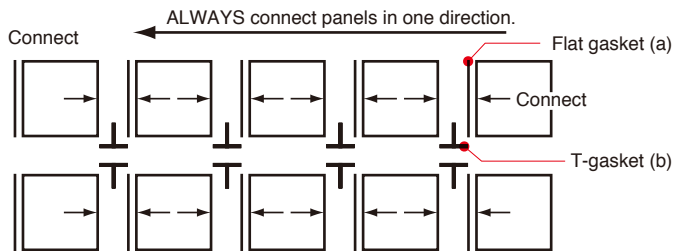
## 2. Assembly of the side panels



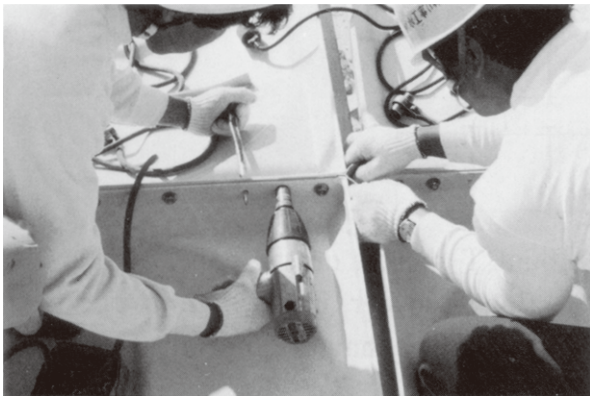
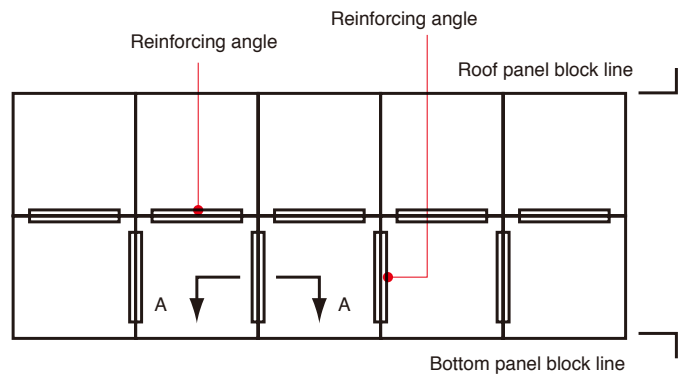
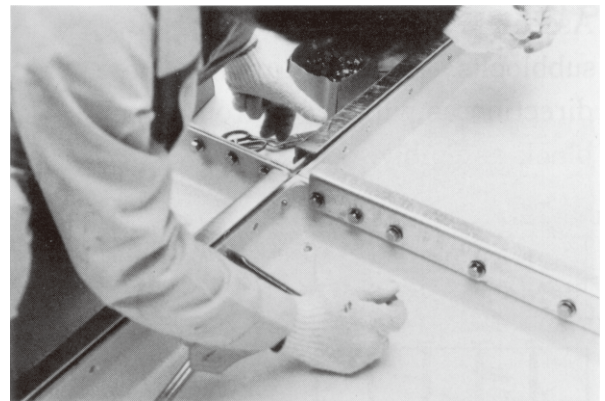
## 1. Assembly of the bottom panels

Check the panel type.

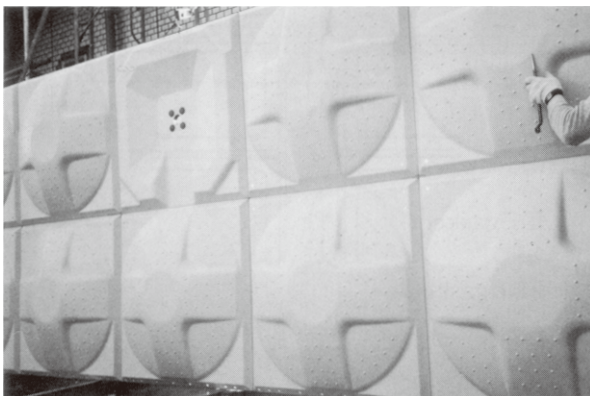
(There is a marking on each panel which indicates the bolt pattern according to the layout diagram.)



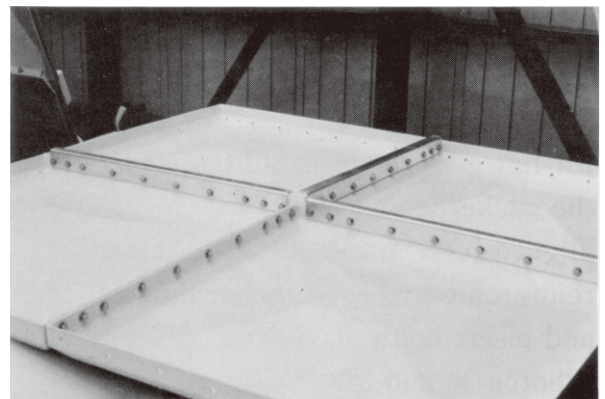
Install the flat gaskets and T-gaskets.



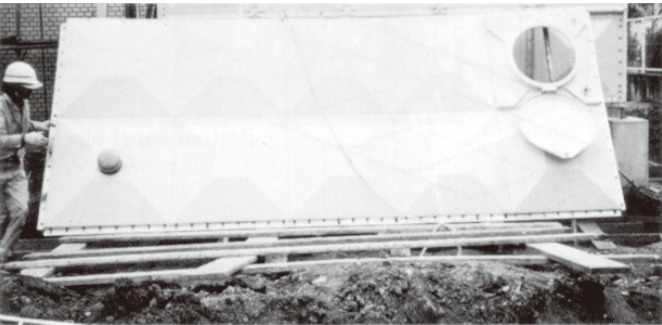
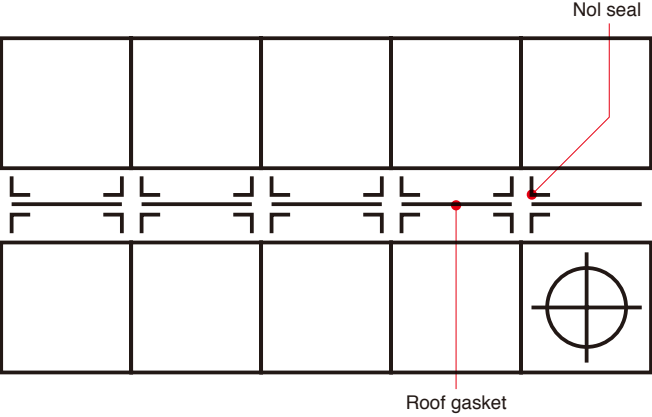
Tighten bolts.



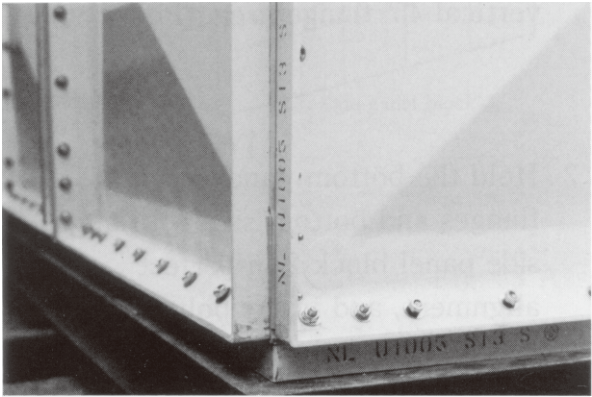
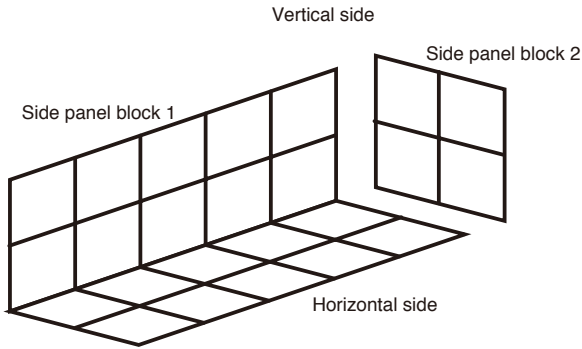
Completed bottom panel block



### 3. Assembly of the roof panels



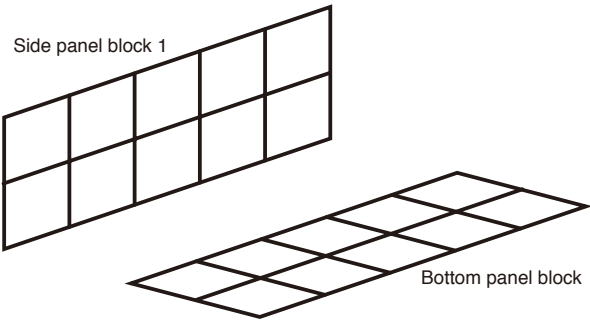
### 2) Connection of side panel block 2 to bottom panel block and side panel block 1



45° flanges eliminate the need for intricate parts.

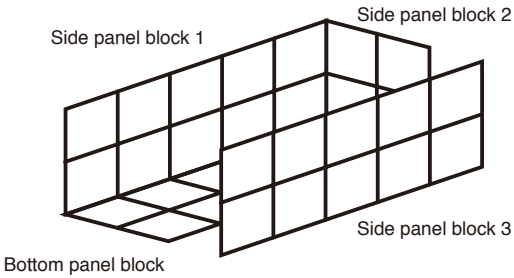
### 4. Connection of the side panel blocks to the bottom panel block

#### 1) Connection of side panel block 1 to bottom panel block

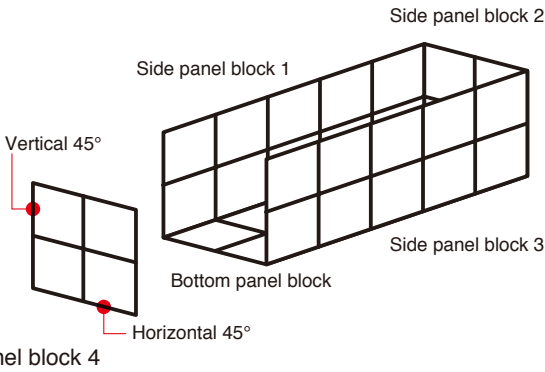


Connect with 45° flanges.

#### 3) Connection of side panel block 3 to bottom panel block and side panel block 2

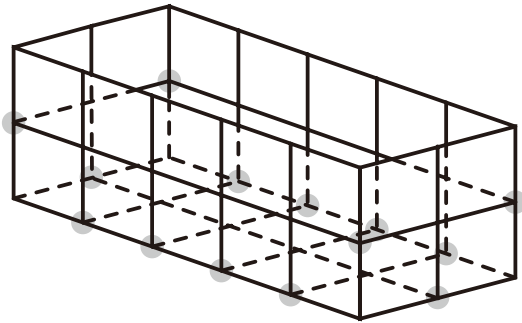


#### 4) Connection of side panel block 4 to bottom panel block and side panel blocks 1 and 3



## 5. Installation of tank internal accessories

### 1) Installation of corner block

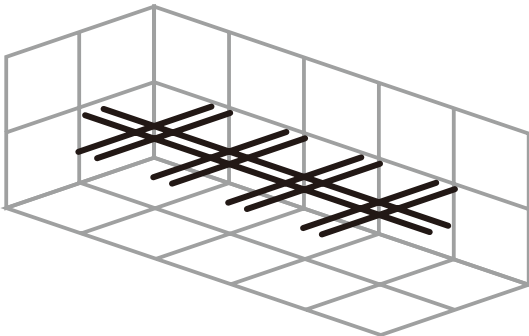


Location of corner block installation

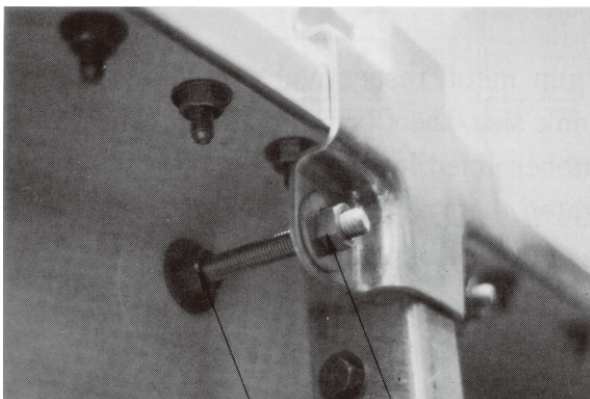


Inside the tank

### 2) Installation of stay bolt

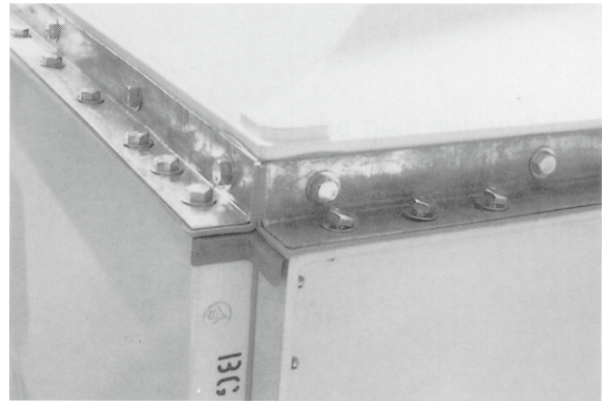


Location of stay bolt installation



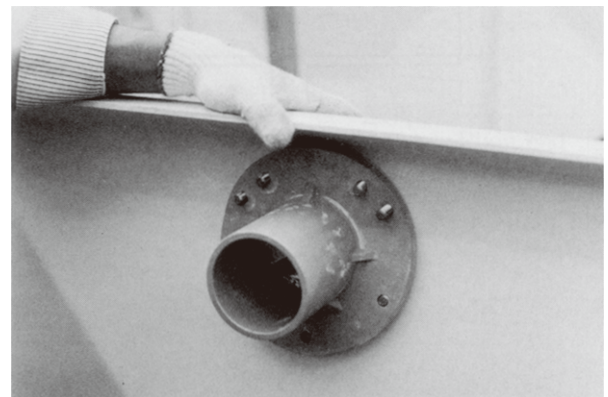
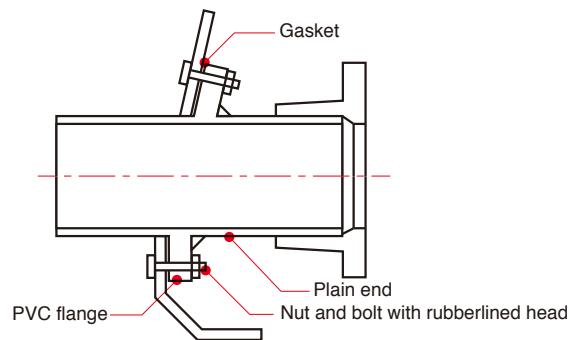
Outside the tank (Attached stay plate)

## 6. Connection of roof panel block to the side panel blocks



Roof rim angle connected to the side panels

## 7. Installation of nozzle



## 8. Installation of ladders





## SEKISUI AQUA SYSTEMS CO., LTD.

International Operations Division  
21st Floor, Tower West, Umeda Sky Bldg.,  
1-30, 1-chome, Oyodo-Naka, Kita-ku, Osaka 531-0076, Japan  
Tel:(06)6440-2508 Fax:(06)6440-2518  
<http://www.sekisuia.co.jp/>